# Cadent
Your Gas Network

Appendix 09.30
Technology

IT and Telecoms, System Operation
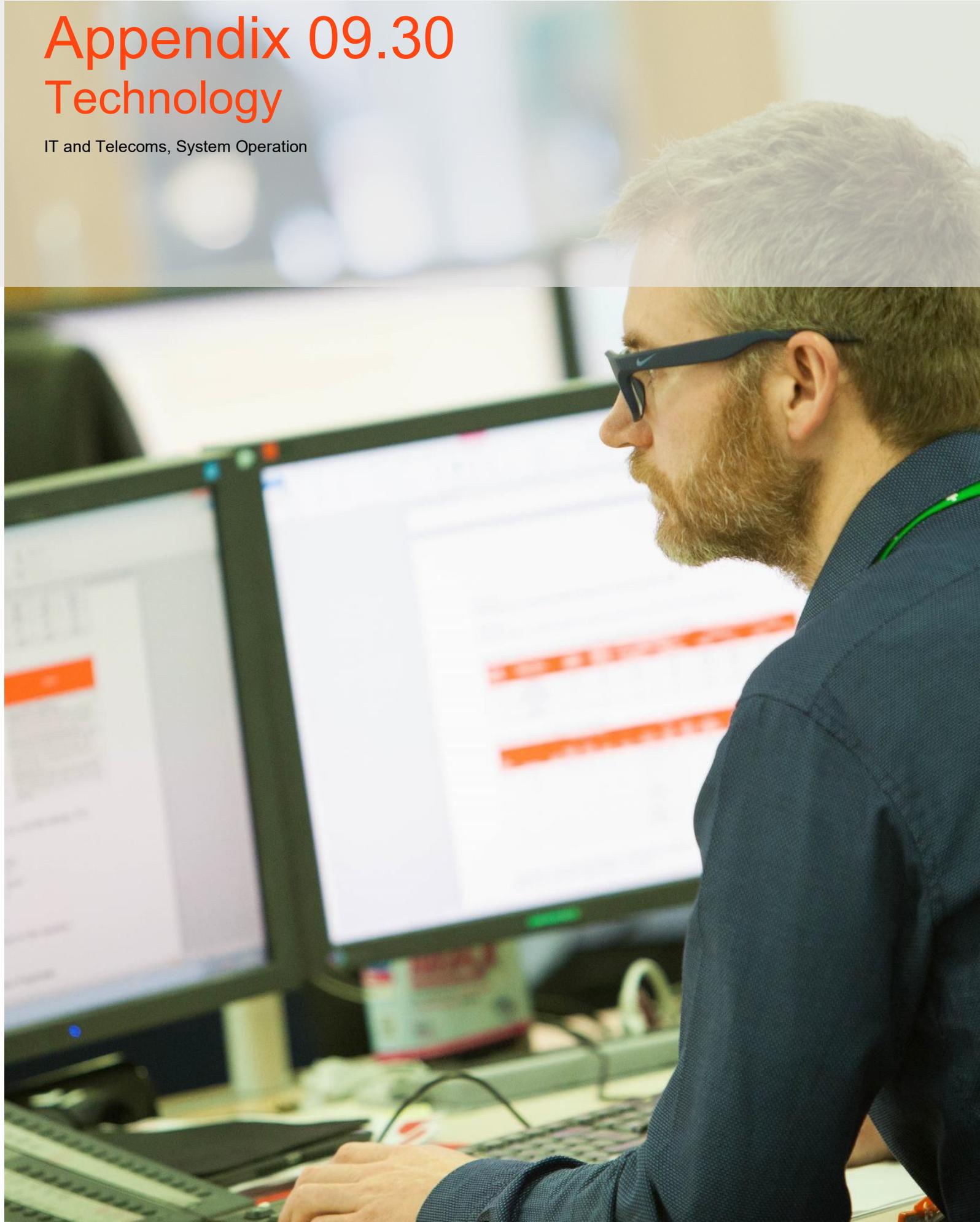
1. Overview – Technology

This Asset Health Engineering Justification Framework outlines the scope of IT and Telecoms, including IT associated with System Operation, for our proposals. It includes similar information to a set of Engineering Justification Papers and we have completed a single Cost Benefit Analysis for the technology portfolio of investments. A brief overview is provided below.

1.1. Overview

Technology is critical to Cadent. It is a core component of how we undertake our work in all areas, and enables us to do our work in efficient, repeatable, reliable ways. It also has the power to transform how we do our work and how the energy industry operates. Technology is ubiquitous, more interconnected, and offers affordable services and solutions than ever before.

Our technology plan underpins our ambitious business plan for RIIO-2, our cyber security strategy and our digitalisation and data strategy.

We have built a portfolio of proposed investments to support our technology strategy, maintain the health of our IT assets, and exploit new technology opportunities for our customers, our business and our partners.

This document explains our technology plan, and our strategy and approach.

We explored four options in the development of our IT investment plan:

- A baseline plan that maintains our existing IT estate on an 'as is' basis
- A transformational plan that exploits the full potential that technology could bring to our ways of working
- A lower level of investment to minimise the cost and footprint of IT in Cadent
- A plan that balances the maintenance of the essential IT services that we operate at the same time as grasping some of the best opportunities that technology will offer us through the RIIO-2 period.

The fourth option of an optimised plan is the basis on which we have compiled our overall business plan and underpins the delivery of our RIIO-2 output commitments.

Plan	Strategy	Total	Capex	Opex
IS	1. Smart Networks / Assets / Sensors			
	2. Customer Experience			
	3. Insight and Analytics			
	4. Cloud / Automation / Robotics			
	5. Workforce of the Future			
	7. IS Operating Model, including efficiency			
	IS Subtotal			
Data	**8. Data and Digitalisation**			
IT Innovation	1. Smart Networks / Assets / Sensors		Redacted due to commercial sensitivity	
	2. Customer Experience			
	3. Insight and Analytics			
	4. Cloud / Automation / Robotics			
	5. Workforce of the Future			
	Innovation Subtotal			
Cyber Security	**6. Cyber Security**			
TOTAL				
NPV				

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Section 4 – Our engagement with customers and how we see technology changing through RIIO-2.

Section 5 – The structure of our plan.

Section 6 – The technology strategies that we propose to pursue.

Sections 7, 8, 9 – These sections outline the need for investment in each area, the options considered for investment, our preferred investment option for each dimension, and the associated business case. The detail for our cyber security strategy and proposed investments are set out in Appendices 07.02.00 and 07.02.01 rather than here.

Section 10 – The summary benchmarking and cost assurance undertaken.

3.2. Role of Data and Technology in Cadent

The most significant change business has seen over the last 20 years is IT. The pace of change and the way we use IT now means that it has become part of everyday life. It is at the heart of our business and a key enabler for us to meet the expectations of our customers, our stakeholders and our employees.

Technology underpins our aspirations for our customers and our business goals.

We're already becoming a digital business, automating a lot of what we do, partly for efficiency but primarily because the volume of data, the complexity of our operating environment and the criticality of the decisions we need to make require it. Over the next five years and beyond we will continue to see an increase in the need for technology and data to achieve the ambitions we have set ourselves and respond to the challenges of a gig-economy, increased customer and employee expectations, and greater societal inequalities.

Technology is ubiquitous, more interconnected, and it offers affordable services and solutions that have never been possible before. Digitalisation has the power to enable new decisions to be made within Cadent and across the industry, and new services to be offered to customers and stakeholders. Our technology plan underpins our ambitious business plan for RIIO-2, our cyber security strategy (Appendices 07.02.00 and 07.02.01) and our digitalisation and data strategy (Appendix 07.02.02).

Through RIIO-1, we have significantly reduced our IS operating costs, modernised aspects of our IT solutions and separated from National Grid. We are now a standalone business, less complex, with no cost allocation or the overhead involved in a shared IT estate.

For RIIO-2, we have continued to challenge the operating costs and level of investment that we will need in technology, balancing the investment needed to deliver our RIIO-2 commitments to customers and support our data and digitalisation, whilst maintaining security and controlling the costs of investment to our customers.

The plan reflects the continued investment in new, lower-cost technology, rationalisation of our application estate, shifting to 'software as a service' solutions and balancing the use of partners whilst maintaining in-house capability and control. Inevitably, the increased use of technology, investment in our data, and the need to protect our activity from cyber threat will create upward pressure through the period.

As we are the largest of the distribution network operators, automation of our activities is an opportunity and an absolute requirement which may be different from those faced by other network companies. The scale of our operation requires us to rely upon technology to underpin robust, reliable, repeatable and efficient processes.

While Ofgem's approach to investment is centred upon the maintenance of engineering 'assets' (and IS assets have historically been treated in the same way) technology in the 2020s creates the opportunity to offer better services which our customers want and expect, and innovative ways of approaching our work that a pure 'asset-maintenance' focus would not realise.

3.3. Change in technology through RIIO-1

Technology has transformed through RIIO-1, and we anticipate that it will continue to change and innovate in a similar way through RIIO-2. For example, before RIIO-1, the mobile phone of choice was a BlackBerry, giving access to mobile telephony and business email. However, since 2013, BlackBerry use declined sharply with the rise of the iPhone iPad and Android devices.

In the intervening years, users' expectations have become that all data and resources are accessible from mobile devices, including online mapping information and GPS location information. The use of paper maps and even car satellite navigation devices has dropped remarkably over the last five years.

Exciting developments with flying quadcopter drones have moved from these being difficult-to-control, low-quality, low-value devices to self-flying, GPS-directed, high-quality video and photography equipment that has the potential for a number of uses.

Devices such as the Amazon Alexa, or assistants on smart phones, such as Siri and Cortana, illustrate the increasing maturity of voice processing over the past ten years. The ubiquity with which these devices can offer voice-recognition instruction, and translation services would not have been considered ten years ago.

Much of this change is enabled by the emergence of cloud computing – the use of virtual machines in containers with appropriate levels of segregation of one virtual environment from another – to enable the computing of millions of small transactions of work very quickly and the digitalisation of a business.

We have grasped a number of these technologies in Cadent over RIIO-1 and we plan to continue to innovate, harnessing new technology opportunities to deliver the best service for our customers.

3.4. Performance in RIIO-1

During RIIO-1, we have maintained our IT service levels, despite a significant reduction in the allowance and much higher cyber security costs than were anticipated, and we have continually challenged our technology operating costs to ensure we deliver competitive value to customers.

The opportunity created by the sale of Cadent by National Grid required investment in our core systems to logically then physically separate our IT. As we separated from National Grid, we have transformed aspects of our IT estate to reflect the smaller, simpler company we have become. This transformation has resulted in a significant reduction in our annual run-the-business opex costs.

However, the timescale to achieve separation was challenging, and whilst we have maximised the opportunity, there is still further work to be done to rationalise and update our estate further. Investments in our IS plan seek to do some of this transformation and the benefits are included in our opex plan[1]

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[1] Feedback from Gartner during the benchmarking or sizing activity for our RIIO-2 plan indicated that some rationalisation would be more expensive than the benefits likely to be realised, so our plan proposes to do moderate levels of rationalisation in order to generate a real cost saving.

4. Customer and Stakeholder Focus

4.1. Customer Consultation on Technology

Our engagement framework with customers is on three levels:
- Delivering functional needs (core, basic services, e.g. security of supply, regulatory obligations and safety)
- Meeting psychological needs (customer service, customer engagement and empowerment)
- Creating opportunities for self-fulfilment (broader societal involvement).

The output of our research and engagement programme has identified four key outcome areas:
- Delivering a resilient network to keep the energy flowing safely and reliably;
- Providing a quality experience to all our customers, stakeholders and communities;
- Improving the environment and addressing the climate change challenge; and
- Being trusted to act for society.

Our technology plan underpins each of these outcome areas, especially our commitment to provide a quality experience to all our customers, stakeholders and communities. For example:
- Using more channels to engage with customers
- Providing a more efficient, easier and more customer-friendly quotation process
- Providing convenient time-bound appointments
- Coordinating street works with others
- Using priority services register data to support the personalisation of services, including welfare services, affordability and our fuel poverty commitments

4.2. Expectations, Needs, Drivers

Throughout our consultation with customers, we have been challenged to improve service without any reduction in the safety or reliability of the essential services we deliver. Technology enables the delivery of these essential services and creates the opportunity for us to understand our customers better, engage with them using a choice of channels, deliver improved and more efficient services, and share data.

Our engagement has demonstrated that using technology to provide additional communication channels is valued by customers, but that the appropriate channel will vary by customer and depend upon their specific circumstances and needs as outlined below:

Employee workshops (August 2019) - A variety of solutions are needed, including: digital signs (showing what is happening and why); social media; face-to-face or door-to-door; an app (with live status updates) and integration with other apps for example Google Maps; a portal; collaboration with gas suppliers and local authorities to spread information; and using our website to provide real time updates.

Business Customer workshops (August 2019) – More than half of participants chose the most ambitious of the options presented for communications on reinstatement and information on roadwork timescales, road closures and alternative routes through face to face conversations, post, text, and an online portal/app for 100% of jobs requiring street works. Participants expect that our approach should be dynamic enough to adapt to different situations and customer preferences. For example, initial communication could be electronic, but with longer or delayed disruptions there should be direct or face-to-face communication prioritised for those most affected. Email is a preferred medium of communication for most business customers but there was concern that important emails could go unnoticed, or be seen as junk mail.

Customer Forum (April and May 2019) - Customers confirmed that text messaging is a useful medium for updates on progress of works, or reminders for works about to start, alongside the availability of an online chat too allowing customers to do other on-line activities in parallel with engagement with Cadent. All of the customer groups suggested Cadent should communicate with customers affected by interruptions in supply through social media channels (e.g. Facebook). Customers want us to utilise existing neighbourhood groups that are already being used nu our customers for community updates. As part of the August 2019 BOT public consultation, customers believed that Cadent should be more accessible with a greater social media presence.

GDN GSOP planned works survey (April 2019) - When asked about restoration of their gas supply, customers saw updates by text / phone or email as helpful, although the majority (58%) preferred face to face communication. Of the 523 Priority Services Register (PSR) customers that responded to the survey, nearly three quarters preferred face to face interaction, with the remainder opting for phone and text.

Phase 1 domestic customer survey (October 2018) - Respondents indicated that it is crucial to invest in a modern security architecture to meet security challenges such as cyber-attacks. Cyber security was also raised in our phase 1 deliberative workshop in terms of ensuring customers' data is stored securely.

Customers in Vulnerable Situations

Technology has an even more important role for customers in vulnerable situations, as it enables a multitude of engagement channels. For example, participants suggested providing information on supply interruptions via Alexa, or video relay services for deaf customers along with an emergency text-line.

Several participants across the engagement events mentioned that the use of Skype, videos with an interpreter, Whatsapp, and text messages to enable communication with people unable to speak English and those who are deaf.

Stakeholders working with or in the interests of customers in vulnerable situations and customers themselves were asked about GSOPs as part of Phase 1 of May 2019 Accent report for GDNs. It was agreed that face to face appointments were not suitable for all (can be threatening for some) and should be optional to offer vulnerable customers the flexibility they require, with greater use of online technology or videos.

4.3. CEG Engagement

Our engagement with the Customer Engagement Group (CEG) has centred on cyber security and our data and digitalisation strategies.

Our approach to cyber security is set out in Appendices 07.02.00 and 07.02.01

Our data and digitalisation strategies are set out in Appendix 07.02.02

4.4. Technology Change Through RIIO-2

We anticipate technology continuing to develop rapidly in RIIO-2 at an ever-increasing pace. Our ambition is to be closer to adapting to that pace and leveraging the opportunities these developments bring to deliver value to our customers.

As part of setting out our RIIO-2 plan, we have considered a number of technology developments and have included a number of initiatives in our innovation plan that we believe could deliver value.

Asset performance management, which is the analysis of asset performance using data collection, advanced analytics and artificial intelligence, has the opportunity to save millions of pounds during the life of an asset base in determining the appropriate intervention periods for assets. We have already invested in a toolset during RIIO-1 to aid us in determining asset risk and the monetization of that risk, but we see this as an area of continued development through RIIO-2.

The distribution of energy resources (in our case as a gas network operator) of biomethane injection or hydrogen injection or new demand points on our network will create a more complex operation, demanding the collection of different data or more detailed data to make the right operational or investment decisions. The complexity of operation looks likely to increase in RIIO-2 going into RIIO-3. This drives the digitalisation of our business.

Research suggests that more and more devices will be connected to the internet by 2020, and this growth in data will continue through RIIO-2. The introduction of 5G will enable billions of new connections and make those connections secure and instantaneous. 5G will impact every industry and is designed to take advantage of cellular connectivity in ways that wouldn't have been possible before. We'll need to scale upwards as the use of 5G expands.

Quantum computing could bring massive opportunity to process data. Google have recently demonstrated quantum computing capability. However, quantum computing will also bring new security concerns.

Our digitalisation strategy provides the impetus for us to 'digitalise' our operation and provide data not only for our own exploitation but sharing our data in an ethos that presumes data is open, creating new, transformational solutions to industry problems.

Customer expectations around information that they can obtain about our work, the ways in which they can interact with us will continue to mature in line with the innovation we have seen in the retail market. It seems likely that customers' homes and appliances will become 'smarter', creating new data interactions with us and our industry, which we need to consider and work towards.

Technology such as flying quadcopter drones is expected to become more intelligent, more autonomous and could bring the opportunity for our field force to manage our assets in different ways, with new data suddenly available for exploitation. We already have the beginnings of tethered and untethered robots operating in our pipelines and we should anticipate a growth in the capabilities and data that such technology will provide.

Blockchain is a technology that can disrupt and transform industries that have traditionally relied upon single trusted parties, and has application outside of financial services and could have a role in any peer-to-peer trust relationship.

It is important that Cadent continues to invest in new technology to ensure that we deliver the services that our customers expect of us as efficiently and effectively as possible.

5. Our Technology Plan Structure

We have structured our technology plan in four sections:

1. Information Services (IS)
2. IT Innovation
3. Data and Digitalisation
4. Cyber Security

5.1. IS

This is the 'base plan', the level of expenditure required to maintain our existing IT estate.

Our technology needs to be maintained in order to deliver the services that customers expect. As the largest of the distribution network operators, automation of our activities is an opportunity and an absolute requirement. The scale of our operation requires us to rely upon technology to underpin robust, reliable, repeatable and efficient processes.

Our information technology estate underpins our whole operation, from recruiting personnel, modelling gas supply, demand and flow patterns, through designing and building our network, to contracting, purchasing, construction, billing, operating, identifying faults, responding to reports of gas escape, sending work to engineers, capturing data, managing performance and paying our employees, contractors and suppliers.

Our distribution network control system is designated as critical national infrastructure and we are an operator of essential services. Customers have told us that they expect a safe and reliable service, so investments in this area are focussed on safety and reliability.

Planning for investment in Information Technology is different from investment in engineering assets. The "virtualisation" of IT and use of cloud computing reduces the need to look at the physical IT estate and allows the focus to fall on the differentiating factors, for example software services. So, our IS investment plan doesn't major upon how many Windows machines we have, how many IBM Unix machines we have, how old they are and when those need replacement, which we would have done at the start of RIIO-1. Rather, the focus is on how we can utilise generic technology in virtual machine "stacks" in the cloud to deliver different software services, choose the right, most cost-effective services and to rationalise where there is overlap.

In managing the portfolio of IT systems that we have, we group the systems into capability areas. This allows us to rationalise the number of systems in a single capability area and reuse as much as possible.

5.2. IT Innovation

Alongside the ongoing investment in our existing IS estate we will need to adapt and adopt new technology throughout the RIIO-2 period, and we have therefore separated the investment we intend to make in IT innovation. Both areas of spend underpin the commitments we are making in our RIIO-2 plan.

Our IT Innovation plan should be quite volatile, with ideas emerging, being tested, and some leading to implementation. Other ideas may be held until the opportunity can be realised. The current identified projects are:

- Sensor Telemetry and Smart Devices
- The Internet of Things
- Customer Insight and Segmentation
- Advanced Analytics, Artificial Intelligence and Machine Learning
- Digital Twin
- Automation
- Wearables, Virtual Reality, etc.

More information is given in Section 8.

5.3. Data and Digitalisation

Data is at the heart of everything we do as a business. With a renewed focus on our customers to ensure a positive impact to local communities and businesses, we are investing in data and the effective use and management of data, as a key enabling capability, digitalising our operation to make us the best at what we do.

For example, we are exploring machine learning and artificial intelligence to drive a whole new approach to how we manage our plant protection. Through this data-driven innovation, which uses satellite images and machine learning technologies, we have the potential opportunity to improve safety across our network by analysing a broader geographical area of our network than we currently do at a lower operating cost. This digitalisation of plant protection may mean we can decommission existing practices of using helicopters and line-walk crews yet have a more complete and accurate understanding of our network further improving safety within our operations.

Our energy system is changing. There is a concerted effort to reduce carbon emissions across power, heat, and transport. Energy is getting smarter, more flexible, and increasingly decentralised. Gas, as a major source of heat, will play an important part in this transformation. Future gas networks will need to transport gases from renewable and sustainable sources requiring improved levels of safety, reliability, and affordability. The effective use of data will be essential to unlocking the potential of these developments and is absolutely critical if we are to hit our net-zero targets by 2050. Cadent is determined to play its part.

Given the importance of data for our business and customers we completed a data management maturity assessment in March 2019, which identified gaps in our current data management capabilities that will impact on the value we can derive from our data and deliver to customers if unaddressed. In light of this assessment, we developed a digitalisation and data strategy in consultation with our Customer Engagement Group (CEG) that articulates how we expect data to support our business commitments going forward.

Our data strategy outlines a routemap of investment in RIIO-1 which will put in place the foundations for robust data management ahead of RIIO-2, when our focus shifts from 'competency' to 'leadership'.

We will be able to use our data to have a 'single view' and provide tailored services to our customers. We will have a complete view of our asset data enabling us to make better asset management decisions. Data capture will be simple for our operational teams, and we will be able to accurately measure our efficiency and quality in near real time. Data will drive operational excellence in the back office. Data will be readily available to all our employees and customers, and we will improve the quality of our data through continuous use. Our data will be easily extracted from our systems in an automated fashion to meet regulatory reporting requirements with intelligent assurance. We will use our data to identify innovative ways of working to lower our costs and to provide valuable new services for our communities and customers. We will trust our data and share it externally with our stakeholders, communities and partners who work with us to identify new sources of value and to support the transition to a low carbon economy.

Further Reading

The first draft of our digitalisation and data strategy, which addresses the areas of Data and Digitalisation agenda, is set out in fuller detail in Appendix 07.02.02. The investments that we propose to make are set out in section 9.

5.4. Cyber Security

Cyber security is a key concern of stakeholders. Its benefits case is centred around the appropriate mitigation of risk of disruption of services as a result of a cyber security incident, and the efficient recovery from a cyber security incident.

Our proposals are set out in Appendices 07.02.00 and 07.02.01 rather than being repeated here.

6. Our Technology Strategy

The RIIO-2 plan for IT investment is driven out of our Technology Strategy for Cadent.

We have identified the technology areas that we utilise in Cadent and for the majority of these, our strategy is to standardise, commoditise, consolidate, simplify and rationalise to deliver these important solutions as efficiently as possible – for example our payroll solution.

However, there are a small number of 'differentiating' technology areas that have the power to digitalise our business, transform what we do and enable great performance for our customers. In these areas, we will seek to deploy solutions that add value to customers, help us to make better decisions, improve the productivity of our workforce and ensure that we deliver the reliability that customers expect.

Figure 1: 'differentiating' technologies highlighted

6.1. Field Technology

Our workforce is one of the greatest cost components of our business and is heavily IT-dependent. The technology available today is significantly different from that found at the beginning of RIIO-1. We seek to maximise the value of that opportunity and continue to do so through RIIO-2.

Interoperability of work and resources is a key constraint today and that represents the essential challenge to address.

The objective of our Field Technology strategy is to give our field, front office and back-office workers the tools and data they need to deliver services that our customers love. We propose to transform the level of access our engineers in the field have to the data and insight they need to work efficiently and serve our customers brilliantly. The data provided to field based workers will be tailored to their network and our priorities, and will deliver flexible ways of working, driving the improvements in productivity needed for our business plan.

As we change our delivery partner operating model for RIIO-2 we need to support new ways of seamlessly exchanging information and data with 3rd parties, providing the same standards of service to our customers regardless of whether they are employed directly by Cadent or through third parties. We need to address the constraints of our legacy solutions to transform the services we provide and deliver the efficiency improvements embedded in our plan.

6.2. Customer Experience

With the exception of the standard connections process, where approximately 60% of quotation requests come through our online portal, almost all (>90%) customer interaction into the Customer Centre is currently telephone-based. In 2017, across the UK, call centres noted a 6.1% drop in voice contacts, a clear signal of a change in customer preference for more digital channels. Email and SMS, along with social media are the biggest growing channels, both areas where we currently have a very limited offering.

The Customer Centre receives approximately 1.4m calls per year of which 1.1m relate to the emergency call handling process, and under the Gas Safety (Management) Regulations these must be delivered via traditional voice contact in the UK.

There is an oportunity to address the channels that we use for other customer interactions into the Customer Centre. 86% of enquiries and 70% of customer escalations are received via voice contact. The next most frequent channel is email, equating to 25% of escalations and 10% of enquiries. Less than 1% of customer contacts currently come via social media and there is a very low following of either Cadent's Facebook or Twitter feeds.

Our vision is to set standards that all of our stakeholders, communities and customers will love, and others will aspire to. We are taking a 'customer first approach' that has an ethos of keeping people safe and warm, and constantly maintaining availability of gas supplies to our customers by developing appropriate techniques and using innovative ways to achieve this goal. We will also push the boundaries of our role in supporting the safety of customers in the home, helping alleviate fuel poverty and making our services more accessible to all types of customers.

Our customer strategy focusses on short-term actions in RIIO-1 to address the current gap and longer-term initiatives to establish a customer-centric operating model and technology platform which will enable our customers to truly feel the changein the way we operate. We have started the process to procure new customer relationship management solutions, which will allow customers to access real time information relating to work in their area and services that they are receiving, plus allow two-way dialogue with customer agents.

Our longer-term technology roadmap will create a multi-channel customer experience with far greater levels of automation, reducing the time to resolve customer enquiries and issues and reducing the operational overheads associated with heavily manual processes. We will be able to use real time data to segment customers and tailor processes and services to their preferences and circumstances. This will bring us in line with the level of service and contact choices customers have come to expect from organisations.

6.3. Insight and Analytics

Our industry is presented with new challenges as operational gas networks, field force, IT systems, devices, and sensors are converging as an end-to-end ecosystem in a connected, digital world. The impact of this is resulting in the rapid expansion of information and data that has never previously been available and has opened up the opportunity for deeper analysis, new insights – digitalisation – for our business and other stakeholders in the energy industry.

Becoming a data-driven organisation will require investment in a modern data and analytics platform. Information and data are at the centre of everything we do.

It is critical that our business has access to data and reporting for analysis, insight and decision support capability. We expect that this will be delivered using a self-serve on-demand model that can provision multiple-use cases for end-users. At the same time it is imperative that our data is secure and protected.

We will leverage cloud computing, and data and analytics capabilities to create a flexible and agile solution, which will be our prime platform for storing, acquiring, organising and analysing our data.

6.4. Future Technology

6.4.1. Smart Networks, Assets, Sensors

The Gas Distribution Network today is effectively classed as a 'dumb' network. That is to say, it can describe what is happening, most of the time, but relies greatly on external, manual decision making, control and monitoring to ensure safe operation.

The network needs to evolve into a 'smarter' grid in order to adapt to the changes in the gas industry, increase operational efficiency and improve customer interactions. A smarter network is more self-sufficient, responds to real-time data, integrates with our customer and operations processes and recommends actions to take reducing the reliance on human decision making. By building a smarter network, we will make efficiency gains from optimising operation and maintenance of the network, though this will likely only be realised in RIIO-3 or RIIO-4.

Customer expectations are increasing and a smarter network will enable us to provide an efficient, interactive experience as well as deliver greater value to reduce energy bills. The role of gas as a source of energy is set to evolve and with it the ways in which our gas networks operate. It is anticipated that the operation of our networks will become more complex, requiring more data to be managed, in faster timescales.

Even though the changes will be gradual, the changing composition of the gas network and the continuous drive to increase efficiency and provide better value for the customer will necessitate engineering and technology changes starting in RIIO-2.

We want to work with industry and new technology to achieve a smarter network. This may involve collaboration with the whole industry helping to define the standards and frameworks that will be required. Our strategy is to invest in pilots and trials using smart network and sensor technologies during RIIO-2 with a roadmap to developing production systems.

We will explore ways in which to cost-effectively extract as much useful data as possible from our network to support decision making, analytics and potential cross-industry collaboration. We will transform the current estate of visualisation systems and analysis systems to improve integration and to make data more available for faster analysis, augmentation and in pursuit of automation or robotisation. This initiative is closely aligned with the "digitalised energy system", as proposed by the Energy Systems Catapult in their Energy Data Taskforce report, as well as our investement in a digital twin.

This strategy aligns to System Operation.

6.4.2. Cloud, Automation, Robotics

Cloud computing is a style of computing where easily scalable or elastic IT-related capabilities are provides "as a service", rather than companies investing in their own physical technology in their own data centres. Utilities have been slow to adopt cloud computing, having had their own data centres for a long time. However, separation from National Grid has provided the perfect opportunity to establish our technology "in the cloud".

Cloud computing is now very mature, with Enterprise Resource Planning (ERP) Customer Relationship Management (CRM) and Human Resources Management (HRM) services moving to the cloud, as well as large numbers of smaller vendors providing low cost cloud based services.

We have adopted a 'cloud-first' policy. We are transforming our IT estate so that by the close of RIIO-1 we will be in a position to realise the value of that transformation through RIIO-2 and avoid the higher cost of change associated with legacy approaches to technology.

We will transition to a hybrid cloud (which includes both public and private) for our core business applications and end-user compute services [text redacted].

Having moved to the cloud, we expect that vendors will start to offer machine learning, automation and robotics capabilities as part of their cloud offering, opening the way to further efficiencies. We have started to investigate these areas in the latter years of RIIO-1.

6.5. IS Operating Model

When we separated from National Grid in RIIO-1 we had the opportunity to create a new IS function and adopt an efficient and effective IS sourcing strategy and operating model. The IS team is made up of both internal and external capability with the former acting as the 'controlling mind' and taking accountability for the services and solutions we provide and the latter being responsible for the delivery of new investment and supporting the IS landscape. The external capability is made up of a small number of strategic IS delivery partners that cover networks, cloud and infrastructure, application and service-management integration and our cyber security operations centre, balancing the value of in house capability for differentiating areas of the function

with leveraging capability from expert providers for efficiency and value. These strategic partners have been engaged following a competitive and rigorous procurement process, ensuring we habe engaged the right capability at the best price in the market.
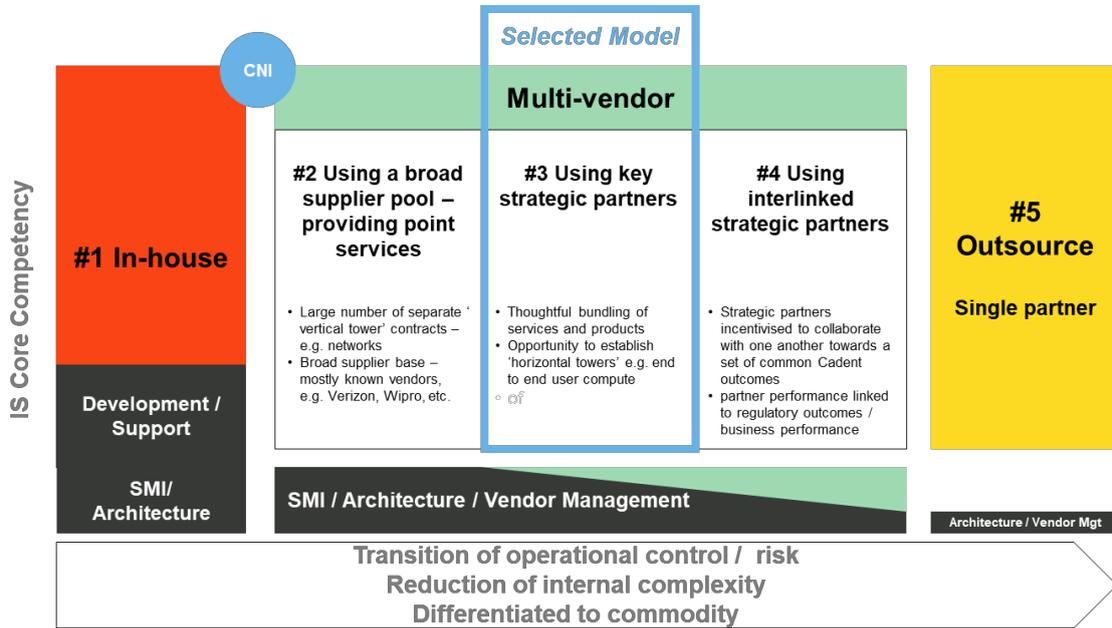
Figure 2: Our IT Sourcing Model

Our solution delivery function is accountable for delivering the investment from business analysis, design, test, build and deployment using the IS service partners. Following deployment, our service delivery function is accountable for managing a secure, efficient and reliable IS service, with focus on maximising productivity, managing risk and optimising cost, by leveraging the full potential of the service-delivery technology partners to ensure a positive customer and colleague experience. We have a framework of partners avaialble to work with to deliver new investment and are able to run mini-procurement events for new investment which ensures that we continue to test the level of investment needed to deliver our projects.

The Service Delivery function manages the day to day running of the IS systems and services we provide. Our processes are aligned to best practice and optimised to ensure seamless customer and colleague experience. Service accountability and assurance sits with the internal service delivery function and our services are optimised and simplified to ensure delivery of a cost-effective and efficient service that is aligned to customer and business outcomes.

7. Our Baseline IS Plan

This part of the plan reflects the level of investment required to maintain our existing IS estate and drive incremental improvement in the processes that we operate using those solutions.

To determine the level of investment we need to make in RIIO-2, in each of the technology areas that we currently use, we explored three options:

1. Baseline/minimum asset health investment sufficient to keep doing tomorrow what we do today.
2. Reducing our reliance on technology and the immediate costs of technology, which would have implications on service and costs elsewhere in Cadent
3. Transformation through technology - where we maximise investment in technology in the expectation that it will transform our operations or services

Each of the options has been costed for individual investment lines within the plan, and we have then considered other efficiency factors and included those within the plan.

It should be noted that whilst we have considered reducing our technology reliance (option 2) it has rarely been an option that we have pursued not only because of the increases in costs we would see elsewhere in Cadent, but also on advice from Gartner. Gartner reviewed our proposed plan and noted that it is already 5% below the low end of their equivalent range and that significant underinvestment poses a risk for Cadent.

7.1. Plan Summary

Our IS investment plan proposes to invest XXXX over RIIO-2[2].

Redacted due to commercial sensitivity
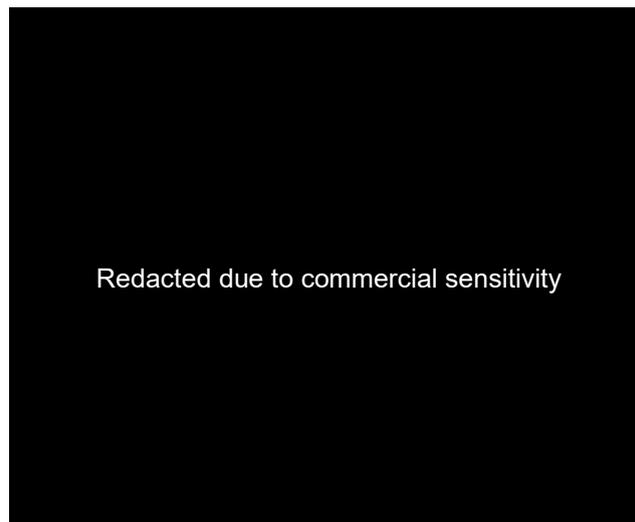
Figure 3: IS Plan Summary

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[2] Totex, 18/19 figures, including efficiency savings.

7.2. Investment Drivers

Information Technology is fundamental to our business and our IS plan reflects the investments we need to maintain the performance and efficiency of our services and operations.

Examples of the underlying drivers for investment in the health of our IS assets are shown below:

'Failure Mode'	Explanation
Compliance Requirements	Some industry regulations (for example Payment Card Industry data security standards) *require* software to be maintained within support to demonstrate that we are appropriately managing personal data.
Hardware Failure Risk	Computer hardware, as a physical asset, wears out. Moving parts such as discs, cooling fans, tape drives will fail. Power supply units and other electronic components can also fail. For the most part, we have managed this in the short term through 'virtualising' systems when we migrated them to new data centres in 2012-2014 and again as we have separated from National Grid in 2018-2019 but a few IT services were not virtualised and remain on 'physical' hardware.
Support for Technology lapsing	Technology goes 'out of support' or is declared obsolete by suppliers. Extending support beyond the expiry date increases costs and risks of failure increase significantly. The use of dev/ops and other development techniques has resulted in the shortening of software release cycles.
Security Risk	Once a vendor ceases to provide software updates for their product, security patches also cease.
Contract Expiry	Even where a service has been procured as a software-as-a-service offering (and therefore there is no need to refresh the hardware separate to the contract licence or support costs) we only enter into a contract for the supply of such services for perhaps three to five years; sometimes longer. Towards expiry of that contract, we have to decide whether to go to the market to replace the system or that the cost/benefit of going to market will not deliver a saving against current operating costs. Staying in a contract without going to market can lead to higher operating costs, as there has been no commercial incentive on the incumbent through competition; but equally, the cost to achieve a migration from one service to another can be significant. Thus, contract expiry will more and more become a driver for 'replacement' as we adopt a cloud-first strategy.

Table 1: IT Failure Modes

In addition to these drivers for investment, there are other factors which determine the level and frequency of investment:

Exacerbation	Explanation
Commoditisation	As market innovation evolves, we expect more services to move from the bespoke offerings that are used by companies in specific markets to a more open, commoditised set of offerings from vendors. Bespoke software will become very expensive or unsupported, forcing a move.
Commodity Devices Shorter Lifespan	The lifespan of commodity devices has become shorter as they are driven by consumer sales which may result in increased asset refresh frequencies.
Business Change	Changes in our business driven by continuous improvement or new services being required etc may result in changes to our existing solutions or can drive a need to secure new solutions

Exacerbation	Explanation
Business Environment Volatility	One of the factors that drives the frequency of refresh or replacement, or the length of a supply contract, is that of the business environment volatility. If the business environment is stable, we might plan to keep an asset or stay in a contract for a longer time. Where a business environment is more volatile, it might be prudent to plan to keep an asset or stay in a contract for a shorter time.

Table 2: Investment Frequency Exacerbations

In addition to the drivers, level and frequency of investment we also need to consider the risk and impact of failure to maintain asset health:

Impact	Description
Business Criticality	The impact of failure on customers and the ongoing business drives the prioritisation, as well as the risk.
Service Restoration Risk	Components of applications or their infrastructure that are past end of life have a risk of lengthening service restoration times, creating an impetus to upgrade or replace.
Availability and Cost of Expertise Risk	The further we get beyond end of life for a given component, the smaller the pool of available knowledge and experience in the market is for our partners, increasing cost and risk.
Software Obsolescence Technology Change Risk	Computer software, standards, communications protocols et al change constantly. This leads to the problem of compatibility of aged software with the other components it needs to interact with, which can inhibit new business change.
Software Obsolescence Business Change Risk	The business environment changes constantly. There is a risk that an aged IT system is no longer able to grow in line with the business if additional disc capacity can no longer be purchased, or software limitations prevent growth.

Table 3: IT Failure Impact Analysis

7.3. Options Considered

To determine the level of investment we need to make in RIIO-2, in each of the technology areas that we currently use, we explored three options:

Baseline As Is	This option would meet the very basic elements of maintaining our IT estate on an 'as is' basis. This option would not enable us to meet our RIIO-2 plan and output commitments to customers.
Option 1 Proposed	Our Proposed plan reflects a balance between maintaining the health of existing assets and selectively investing in technology to deliver improvements in the services we offer and, in some cases, transform them.
Option 2 Minimise Investment	This option assumes that we remove technology and reduce reliance upon it. This plan would seriously undermine our ability to deliver existing value to customers and would not allow us to meet our proposed RIIO-2 technology-enabled commitments.
Option 3 Full Transformation	This option assumes we maximise investment in technology to transform our services and processes. Feedback from Gartner highlighted the risk of achieving the business benefits associated with this level of investment particularly in new and less tried and tested technology solutions

Table 4: Technology Plan Options

7.4. Business Case

The business case for our technology expenditure is embedded in the rest of the Cadent plan, for instance benefits associated with investment in our field technology solutions will reduce our operating costs, support improvements in productivity, and remove manual handling of data between systems.

We need to invest in the IS plan in order to

- Enable our connections strategy
- Improve customer satisfaction, for example by improving the information we can provide about the work we are doing; offering more channels of communication; reducing waiting times for work; and improving our change pace
- Offer a capacity reservation service
- Avoid growth in employee numbers, for example: where operations are becoming more complex, we will automate more of the activities
- Improve personnel safety
- Comply with regulations and reducing the risk of non-compliance
- Reduce operating costs by improving productivity, for example: by removing the 'data preparation' or manual handling of data between systems
- Remove manual data-entry errors, for example: in our network analysis activity
- Maintain our ability to make good decisions by maintaining our management information and reporting capabilities
- Improve the amount of data that we can process and make decisions on through the introduction or expansion of advanced analytics, artificial intelligence and machine learning
- Improve the flexibility, scalability of our IT, and hence reducing business change costs by moving services to the cloud
- Improve the IS management of our estate of technology through the provision of cloud orchestration, sourcing effective service management providers
- Avoid service failure by maintaining our IT assets
- Rationalise our IT assets by reducing the cost and complexity of the IT estate
  Reduce the cost of change through standardisation

Failure to invest in our technology can lead to a reduction in safety and security, reliability, financial impacts, disruption to customers or other effects, depending on the technology that is affected.

We prioritise the services that we operate in a "business continuity" planning matrix. The impact of failure of a service is prioritised to ensure that those services that are most important and impactful to customers and stakeholders are not only designed and built to a standard appropriate to the need but also prioritised for restoration in the event of failure, so that impacts to customers and stakeholders are minimised.

One example of a critical service we provide is the gas emergency telephone service. The consequences of a failure of that service could result in customers being unable to report a gas escape, which in turn could lead to an avoidable loss of life or property.

The systems that we use to manage the work that our engineers do are also critical to our effective and efficient operation. When these systems fail, it affects our ability to issue work quickly and efficiently affecting standards of service, reducing productivity, increasing costs and disrupting customers. We know that disruption to these systems can lead to significant additional costs.

Of course some of our systems have much lower impacts when they are unavailable and we are able to use manual processes instead. However, the major investments in our IS plan are focussed on the core, critical activities that we undertake; and our technology is essential to ensure we can meet our business goals and aspirations for our customers.

7.5. Proposed Option

Our Proposed IS plan investment is set out below and is a combination of Asset Health, Continuous Improvement and Transformation. Our plan is intended as a balanced view of the options and with due regard to the Totex Incentive Mechanism.

18/19 prices	Baseline	Proposed Option 1	Option 2	Option 3
1. Smart Networks / Assets / Sensors				
2. Customer Experience				
3. Analytics / AI / ML and MI				
4. Cloud / Automation / Robotics		Redacted due to commercial sensitivity		
5. Workforce of the Future (Field Technology)				
7. IS Operating Model & Efficiency Savings				
Total				

Table 5: IS Plan Options Analysis

Smart Networks/Assets/Sensors:

Our proposed investment in Smart Networks / Assets / Sensors includes some efficiency in the rationalisation of the Gas Supply, DNV GL and Engineering Framework applications, so proposes a lower spend than a baseline minimum asset health plan.

Customer Experience:

Our proposed investment in Customer Experience is to invest more in this area to meet the output commitments that we have made.

Analytics/AI/ML and MI:

Our proposed investment in analytics is in line with the minimum to maintain asset health. Note – the IT Innovation plan does include investment in this area.

Cloud/Automation/Robotics:

Our proposed investment in this area is a little higher than the baseline to reflect expansion of these solutions in line with other investment areas

Workforce of the Future/Field Technology:

Our proposed investment includes efficiencies in device replacement.

IS Framework and Efficiency:

We will need to re-tender the contracts for applications development, applications maintenance, service management integration, cyber security operations and printing during RIIO-2. There are no assets in this contract re-tendering activity, so the baseline asset plan for that investment is nil. However, we are required to go to market for contracts over the EU threshold, so our proposed plan includes some costs for moving to new suppliers.

Overall, we believe our proposed plan to be challenging but appropriate: we are reducing costs where we can see opportunities to do so and investing more to improve customer service.

8. IT Innovation

8.1. Plan Summary

Our IT Innovation plan should be quite volatile, with ideas emerging, being tested, and some leading to implementation. Other ideas may be held until the opportunity can be realised.

Our IT Innovation plan proposes to invest XXXX over RIIO-2[3].

Redacted due to commercial sensitivity
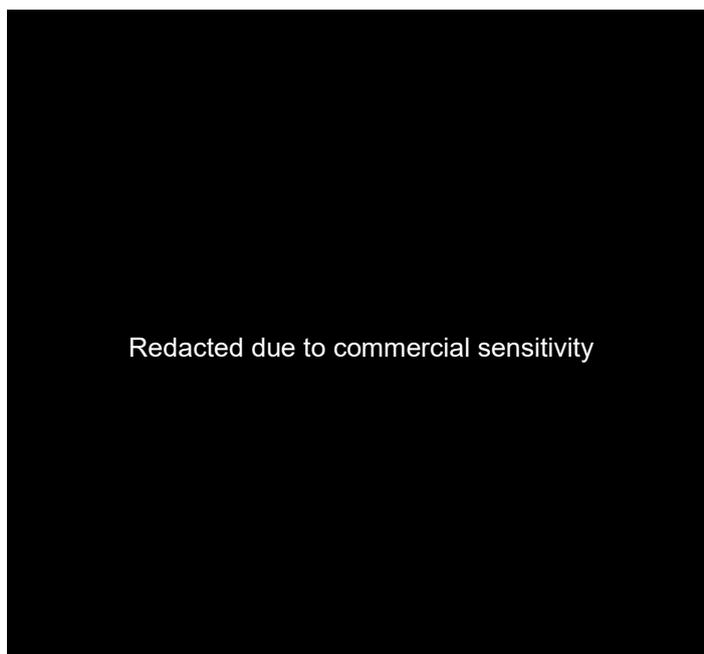
Figure 4: IT Innovation Plan Summary

8.2. Investment Drivers

One of our company values is curiosity: we look upon the challenges of the work that we do and challenge ourselves to ask the questions about how we do that work or what we could do differently that would deliver a better outcome for customers, and we have the courage to make the change.

Technology is one of the levers that we will use to transform the way in which we deliver value for our customers.

Our engagement with industry analysts indicates a number of technologies that could have relevance to us as a utility company: augmented reality, virtual reality, blockchain, the use of drones, the Internet of Things, the availability of GPS tracking data, RFID tagging, satellite imagery and many other innovations could have a role in helping us to serve customers more effectively or deliver core services more efficiently, reliably and safely. We have considered which of these, and other emerging technology, have clear use cases or are at an appropriate level of maturity for us to invest in and deliver value for customers.

The proposed plan includes those areas we have identified but we expect that the plan will be dynamic and new opportunities may be identified.

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[3] Totex, 18/19 figures.

8.3. Project Scope and Interrelationships

Our IT Innovation plan represents investment over and above our IS plan. The current identified projects are:

Sensor Telemetry and Smart Devices [4]	Initial funding to transform the way in which we collect data by deploying sensors across the network. This initiative has the potential to create a data set that will allow us to understand our networks at a level of detail beyond what we have today, and which will help us to integrate new sources of gas, and to offer capacity or connections more cost-effectively.
The Internet of Things	We will need a central capability to manage the collection of data from field sensors.
Customer Insight and Segmentation [5]	We have started to segment and understand our customer and stakeholder groups in RIIO-1. However, to reach the maturity of delivering the most inclusive and accessible services to all of our customers, we need to invest further in this technology area.
Advanced Analytics, Artificial Intelligence and Machine Learning [6]	The utilisation of data to make better decisions. Investment in advanced analytics, artificial intelligence and machine learning is assumed in our plan.
Digital Twin	Digitally representing real world objects to deliver insights, improve operations, increase efficiency or discover an issue before an impact is experienced. The lessons learned from the digital twin can then be applied to the real-world system with lower risk and higher return on investment.
Automation	Automation of activities enabled by cloud computing and the opportunity to use services from our suppliers to run automated activities, saving on employee or contractor resources to undertake repetitive activities.
Wearables, Virtual Reality, etc.	As part of our field technology/workforce of the future strategy, we will investigate the role and opportunities that wearables and virtual reality have in changing the ways in which we work.

8.4. Options Considered

As it is difficult to estimate the level of investment required we have considered the following approaches:

Option	Criteria
1. Full funding	The innovation could be fully implemented in RIIO-2 or could be implemented on a significant scale and the benefits of the project are clear.
2. Partially funding	Capability and applicability of the technology tested in some organisations and benefits being realised elsewhere but a trial deployment or a series of trials is needed to demonstrate the value of a fully funded investment in Cadent.
3. 'Seed' funding	This is appropriate where projects are broadly expected to deliver nett present value outcomes (otherwise, we would not pursue them) but there is an up-front need for investment to deploy the technology required: the business case for each individual investment might never be sufficient to venture to invest in the minimum level of technology required for delivery.

Table 6: IT Innovation Plan Options

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[4] This investment is additional to a similar line in our IS base plan that maintains some of the existing data collection systems we have today.
[5] This investment is in addition to that set out in our IS base plan.
[6] Again, this investment is over and above the investment also identified in our IS base plan.

The following table sets out the costs[7] of a full roll-out of each of these technology areas, the level of investment that we propose and the option from the above table that has been selected.

	Fully Funded	Proposed Option £m	Option Proposed
INVP 5101IN Sensor Telemetry & Smart Devices **INVP 5104 The Internet of Things**			
INVP 5205IN Customer Insight & Segmentation			
INVP 5301IN Analytics, Artificial Intelligence & ML	Redacted due to commercial sensitivity		
INVP 5304 Digital Twin **INVP 5405 Automation**			
INVP 5504 Wearables / Virtual Reality, etc.			
TOTAL			

Table 7: IT Innovation Plan Options Analysis

8.5. Business Case

Sensor Telemetry and Smart Devices investment could:
• Reduce the cost of monitoring gas quality, which is important at biomethane injection sites
• Enable the 'future billing methodology' which will require many more data collection points
• Improve our ability to automate decisions. Enable us to make better decisions.
• Automation of activities in our control room will allow us to offer better services to customers by focussing on value-adding activity rather than mechanical actions.
• Collection of a lot more pressure data could help to ensure we can offer capacity in our network to customers without the need for reinforcement investment, by having the data to underpin such decisions.
• BEIS, Ofgem and Innovate UK have commissioned a report on how to achieve a Digitalised Energy System. This investment would be a step towards gathering data that may be needed by such an initiative, although it has not been scoped or scaled for that work.

Internet of Things investment would

• provide a central capability to collect data from commodity devices across our operation
• Allow us to collect more data at a lower cost than using other methods.

Customer Insight and Segmentation investment underpins our business plan and would enable:
• Differentiation of customer offerings through data analysis.
• Tailored responses to customers based on insight.
• Delivery of our customer commitments.
• Reduction of costs by automating some activities.

Advanced Analytics, Artificial Intelligence and Machine Learning investment will enable better decision making to:
• Improve customer satisfaction.
• Improve productivity; meet our operating cost proposals.
• Remove human error.

Automation investment will enable

• Reduction in operating cost in line with our RIIO-2 plan

Wearables and Virtual Reality investment could:

• Improve productivity
• Improve safety

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[7] Totex, 18/19 prices.

8.6. Investment Timing

Typically, these investments are proposed in the early years of our plan. Digital Twin, Automation and Wearables investments are currently later in the plan.

18/19 prices	Total	21/22	22/23	23/24	24/25	25/26
1. Smart Networks / Assets etc.						
2. Customer Experience						
3. Analytics / AI / ML and MI		Redacted due to commercial sensitivity				
4. Cloud / Automation / Robotics						
5. Workforce of the Future						
Innovation						

Table 8: IT Innovation Plan Proposed Option

9. Data and Digitalisation

Data is at the core of everything we do at Cadent.

Our data is critical to how we meet our commitments and deliver quality services to our customers. We have developed data and digitalisation strategies that will support us as we transform our network into one that is smart, self-sufficient, real-time, and integrated.

We have embarked on an ambitious program to transform us into a data-driven organisation and achieve 'data-leadership' by the end of RIIO-2. Investing in data and digitalisation will support us in embedding a data-led culture, enhance our enterprise insight capability to drive decision making, and enable us to share data externally to drive innovation across the energy sector and beyond.

We are already making significant investments in data foundations even as we approach the end of RIIO-1. Additional investments in RIIO-2 are necessary to shore up those foundations and go further.

The investments in RIIO-2 fall into two categories:

1. Further investments into our data foundations including:
   - Data Transformation – investments to maintain and enhance our data estate as core systems and data sources change. This also includes growth in capacity.
   - Data Cleansing – investments in ongoing data management and cleansing across data domains
   - Data Projects – investments in specific initiatives set out in our data strategy in the first year of the RIIO-2 period
2. The implementation of projects to exploit our data (for example through the use of advanced analytics). These investments are included in our innovation plan.

9.1. Plan Summary

This part of our plan proposes an investment of XXXX over RIIO-2[8].

Redacted due to commercial sensitivity

Figure 5: Data and Digitalisation Plan Summary

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[8] Totex, 18/19 figures.

9.2. Investment Drivers

We commissioned a comprehensive data maturity assessment in March 2019. The assessment concluded that we are not where we need to be as a data-led organisation. This lack of maturity has a material impact on the value we can derive from our data and the value that we deliver to customers. In light of this assessment, we developed a digitalisation and data strategy in consultation with our Customer Engagement Group (CEG) that articulates how we expect data to support our business commitments going forward.

We are also aware that as Britain's largest gas network, the data we hold can be valuable to propelling innovation and contributing to solutions in the energy sector and beyond. We want to do more to make this data accessible, available, and insightful to our partners and stakeholders.

We have already started on our journey to become a data-driven organisation and have set in motion an ambitious programme that will establish data competency by the end of RIIO-1, and sector wide data leadership by the end of RIIO-2.

The drivers for investments in data are:

Cultural Change	There is a need to further embed a 'data-led' culture throughout the organisation in order to create visibility and appreciation of the role and importance of data being captured, maintained, used to drive insights.
Data Quality Management	There are general concerns around the quality of data and its impact on business performance. There are numerous offline/non-core systems present and a general lack of quality measurement and management.
Data Governance	Previous data programmes have been siloed with varying degrees of sponsorship and governance in each business domain. This results in a lack of central drive, focus and end to end thinking on data.
Data Warehousing and BI Management	There is a reliance on the use of spreadsheets and manual intensive processes to develop MI and RRP. It can be challenging to reach a central single source or truth.
Field Data Capture	There is an issue with the quality and timeliness of data returned from field operations (e.g. planned and reactive repair work order data), and there are several tactical non-integrated solutions in use for capturing additional field data such as surveys.
Data Security Management	Access to data is secured in core systems but there is inherent risk across non-core and offline systems. There are varying levels of understanding and management of roles and accesses across Cadent.
Master & Reference Data Management	Some data have strong master and reference data management, however there are opportunities to improve, particularly across domains and where external data (e.g. maps) is used.
Meta Data Management	There are opportunities to make data retrieval easier through improved search and to trace dependencies between data items, aligning with the ambition in our digitalisation strategy for our data to be 'searchable, discoverable, and understandable'.

As well as these "data" drivers, digitalisation – specifically providing 'open data' to the industry, and the breaking down of data siloes within Cadent to allow "data hacking" events to take place to find new insights that will drive benefit for our customers and the industry – requires us to make significant steps from where we are in 2019

To address the above drivers, we have identified the following actions:

Governance	Mobilisation of a centralised data team to embed and enforce data governance, data quality management, and monitoring.

Culture	Development of a data engagement programme to communicate Cadent's data strategy and vision, and the importance of getting data right across the business, sponsored by key messages from the ExCom.
Value	Delivery of an Analytics platform to support the business exploiting value from the data lake / enterprise data warehouse delivered in RIIO-1. This includes investment in analytics and data-science capability in the core data team and supporting the various data domains in developing advanced analytics use-cases.
Engagement	Proactive leadership in the digitalisation of energy. We are engaging with others across the industry, currently utilising the Energy Networks Association Energy Data Working Group as a forum for engagement but we recognise that there will be many players who can contribute and our engagement strategy will adapt to bring diverse views to bear.

9.3. Project Scope and Interrelationships

Our planned investments in technology, data, and cyber security will put in place the foundations for data management by the end of the RIIO-1 period (31 March 2021) including a centralised data team, data governance, data quality management, and monitoring. We are building data engagement throughout the organisation, delivering critical data fixes (filling in the gaps), and developing a leading data analytics platform to help maximize the value of our data.

Our Data Foundation Programme has started and includes the following initiatives:

- Setting up a central data team
- Governance and architecture
- Internal engagement campaign
- Analytics platform
- Data quality tooling
- Data Refreshes
- Feedback mechanisms and training

Beyond RIIO-1, the focus shifts to using the foundations to go further. By the end of RIIO-2, Cadent intends to move to a state of 'data leadership' with our data being used to drive internal innovation and enable the wider industry to make better operational and investment decisions.

Along with additional investments to bolster the data programme, we aim to use our foundations to go further. This involves consolidating our analytics platform, identifying advanced analytics use-cases, and investing in strategic initiatives.

We have identified the following initiatives requiring investment during the RIIO-2 period:

RIIO-2 Initiative	Description	Proposed Investment X
Data Projects	Cataloguing of engineering drawings that current reside in our archive and digitisation into core systems of record, based on value. Review of existing system roles across core systems and owners, and identification of new owners if required. Includes ensuring that each role owner is clear on the role description, and the approval process for new requests Further change initiatives building on the foundation campaign and training delivered during the RIIO-1 period	Redacted due to commercial sensitivity
Data Cleansing	Ongoing data cleanse during RIIO-2 across data domains	
Data Transformation	Development of data capabilities as the technology landscape changes during RIIO-2. Covers the maintenance of existing capabilities as core systems and data sources change, and delivery of additional capability later in the period.	

Table 9: Data and Digitalisation Investments

This plan is the natural progression of the journey that we have started in RIIO-1 and is a key enabler of our data and digitalisation strategies. It will play an essential role in providing the capabilities required to become a truly data-driven organisation.

9.4. Business Case

Data is fundamental to our business and the realisation of benefits in the rest of our plan. For instance, it is a key enabler of our innovation plan which includes advanced analytics capability. It will also help us to reduce our operating costs, optimise our operations, and deliver better value to our customers. Our historical shortcomings in managing data also had severe consequences on our ability to deliver on our commitments to our customers. Investment in data, data governance, management and integration is essential to maximising value to our customers, partners, and stakeholders.

Our focus in RIIO-1 is to get a central data team in place, a data governance and architecture framework, an analytics platform and data quality tooling. In RIIO-2 the investments will take us further, enabling operational improvements, better insights into customer need and data-driven innovations to help safeguard energy security for future generations.

9.5. Regulatory Treatment

This investment will not be processed through the NARMs reporting tool.

Cost variance for low materiality projects such as this will be managed through the Totex Incentive Mechanism (TIM).

This investment is accounted for in the Business Plan Data Table 3.05 Systems Operations: Individual Projects XXXX Sub Table under the System Operations line and IT & Related Telecom: Individual Projects XXXX Sub-Table under the IS Projects line.

10. Benchmarking and Cost Assurance

10.1. Benchmarking

Our technology plan has tried to balance the need for maintaining our existing assets and ongoing investment to support the commitments in our RIIO-2 plan as well as exploit the opportunities that new technology offers.

As the plan developed we have tested it by engaging with international research and advisory firm Gartner to benchmark it in April-May 2019.

Gartner undertook two assessments

1. An 'Enterprise Assessment' of IT spending using 2020-21 data;
2. An investment review of two alternative investment portfolios – one based on an asset health refresh of our IT estate – the fundamentals – and the other, our more transformational plan.

The headlines from the Gartner report are[9]:

Redacted due to commercial sensitivity

Figure 6: Gartner Analysis Headlines, May 2019

Following Gartner's assessment, we reviewed the level of investment and in aggregate, in 18/19 figures, our proposed plan has increased by XXXX than in April 2019.

The following table shows the analysis and assessment of the costs for each of the strategies against Asset Refresh only and our Proposed plan in each investment, in 20/21 prices, including efficiency, that Gartner completed in April 2019, adjusted to show our final plan:

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Strategy	Asset Refresh				Transformation			
	Cadent X	Gartner 'Low' Range	Gartner 'High' Range	Observation	Cadent Proposed	Gartner 'Low' Range	Gartner 'High' Range	Observation
1. Smart Networks etc.				4% above range				18% below range
2. Customer Experience				23% below range				8% below range
3. Analytics / AI / ML etc.				5% below range				Within range
4. Cloud / etc.				12% above range				Within range
5. Workforce of the Future	Redacted due to commercial sensitivity			Within range	Redacted due to commercial sensitivity			33% below range
6. Cyber Security				Not assessed				Within range
7. IS Operating Model				48% below range				46% below range
8. Data and Digitalisation				Not assessed				Not assessed
Total				Within range				4.6% below range[10]

Table 10: Gartner Investment Analysis, Adjusted For Final Submission.

NB: Opex cost savings have been applied to the IS Operating Model numbers, rather than being uniformly distributed across the plan.

Excluding the efficiency savings, the Transformation plan is 1.6% below Gartner's expected range overall for the same scope.

Our RIIO-2 forecasts, as well as adjusting for workload and work mix factors, also include ongoing efficiencies flowing from our transformation activities including from updating and renewing our contracting strategies. Our initiatives are outlined in Appendix 09.20 Resolving our benchmark performance gap. For Capex activities this seeks a 2.9% efficiency improvement by 2025/26 on the end of RIIO-1 cost efficiency level. We have not applied specific efficiency to this element of investment

For Technology IT and Telecoms our confidence is defined as being within Construction stage with a range of +/-5%.

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[10] For the same scope. Data & Digitalisation was not in scope in April-May 2019 when Gartner undertook their analysis.

10.2. Cost Benefit Analysis

In addition to seeking assurance from Gartner, we have undertaken some cost benefit analysis with ICS Consulting. This analysed the options set out in section 7.3. For all of the dimensions of our technology plan, the options analysed are:

Option	Investment Totex[11]
Baseline	
Option 1: Preferred	Redacted due to commercial sensitivity
Option 2: Minimal Investment	
Option 3: Full Transformation	

Table 11: Comparison of CBA Analysis Options

10.2.1.   CBA Approach

We have carried out a Cost Benefit Analysis (CBA) to help inform our investment decisions.

We have used a combination of a full cost benefit analysis on the preferred option against the baseline, and a 'Switching Analysis' approach to understand sensitivities. We have considered the efficiency savings from this investment as part of a full CBA of our proposed option relative to the baseline / status quo position. We find our proposed investment to be cost beneficial. To test alternative levels of investment to our proposed investment, we have used a switching analysis to understand the additional efficiency savings that would be needed to make these levels of investment cost beneficial. From this we conclude that higher levels of investment are unlikely to be cost beneficial.

Where it is not possible or proportionate to undertake a full CBA, the switching analysis approach enables us to use CBA to identify whether an option would be cost-beneficial under reasonable risk scenarios of the likelihood and consequences of failure.

Switching analysis, as set out the in HM Treasury Green Book, is a form of sensitivity analysis that identifies the input values required to change the CBA results:

> *'A switching value refers to the value a key input variable would need to take for a proposed intervention to switch from a recommended option to another option or for a proposal to not receive funding.'* (HM Treasury Green Book, p33)

This approach is particularly useful where there are significant uncertainties, making specification of accurate risk scenarios problematic, as is the case here because the benefits from information systems are difficult to quantify and evaluate, and vary between different systems and hardware. We have considered positive benefits associated with making efficiency savings from a range of initiatives and the avoided costs associated with not investing in systems leading to system failures.

This methodology avoids the need to make central assumptions about the frequencies and the consequences of savings and failures which would be required under a more traditional approach of sensitivity testing the switching values of different input assumptions. For this particular investment area, the frequencies and consequences are uncertain for some of the options, as such it is not possible to specify central estimates. Therefore, it is appropriate to support the full CBA with switching analysis. For our preferred option, we have been able to identify the potential cost savings and have therefore used a full cost benefit analysis to compare with our baseline scenario.

In developing our switching analysis approach, we have followed the Ofgem approach, spreadsheet and societal benefit values and calculations. We have undertaken switching analysis calculations for each region and for the business as a whole.

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[11] Total investment (capex + opex) in 18/19 figures, including efficiencies.

For the switching analysis, our approach is to identify the level of benefits required for the preferred strategy to breakeven. The analysis is undertaken in Present Value terms – that is, we ask 'what is the present value of the stream of benefits that is required to equal the present value of the costs of the option'. We then review this level of benefits to understand whether they are a reasonable minimum description of the uncertain benefits associated with the preferred option.

10.2.2.   Modelled Options

The table below sets out the options taken into the CBA modelling, together with the costs and benefits modelled.

Option	Modelled Costs	Modelled Benefits
Baseline: Maintain the existing IS systems, modernisation as part of cyclical replacements		
Option 1: Proposed Baseline plus balanced spend on technology innovation	Redacted due to commercial sensitivity	
Option 2: Minimal Investment Reduced baseline expenditure, allow IS infrastructure to age		
Option 3: Full Transformation Baseline plus enhanced investment in innovation		

Table 12: Basis of Calculations in CBA Template

In order to compare the net present value of different options to each other the costs and benefits associated with each option need to be entered into the template within the baseline and each option tab. Costs have been taken for the RIIO-2 period.

In simple terms, increasing investment has the potential to release more efficiencies and other service benefits. However, there is a point at which these benefits start to diminish, as illustrated in the following figure. Decreasing investment removes the chance for technology-driven business improvement and the reduction increases the likelihood of IS failures, triggering additional business costs.


Redacted due to commercial sensitivity
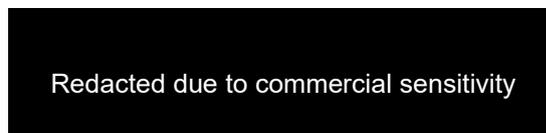
Figure 7: Total Cost / Benefit Illustration (Not Marginal)

10.2.3.   Benefit Calculations:

The benefits considered are the financial savings between the options where there are investments in new technology and initiatives (Options 1 and 3), and the avoided costs due to IS failures where the investment is below the level to maintain the existing IS systems (Option 2). The benefits and avoided costs have been recognised for a 15-year period, which is a conservative assumption from our experience. The XXXX per year of recognised benefits associated with the preferred option have been ramped up over the RIIO-2 period and then assumed to be constant for the remainder of the 15 years. For the switching analysis we have assumed a constant rate of avoided costs and savings over the 15 years.

10.3. Key Business Case Drivers Description:

The business case for our technology expenditure supports and is integrated through all areas of our plan. For example, our proposed use of new technology will support the delivery of our transformation programme; will enable the reduction of our operating costs; provide flexible systems for our workforce to be able to use; supports the intended improvements in productivity; and will remove significant amounts of manual handling of data between systems.

The choice of the preferred option within the cost benefit analysis is driven primarily by the benefit of longer-term cost savings of XXXX over the RII0-2 period and then an additional XXXX per year going forward, resulting from the adoption of the new technology.

The preferred option provides the following benefits:

- Enabling of our connections strategy
- Improving customer satisfaction, for example by improving the information we can provide about the work we are doing; offering more channels of communication; reducing waiting times for work; and improving our change pace
- Offering a capacity reservation service
- Avoiding growth in employee numbers, for example: where operations are becoming more complex, we will automate more of the activities
- Improving personnel safety
- Complying with regulations and reducing the risk of non-compliance
- Reducing operating costs by improving productivity, for example: by removing the 'data preparation' or manual handling of data between systems
- Removing manual data-entry errors, for example: in our network analysis activity
- Maintaining our ability to make good decisions by maintaining our management information and reporting capabilities
- Improving the amount of data that we can process and make decisions on through the introduction or expansion of advanced analytics, artificial intelligence and machine learning
- Improving the flexibility, scalability of our IT, and hence reducing business change costs by moving services to the cloud
- Improving the IS management of our estate of technology through the provision of cloud orchestration, sourcing effective service management providers
- Avoiding service failure by maintaining our IT assets
- Rationalising our IT assets by reducing the cost and complexity of the IT estate
- Reducing the cost of change through standardisation

Some of these have financial benefits that are part of our overall plan; other service and process benefits are more difficult to apply financial values to.

Failure to invest in our technology can lead to a reduction in safety and security, reliability, financial impacts, disruption to customers or other effects, depending on the technology that is affected.

We prioritise the services that we operate in a "business continuity" planning matrix. The impact of failure of a service is prioritised to ensure that those services that are most important and impactful to customers and stakeholders are not only designed and built to a standard appropriate to the need but also prioritised for restoration in the event of failure, so that impacts to customers and stakeholders are minimised.

One example of a critical service we provide is the gas emergency telephone service. The consequences of a failure of that service could result in customers being unable to report a gas escape, which in turn could lead to an avoidable loss of life or property.

Our "front office" systems that we use to manage the work that our engineers do are also critical to our effective and efficient operation. When these systems fail, it affects our ability to assign work or to do so efficiently, leading to lower productivity, increased costs per job and disruption to customers as work takes longer to complete (for example where there are multiple stages to a job that needs different parties to contribute to). We know that disruption to these systems can lead to costs of the order of XXXX per month.

Some of the systems that we have are of much lesser impact, and when those are unavailable for a period, we may resort to delaying activities or a pen and paper, or telephone and email. However, the major

investments in our IS plan are focussed on the core, critical activities that we undertake; and our technology is critical to ensuring we can meet our business goals and aspirations for our customers. We have considered an option to reduce investment in our existing systems (Option 2) to a minimum to determine the risk. The switching analysis below calculates the, breakeven, avoided costs associated with any impacts of not investing in our current systems.

The results of the Cost Benefit Analysis are discussed in more detail below.

10.3.1. Cost Benefit Analysis Results:

The results of the Information System Cost Benefit Analysis are set out in the Table below.

Option	Total NP	NPV relative to Baseline	Cost Beneficial	Payback Year	Capex Spend	Ratio Relative NPV to Capex spend
Baseline						
Option1: Proposed Option		Redacted due to commercial sensitivity				
Option 2: Minimal Investment						
Option 3: Full Transformation						

Table 13: Results of Cost Benefit Analysis for Information Systems X

In option 1, we have identified cost savings associated with the investment in the new technology of at least XXXX over the RIIO-2 period and ongoing at a constant rate until 2036. There are many different benefits associated with the new technology and many are difficult to quantify in monetary terms. These are listed in section 7.1. We have only considered clearly identified cost savings in the cost benefit analysis.

Implementing only the baseline would limit the benefits to the maintenance of the current level of reliability in our IT assets, whereas with additional investment in new technology (Option 1), shows a positive cost beneficial NPV over the baseline of XXXX with a payback in 2041.

Option 3 uses switching analysis and shows that the savings would need to be over XXXX per year to breakeven with the additional investment of XXXX . We do not believe that this quantity of savings would be achievable and therefore do not support this level of investment in new technology at this time. In this case the return on additional IS investment is diminished compared to Option 1.

Option 2 also uses switching analysis, and shows that avoided costs from IS failures of less than XXXX per year would be required to make this option cost beneficial. This is an unacceptably high risk and does not provide good value to customers. This option would exclude capacity planning improvements and reduce our customer segmentation; it would allow our Smart Metering commitment to expire; it would limit the investment in our SAP "front office" estate and reduce our cyber investment significantly. When we have issues with our front office systems, we know it can cost us of the order of XXXX per month. Any failures in our current systems are very likely to impact greater than the breakeven cost. In this case high return investments are not delivered and failure rates increase.

Our priority for information Systems is to ensure that our existing systems continue to provide a reliable service to enable us to undertake our operational activities effectively and efficiently. This is key to enabling us to provide service to customers. There is also an opportunity to invest, at an appropriate level, in new technology and hence make cost savings for customers that are reflected in our overall efficiency savings. Our preferred plan is to maintain our existing services and invest to make cost savings. The cost benefit analysis clearly supports the preferred option and justifies the level of investment.

10.4.Delivery Risk

Ref	Risk Description	Impact	Like-lihood	Mitigation / Control	Commentary
09.30 - 001	Supply & Demand deliverability risk of Resource availability within the Gas industry	Potential cost increases in labour / commodity markets as demand is greater than supply	Low	This column redacted due to commercial sensitivity	This risk for Technology is more pertinent to the IT industry availability of skills, resources, etc. than to the availability of resource in the gas industry. "Cloud first" strategy also in line with rationalisation, simplification and commodity solutions.
90.30 - 002	Stretching efficacy targets may not be deliverable (unit costs increase)	Outturn costs are not met increasing overall programme costs.	Med		
09.30 - 003	Unforeseen outages and failures restrict access for planned work	Programme and delivery slippage due to delay of planned outages and or site access	Low		
09.30 - 004	Unseasonal weather in 'shoulder months', Autumn and Spring reduce site access/outage windows	Increased demands affecting access to sites and planned outages delay and cost increases	Med		IT change is rarely directly affected by the weather. However, our standard practice is not to implement changes to operational systems during the winter operating period, depending on the seasonal nature of the work undertaken by the userbase and the technology proposed to be changed. OT change could be disrupted more by the weather and the impact on gas engineer availability.
09.30 - 005	Unexpected / uncommunicated obsolescence during RIIO-2 period of equipment components	Inability to maintain equipment at full capacity with risk of impact upon supply	Low		
09.30 - 006	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 3rd Party landowner / asset owners. The potential impact is more engagement and slower delivery	Med		

Table 14: