Re-opener submission

Non-operational IT Capex – Enhance Asset Design

January 2023

nationalgrid

Non-Operational Capex re-opener business case

Enhance Asset Design

CONTENTS

1. EXECUTIVE SUMMARY

Our world and industry continue to change at a significant pace and our digital products will need to be able to react and adapt with it. Enhancing our asset design will contribute greatly towards our mission in providing a reliable and flexible gas system as the energy landscape changes. Efficient delivery of our construction projects is crucial to ensure uninterrupted and cost-efficient supply of gas in Great Britain. The key to being able to deliver these projects within the budgeted costs and as per planned timelines is to have an accurate and streamlined flow of data required to make informed decisions about targeted asset interventions.

There are a series of opportunities to achieve greater efficiencies and benefits within current construction processes. Although these benefits have already been assumed by OFGEM through the ongoing efficiency challenge imposed at RIIO-2 final determination for the delivery of investment and construction projects, they require this project to deliver those benefits. In addition, the systems with limited opportunity for data standardisation [redacted] Above all, without major enhancements, the current system becomes a challenge for us to meet the OFGEM data best practice guidelines, Energy Data Task Force (EDTF) and Energy Digitalisation Taskforce (EDiT) commitments.

Our ongoing projects in RIIO-2 have been a continuous endeavour towards enhancing the value of data and how we utilise data to meet our own needs and the needs of external stakeholders. This project is intended to significantly improve the data quality in engineering and construction. Through our research, we have found that implementation of Building Information Modelling (BIM) and Common Data Environment (CDE) together with process transformations, would achieve greater efficiencies in the delivery of construction projects with improved controls and more accurate decision making on asset interventions. Some of the benefits have been listed below:

- Enhanced data management practices.
- Faster drawing appraisals and updates.
- More efficient management of corrosions, defects and works schedule.
- Geo-referenced construction information.
- Improved safety standards and compliances.
- Provides the level of data quality required as part of a foundation for a Digital Twin of the gas network.

Based on this premise, we have been working on details to make an informed choice. [redacted] is estimated to be spent on R&D in FY22/23 to investigate the in-depth business challenges and carry out market research. As a result of this research, we have shortlisted four possible options:

- To do minimum CDE implementation supported by BIM, although it will have lower costs, it does not align to our Digitalisation Strategy, we would not be able to integrate with other systems for enhanced asset management resulting in greater effort to upgrade in the future.
- Second option being delayed implementation of BIM to later date in RIIO-2 or next regulatory period, we would have missed the window of opportunities in applying the efficiencies against majority of construction delivery and RIIO-2 projects. The benefits of the projects would be eroded as the costs of delivery would have risen due to further ageing of assets and greater effort required in the future, thus restrict our ability to plan a Net Zero focused asset plan in the next regulatory period.
- We have also researched into the option of taking a leapfrog approach in creating a Digital Twin Platform which means consolidation of all data asset across the enterprise as well as introduction of BIM and CDE in the business. The effort required from IT and across the business will be significant and to achieve the implementation within the remaining RIIO-2 timeframe will be both high risk in business change impact and high cost involved. There are high dependencies on other in-flight projects, thus putting delivery at risk.

Our recommended option is full implementation of BIM and CDE platform and digitalisation of the complete construction project lifecycle within RIIO-2 period. This approach will enable the benefits of the project to be realised by in-flight and planned construction project, enabling standardisation and full integration of systems to allow consistent and accurate data flows, addressing the opportunities and challenges within RIIO-2 period as well as establishing a solid foundation for digital twin in the future through the internal capability of using BIM and CDE. This is a balanced approach evaluated based on a set of criteria defined to ensure that we can achieve our target within a reasonable cost and time and managed risk involved.

Through the recommended option in this project, we plan to invest in the following:

- Introducing a CDE for collaborative working with our partners, bringing together other key elements such as our Digital Platform and our Enterprise Content Management (ECM) systems.
- Standardise asset data collection, analysis and reporting documents, asset classification and hierarchy across the organisation.
- Streamline the end-to-end construction project delivery processes with improved user experiences, training and support of user and establish a framework for continuous process improvement.
- Apply new standards and use the BIM-CDE capability on [redacted] construction projects [redacted]
- Integrate the relevant applications such as [redacted] with the CDE platform.

The request is seeking the approval for [redacted] investment to achieve the outcome of the recommended option. The breakdown for which has been detailed out in the subsequent sections in this document. The implementation of this project will result in up-to-date systems, ability to use BIM and CDE to give us standardised data which can enable us to expand supplier community and support easier future exploitation of data.

Investment Request Summary

The table below shows the amount requested in **2018/19** prices.

Table 1 Enhance Asset Design - investment request summary (2018/19 prices)

Investment (£m)	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	Totals
CAPEX		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

2. NEEDS CASE

Gas Transmission (GT) deliver various construction projects on our operational sites, to deliver a safe and reliable service to our customers and consumers. Our construction project delivery team is responsible for delivering these effectively and efficiently.

Our experience of working with our construction partners in RIIO-1 helped us recognise a wide range of challenges that we face in delivery efficiency of investment projects. Through further investigation, we have identified that efficiencies can be delivered by improving the quality of our data and ensuring we have access to all the data needed in one system. We have learnt that through Digital Engineering, often referred to as BIM, it provides a set of industrial level standardised processes as well as modelling capabilities. Through BIM implementation, it provides a robust, scalable, and accurate asset data platform that enables data interoperability and to achieve full system integration with ease.

The transition towards digitalisation of the asset design and construction project lifecycle at Gas Transmission & Metering began in late 2021 with trying to understand the requirements and pain points of the users who are involved in the end-to-end construction processes. We held several user-oriented design thinking workshops to uncover the issues which lead to delays in construction projects delivery and identify opportunities of improvement which would enhance the overall asset lifecycle. Armed with a wider perspective of the intricacies involved in a construction project, we set out to conduct a proof of concept to test the features of the available solutions in the market for construction project delivery and management. As a part of the proof of concept, we collaborated with an external vendor to explore, assess, and validate the features. Alongside this, we also mapped out existing construction project processes in their current state so that we could identify the gaps and efficiency improvements within them. This is going to form our foundation for the redesigning of processes to optimise them and extract increased efficiency during the delivery of a construction project.

2.1 ALIGNMENT WITH OVERALL BUSINESS STRATEGY AND COMMITMENTS

Implementation of BIM into our construction processes will ensure that the quality of construction data is improved and will support Ofgem's data best practice guidance, laying the foundations that enable data interoperability and data sharing through a future digital twin.

In March 2022 we published our Digitalisation Strategy[1], which sets out the path to digitalisation of our systems and processes, to enable better use of data, meeting our Energy Data Task Force (EDTF) commitments and the shift to Net Zero.

This investment is a key enabler for GT&M to achieve its business objectives aligned to the EDTF as well as EDiT recommendations2, through:

- ***Maximising the value of data***
  Introducing a Common Information model (CIM) for construction data standards; this is a key enabler to achieve a single connected data repository and platform with consistent pre-defined workflows. This can then integrate all different asset health and construction related datasets and correctly stored and readily accessed for the entire construction project which allows operations and project deliveries to be more efficient and sustainable as the industry moves into renewable energy.
- ***Enhancing the visibility of data through metadata***
  We have numerous sets of data related to the asset – namely [redacted] to enable the business to make data-driven decisions and avoid the risk of outdated and unreliable

[1] https://www.nationalgrid.com/gas-transmission/document/139181/download
[2] *Catapult-Energy-Data-Taskforce-Report-A4-v4AW-Digital.pdf (esc-production-2021.s3.eu-west-2.amazonaws.com),* https://www.gov.uk/government/publications/digitalising-our-energy-system-for-net-zero-strategy-and-action-plan/energy-digitalisation-taskforce-report-joint-response-by-beis-ofgem-and-innovate-uk

information being used. Thus, it is imperative to have asset related information and its associated relationship to the relevant metadata captured and configured based on standards which are commonly recognised across the industry. This is in line with data best practices enabling easy access by any user when required and maintain a single source of truth which then becomes essential for operations to maintain the asset.

- ***Coordination of Asset Registration***
  Commissioning of assets at the end of any project is followed by its registration in the relevant systems to ensure all its associated data has been captured correctly for future use. As part of the scope of this project, we need to create scalable data structure to meet the asset registration strategy to enable swift closure of project without compromising on the sufficiency of data required for asset registration. This will also allow timely updates on third party asset condition data reporting systems and ultimately prevent third party infringement.
- ***Visibility of Infrastructure and assets***
  It is imperative to have clear and accurate identification of existing and future built assets for optimised asset management. By using BIM, our construction projects have the capability to design and manage 3D construction models which enable us to carry out the necessary simulation and scenario planning activities as well as to evaluate current assets in use, so that there is more depth understanding and visibility of existing infrastructure to aid planning future projects more effectively and with better accuracy.

As part of our RIIO-2 Final Determination submission we highlighted the Stakeholder Priorities and Consumer Benefits (expanded upon in the Umbrella Document). These priorities were created collaboratively with our stakeholders, to ensure that we focus on the right areas that drive value for stakeholders and consumers and form a part of the key commitments made in the digitalisation strategy of the organisation. This Enhance Asset Design project which focuses on digitalising existing and future construction design and delivery projects directly addresses and aligns to the following:

Key Stakeholder Priorities

- ***Operate a safe, reliable and flexible transmission system***
  Enhance Asset Design will improve the accuracy of asset data available to all stakeholders, increasing the speed and efficiency of data visibility and exchange as well as improve the user experience of involved stakeholders. With a better understanding of assets comes an increased safety when completing maintenance or other work on site. It is also helpful in compiling the health and safety files as a part of digital databooks which are required under data management regulations.
- ***Shape the gas market of the future***
  Introduction of BIM and CDE will improve the quality of constructive components, reduces their cost and minimises waste in comparison with other similar work on site. It is proven that a high amount of construction waste and use of concrete can be avoided by this method.3 The enhanced asset data through the utilisation of BIM and CDE form the foundation of a digital twin across the gas network which will in turn provide us with optimisation simulation capabilities helping us progress towards our Net Zero commitments. This may underpin investments in future regulatory periods where we explore implementing a full digital twin.

Consumer Benefits

- ***Improved Safety & Reliability***
  Access to enhanced data with predictive analytical capabilities will enable pro-active asset interventions, thereby reducing likelihood of asset failure. This can help improve the efficiency of asset operations. The early identification of risks could potentially boost the accuracy of scope and aid reduction in project delivery time.

[3] *https://www.bimcommunity.com/news/load/1324/bim-the-green-future-of-the-sector-the-case-of-net-zero-in-uk*

- ***Reduced environmental damage***
  Asset collateral available in BIM format along with a layer of geospatial maps which will support more environmentally conscious decisions in the future and improve environmental conscious decision making. The availability of a 3D asset library overlaid with GIS data provides capabilities such as clash detection and collaborative environmental surveys which can help minimise environmental impact of new projects to a huge extent.

2.2 DEMONSTRATION OF NEEDS CASE

Our experience of working with our construction partners in RIIO-1 helped us to recognise a host of opportunities to achieve greater efficiencies and benefits in delivery of investment projects. They include:

- ***Require better accurate data feeding pre-construction work***
  We need to provide more precise drawings and records as pre–construction information for the supply chain to validate
  [redacted]
- ***Require better efficiency and accuracy in processes and scope***
  Inefficient processes due to [redacted] and lack of standardisation between teams, which can result in scoping inaccuracies.
  [redacted] This presents an opportunity to drive further efficiencies in delivering to a defined scope
  [redacted]
- ***Obsolete systems preventing delivery optimisation***
  [redacted] There have been missed opportunities in exploiting historical project and asset data due to existing systems unable to support the storage of the same data.
  [redacted]
- ***Require adequate technology to minimise project closure delays***
  Not having access to online design tools
  [redacted] affecting the scoping of future projects.

[redacted]

[redacted] It also restricts us from meeting our internal digital strategy objectives as well as the data best practices demanded to be put in place by Ofgem, EDTF and EDiT.

3. OPTIONS

Details of the preferred option, the list of options considered, and the selection process undertaken to reach the preferred option are set out below.

3.1 CONSIDERATION OF OPTIONS AND METHODOLOGY

The shortlisted options considered were selected through working with key internal business stakeholders and our Architecture team to understand the requirement, and then assessed using a broad range of parameters which we can be grouped as follows:

- ***Criteria 1 – Strategic and customer alignment***
  How does the option align to our business strategy to keep the Gas flowing efficiently and safely? How does it align to our future business strategy of enabling hydrogen on the network, and Net Zero? Does it support our Digitalisation Strategy and stakeholder priorities?
- ***Criteria 2 – Cost***
  How does the chosen option perform against the other options in the Cost Benefit Analysis (CBA)? The CBA includes the Do-Nothing option as the baseline, the cost of delay, and the cost/benefits of the options in this business case. This also considers that some options will realise a larger benefit if delivered sooner.
- ***Criteria 3 – Timeline***
  The possible implementation timelines, when accounting for ongoing internal project dependencies, separation of GT&M from National Grid, and other external factors, such as Government changes in priority and new policies.
- ***Criteria 4 - Other dependencies***
  Does the option depend on a specific vendor or external factors outside of our control.

Following these criteria, we identified a list of options; one has been discounted and four were shortlisted for consideration for Enterprise Asset Design.

Table 2 Options comparison on shortlisted options

Options	Option 1	Option 2	Option 3 *preferred	Option 4
Option Type	Do Minimum	Delay Proposed Capex	Market Based	Market Based
Option name	Simple BIM implementation	Delayed Implementation	Digitisation of construction project lifecycle	Digital Twin Platform
Description	Introduce in-house BIM applications to create and manage 3D designs while everything else remains unchanged.	Delay the implementation of BIM to a later date in RIIO-2 or next regulatory period.	Introduce BIM – CDE platform supported by process transformation. Integration of all systems used in construction within the platform.	Create the digital twin platform across the entire gas network though introduction of BIM-CDE platform followed by 3D scanning, photogrammetry overlay and data consolidation of all assets.
Key Features	• Ability to create, update, store and collaborate on 3D design models for assets.	• Same as Option 1	• Reliable and safe delivery of construction projects as they run and manage end to end with consolidated data from a single platform. • Full data integration and collaboration including 3D design models, project costs and risk datasets with various stakeholders across the network. • Accurate datasets enable data reuse for planning, estimation, and reporting which can then be updated and sustained throughout the asset lifecycle.	• Complete inter-operability across the asset lifecycle. • Full interaction with the asset data across its lifespan to have a single real-time 3D view of the asset/site data. • Predictive analytics capability for pre-emptive asset interventions.
Performance against assessment criteria	• Strategic alignment – partially meet digitisation strategy, most processes will remain manual. Will not meet our architecture strategy as data will not be digitised. Unable to integrate with other asset systems. Limited contribution towards hydrogen transition	• Delayed implementation will restrict our ability to deliver the project within RIIO-2, limited benefit of project. and our ability to plan a net zero focused asset plan	• Strategic alignment - Will meet our digitalisation strategy as it would enhance the quality of asset data right from the get-go and enable us to build further on that through other projects. • Cost - Significant cost for implement but realistically manageable within the current	• Strategic alignment - Will meet our digitalisation strategy. However, there is an element of ‘too much too fast’, and it is beneficial to get the core BIM features stood up before looking at Digital Twin. • Cost – very high cost, which will be challenging to implement

Options	Option 1	Option 2	Option 3 *preferred	Option 4
	with limited data accuracy and re-use capability. • Cost - Lower cost due to less effort required. • Timeline – minimum scope requires minimum time. • Dependencies - less complexity involved with minimum scope.	in the next regulatory period.	RIIO period based upon initial estimation. • Timeline - will meet the criteria based on resource and project scope assessment. • Dependencies – has dependencies with in-flight projects. Have mitigations in place, as shown in the Risks and Dependencies section.	within the remaining years of RIIO-2. • Timeline - will not meet the criteria, due to very high SME and IT resource demand. • Dependencies – this will have critical dependencies on resources used on other projects.

Cost Benefit Analysis Summary

The table below shows a summary of the option analysis completed in the Cost Benefit Analysis.

Option	Total Forecast Expenditure (£m)	10 Year NPV	Delta to Baseline
Baseline	[redacted]	[redacted]	[redacted]
1. Simple BIM Implementation	[redacted]	[redacted]	[redacted]
2. Delayed Implementation	[redacted]	[redacted]	[redacted]
3. Digitisation of construction project lifecycle	[redacted]	[redacted]	[redacted]
4. Digital Twin Platform	[redacted]	[redacted]	[redacted]

To assess the relative financial merits of the options under consideration we have chosen to adopt a Cost Benefit Analysis (CBA) aligned to the CBA model and guidance published by Ofgem. For an IT investment of this nature we consider a project lifetime of 10 years, the minimum term in the template, to be the most appropriate and have therefore predicated our option evaluation on the NPVs over this timeframe and their relative performance to the baseline or 'do nothing' alternative. In this paper our baseline scenario simply includes the costs for running the existing systems used in construction project delivery. All relevant capital costs and operating costs over the project lifetime for each option have been included in the analysis based on the source data in our cost breakdown for the preferred option and our historical experience of similar projects. Our preferred option, Digitisation of Construction Project Lifecycle, is supported by the output of this CBA analysis over the ten year timeframe. The more advanced option of a Digital Twin Platform may deliver greater benefits over a longer timeframe but given the current maturity in this area, complexity involved and high dependencies on other in-flight projects our preferred option strikes the correct balance between investment, risk and payback at this point in time. A delayed or more simplified implementation does not deliver sufficient benefits to support these options.

Other options considered:

- Do Nothing – This is discounted as our systems are end of life, implementing BIM is a key enabler to achieve data interoperability and meeting our published Digital Strategy and EDTF recommendations as referenced in Section 2.

Option Scoring

The table below shows how each of the shortlisted options performed against the assessment criteria and specific parameters.

Table 3 Options evaluation based on selected criteria

Criteria Grouping	Parameter	Option 1	Option 2	*Option 3	Option 4	Justification for selection of preferred option
		Do Minimum	Delay	Digitisation	Digital Twin	
Criteria 1: Strategic Alignment	Keeping gas flowing safely and efficiently (1 - Low, 5 – high)	4	4	5	5	Both Digitization and digital twin options will make project delivery more efficient and provide safety enhancements.
	Alignment to Digitalisation Strategy (1 - Low, 5 – high)	1	1	5	5	Full alignment to published digitalisation strategy and EDTF and EDiT recommendations.
	Does it support our stakeholder priorities (1 – meets 1, 5 – meets all)	0	0	2	2	Preferred option and Digital Twin align the most with the stakeholder priorities set out in the digitalization strategy.
	Does it support the consumer benefits (1 – meets 1, 5 – meets all 5)	1	1	2	2	With delayed implementation, even though having the same features as the preferred option, would erode most of the benefits as further delay lead to further deterioration of assets and associated data.
Criteria 2: Cost	Cost Benefits Analysis Score (1 – Low, 5 – High)	1	2	4	3	The preferred option gives us a balanced risk against benefit [redacted]
Criteria 3: Timeline	Ease of implementation (1 – Complex, 5 – Easier)	4	4	2	1	Easier to implement and less complex compared to digital twin platform.
	Dependency on other projects (1 – High, 5 – Low)	2	4	2	1	Shared synergy and alignment with other related data improvement projects.
Criteria 4: Other Dependencies	Vendor partners (1 – Not available, 5 – Many)	3	3	4	5	Multiple vendors already in initial engagement.
	Does it have a dependency on separation from National Grid (1 – High, 5 – Low)	5	5	5	5	All options have low dependency on separation.
	Total score	21	24	31	29	Preferred option scored the highest of the four options.

With the recommended option, we have assessed each within the shortlisted options against the assessment criteria and parameters in Table 4 – Options Comparison. 'Option 3: Digitisation of Construction Process' has been selected as the preferred option as it has the highest scoring and meets all the assessment criteria:

- ***Criteria 1: Strategic and Customer Alignment***
  It aligns to our business strategy. Our Enterprise Architecture strategy requires systems to be supported and digitised. Delivering this option will move us away from manual processes and outdated systems, enabling future integration with our asset management system. Our business strategy is to decarbonise the energy system, introducing BIM will have positive environmental impact through better proactive management of asset maintenance, and improve our understanding of assets, as an enabler for digital twin.
- ***Criteria 2: Cost***
  The cost of [redacted] for the remainder of the RIIO-2 period is based on the requisite software costs and the implementation plan, and it is realistically achievable to prioritise those funds to the most value-add activities and to meet our target of digitization of design and build activities of assets.
- ***Criteria 3: Timeline***
  It is feasible to deliver option 3 in the remaining time of RIIO-2 without excessive reliance on SME time across multiple projects, this has been confirmed through working with the SMEs to complete a resource schedule.
- ***Criteria 4: Dependencies***
  The dependencies within Option 3 are explored in section 3.2. This option has dependencies on other inflight projects within the IT Portfolio, however these can be managed through mitigating actions and working as a portfolio.

3.2 THE PREFERRED OPTION

Description

The available options were evaluated based on factors as the criteria mentioned above including benefits, associated risks, costs and implementation timelines:

- The 'Do nothing' was discounted as it would mean that there would be greater occurrences of project delay. It would restrict our ability to perform pre-emptive maintenance. It would also make us unable to deliver our digitalisation strategy.
- The option of delayed implementation was eliminated as any delay would prevent us from delivering the planned investments for RIIO-2. The benefits of the project would be eroded as the costs of delivery would rise due to ageing of assets and greater effort required. It would also delay our Net Zero focused asset plan in the next regulatory period.
- A simple BIM – CDE implementation plan was also discounted as it may be the least complex and involve lower cost, but most processes will remain manual, data accuracy not addressed and doesn't meet our digitalization strategy.
- Digital Twin implementation across the entire gas network was under high consideration but eliminated because it would be extremely cost and labour intensive. It would not be feasible to be done within the RIIO-2 period either as it would also have high dependencies.

The proposed option includes creation of a BIM Implementation strategy that outlines the BIM core Information requirements which then supports the introduction of BIM - CDE platform. It will be aided with end-to-end process transformation to streamline the flow of work across a construction project, thus creating a single source of accurate construction dataset enabling full data interoperability and collaboration between stakeholders and systems involved in the processes. This will also be supported by the integration of different systems used during a construction project for various purposes to the centralised platform making it easier for all teams to collaborate and keep track of any required asset data.

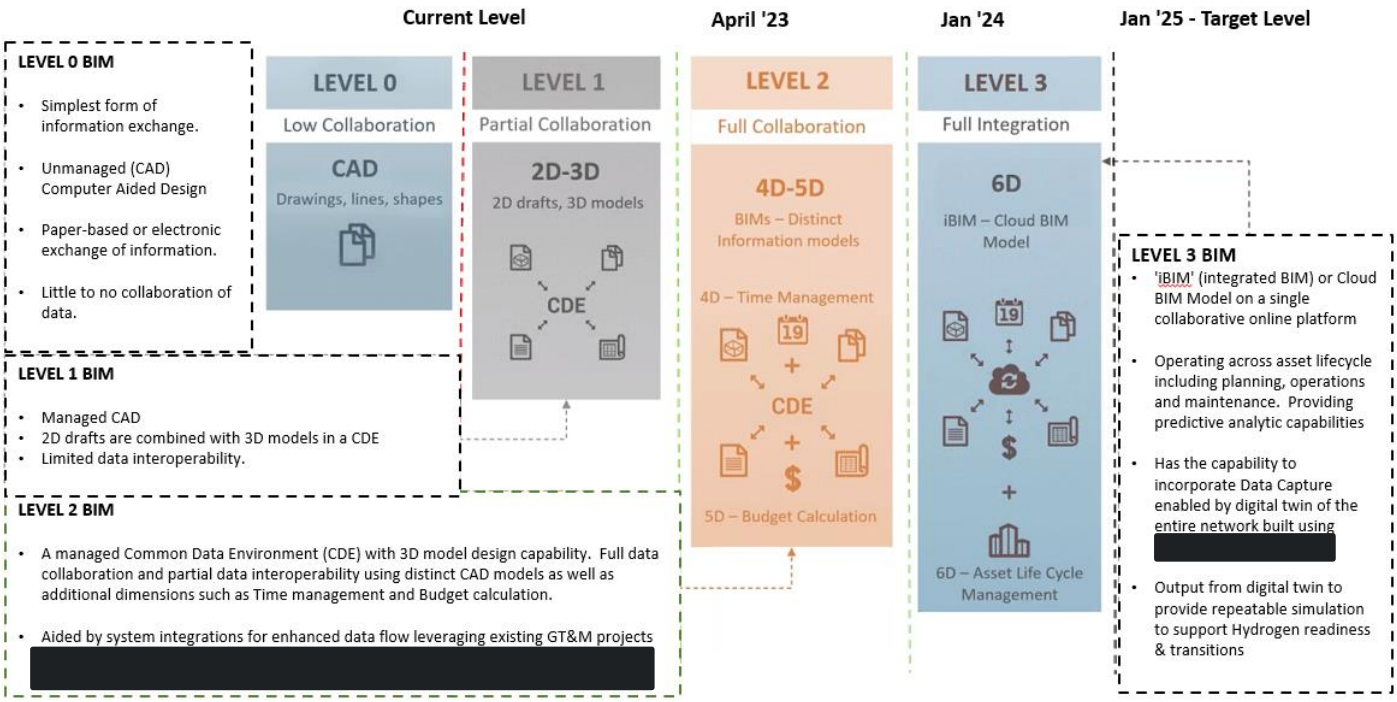
This capability is a cornerstone for creating digital twin of assets across the gas network. The availability of a digital twin would be extremely beneficial for asset performance management as well as asset management in general.

The proposed option has been selected because it will help us meet the following business objectives and provide us benefits in the form of:

- We will have a better understanding of costs and resources allocated when completing asset interventions.
- Standardised data to expand supplier community by having an open process for selecting suppliers and reducing their barriers of entry.
- Enabling way to offer data out to external parties which would in turn enable digital twin and operational work by providing them collateral in BIM format.
- Consistent data flow across internal teams and processes for faster and more accurate decision-making regarding asset interventions.
- Improved operational capability of the network supported by a robust pipeline of data being fed right from asset commissioning with regular updates to capture precise asset health.

There are four defined levels of digital maturity that measures design and build collaboration proficiencies in the construction industry. The associated capabilities and benefits are shown in diagram below. Currently, we are at between level 0 and 1 where our existing capabilities only allow us a limited amount of collaboration of data accompanied with manual modes of information exchange. Through the implementation of this project with the preferred option, the aim is to achieve digital maturity level 3 where all the users across the network can view and collaborate on 3D models of assets supported by consolidation of all data sources. We have already worked on policy changes in the past which encourage the use of BIM and define our aspirations toward 4D maturity This will help them take highly informed and pre-emptive decisions about asset interventions and introduce interoperability across the organisation.

Figure 1 Digital construction maturity levels and associated benefits

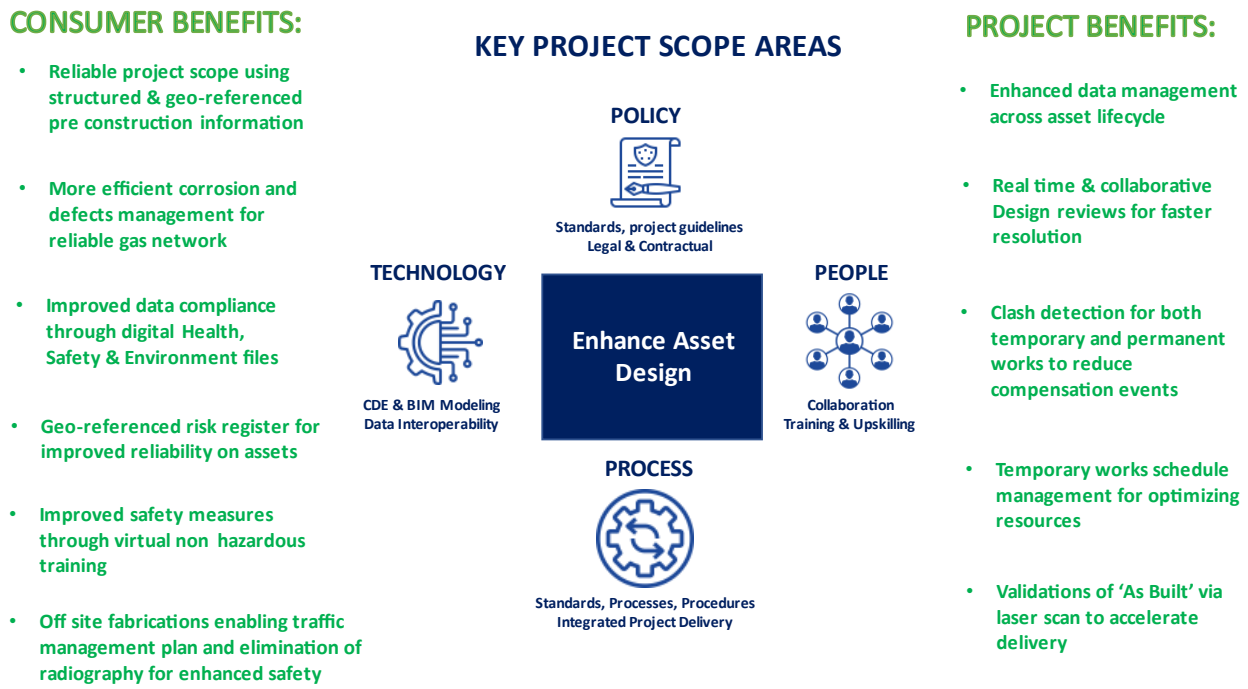


Technical feasibility and consumer benefit

- Technical Feasibility has been assessed as part of the options analysis in Section 3.1 and explored through the risk analysis in section 3.3 in this document.
- Consumer benefits have been listed in Section 2.1 Needs Case and highlighted below.

The overall benefit of the project can be categorised into four key aspects: Technology, Policy, People and Process. Improvements in these areas would provide both consumer and business benefits as shown in Figure 2 below.

Figure 2 Project scope areas and benefits



Dependencies

The project will be delivered using SAFe Agile, which follows an iterative Agile project delivery methodology including our approach to managing dependencies. The details of how SAFe Agile is implemented is captured in the Umbrella Document.

In planning project delivery, the investments are grouped into four value streams based on types of capabilities that this project delivers. This project falls within **Data Driven Asset Management** and so has dependencies on in flight projects such as Digital Asset Management project for the transition from [redacted] and ongoing Construction Projects.

Both upstream and downstream application impacts are considered, and dependencies identified before releases are committed. The project release planning process ensures that dependencies are identified and then closely monitored thus ensuring environment and change conflicts are avoided. The Umbrella document further explains how dependencies are managed through delivering the IT Portfolio using SAFe Agile.

The below depicts the dependencies between the planned programme and other activities, projects and programmes.

Table 4 Project dependencies

ID	Title	Type	Impacted projects	Description and mitigations	Dependency year
D1.1	In flight IT projects	Internal	Digital Asset Management (DAM)	The system for asset data storage and management is undergoing transition from [redacted] to [redacted] and it will heavily impact the system integration phase of our project as the CDE will need to be linked with [redacted] for flow of accurate asset data. It is being mitigated by regular engagement with the DAM project team and sharing our requirements with them once they move forward from the MVP stage of [redacted].	2023-24
D1.2	In flight IT projects	Internal	Data Platform	The data platform is being developed as the one-stop shop for asset and non-asset related data. It would be crucial to ensure that the data platform is linked to the BIM-CDE solution so that there can be a two-way exchange for the users to access pertinent data during design and build as well as upload new asset related data onto the system.	2023-24
D1.3	In flight IT projects	Internal	[redacted]	[redacted] consists of all asset investment planning related information and is undergoing enhancements right now for ease of use to the stakeholders. The integration of the investment data with the BIM-CDE platform would be required to monitor the cost and resources allocated to an asset intervention in real time.	2023
D1.4	In flight IT projects	Internal	[redacted]	Some manual processes which are a part of the construction project lifecycle are being digitised using the [redacted] capability. They would be integrated with the CDE for seamless transition from one stage to another throughout the project lifecycle.	2023
D2	Construction Projects	Internal		Onboarding of future construction projects would need to be done on the new platform at relevant stages. Incorporation of digital construction in the overall construction project is required for mitigation.	2023-25
D3	External contractors	External		Reduction of dependence on contractors by gradually transitioning from their ownership of GT collateral to our own along with significant changes in contracts.	2023-25
D4	Organisational Digital Strategy	Internal		To ensure that the implementation of digital construction aligns with the overall digital strategy for asset operations & maintenance by integration of various digital modules as per business requirement.	2023-26

3.3 PROJECT DELIVERY AND MONITORING

Project delivery plans shown below are achieved using Safe Agile delivery methodology. The overall solution is broken into EPICS (a large body of works which can be broken down into several smaller features and stories). There EPICS are delivered in one or more Product Increments. Each Product Increment spanning a duration of 10-weeks.

Overall Project Milestone are shown in Figure 3.

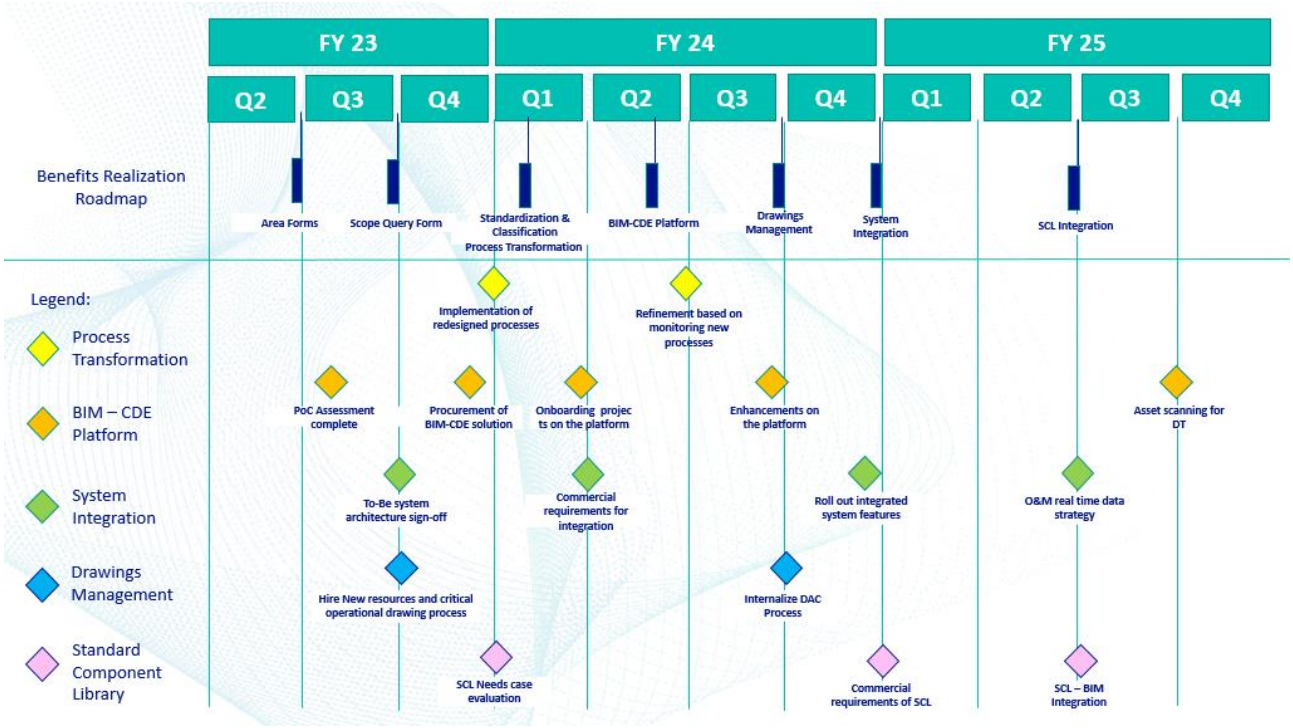
The overall Delivery is split into the following phases.

Table 5 Project delivery phases

Phase	
Solution Discovery	• Numerous discovery workshops were conducted with various stakeholders who are a part of the design and build of assets either directly or indirectly to understand their requirements, pain points and potential opportunities to improve. These workshops gave a wealth of information to action upon as we go about improving the delivery of construction projects.
Solution Build	• Using the information gathered in the Discovery phase, proof-of-concept work is carried out. The Proof of Concept helps validate our understanding of requirements which we will then use to procure the required infrastructure for full-fledged implementation of BIM System • Process Transformation is another important aspect of the proposed solution. An end-to-end AS-IS process gap analysis is to be carried out together with impact analysis in consolidation of various systems, interfaces and user interactions. These insights input towards the BIM Strategy and improved standard of working and data requirements to form the TO-BE process and integrated solution.
Deployment	• After the implementation of the optimum solution and defined new ways of working, the selected construction projects will be onboarded to the new systems and processes. The users will be trained to ensure a smooth transition to the much-improved ways of working. Based on an iterative feedback process on the new solution, enhancement to the platform will be identified to optimize the system continuously. • System integration requirements will be refined in correspondence to the user feedback once the initial selected projects have been piloted on the basic BIM-CDE platform. The robust system linkages with other systems will ensure a consistent flow of data to the BIM-CDE platform whereby to amplify the power of the solution with great user experiences for platform users to run the complete design and build phase from a single comprehensive tool.

Project Plan

Figure 3 Overall project milestone plan

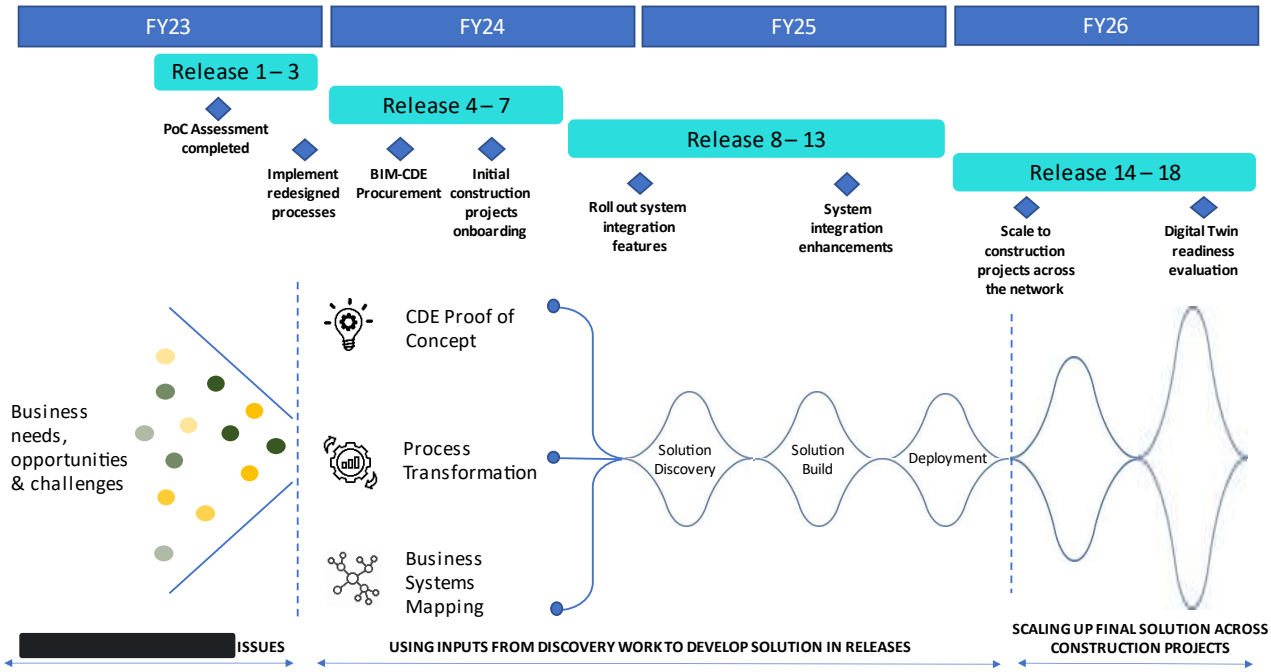


The proposal is to receive funding confirmation July 2023, and to start delivery in early Q2 FY24. There is an urgency to start this project at pace as the systems used for construction projects are rapidly reaching end of life. The lack of technology capability to design, build, store, maintain and share 3D models of assets is affecting the delivery costs and timelines of projects significantly. This results in poor data quality, visibility and undermines data confidence which delays decision makings and incurs higher costs for survey and audit of asset and site data. The further delay in the introduction of new systems and processes changes, the further increase in cost and effort expended towards the management of the assets, together with the increasing risk of dealing with unreliable data that could be leading to safety concern.

The construction projects are delivered using the waterfall methodology. We have elicited relevant objectives and deliverables from the construction business, as well as the planned construction projects within RIIO-2 period and overlaid the project milestone plan as shown in Figure 3. We have then organised the relevant deliverables and outcomes into phases to enable them to deliver by agile methodology so that we can develop the potential solutions faster.

The illustration below shows how this project is delivering the desired outcome through agile methodology for projects which are typically conducted through the traditional waterfall method.

Figure 4 Balancing agility and the classic project approach



The table below illustrates the resources required and the effort across various releases.

Table 6 Resource requirements

Release	Sprints	Resource type	Estimated Scale (days)
Release 1-3	5 sprints per RELEASE (2 weeks per sprint)	• Scrum Master (1) • Product Owner (3) • Solution Architect (0.5) • Lead Business Analyst – Onshore (1) • Business Analyst 1 – Offshore (1) • Business Analyst 2 – Offshore (1)	1125
Release 4-7	5 sprints per RELEASE (2 weeks per sprint)	• Scrum Master (1) • Product Owner (3) • Solution Architect (1) • Lead Business Analyst – Onshore (1) • Business Analyst 1 – Offshore (1) • Business Analyst 2 – Offshore (1) • Developer (1) • System Integration SME (1) • Testers (1)	1650
Release 8-13	5 sprints per RELEASE (2 weeks per sprint)	• Scrum Master (1) • Product Owner (3) • Solution Architect (1) • Lead Business Analyst – Onshore (1) • Business Analyst 1 – Offshore (1) • Business Analyst 2 – Offshore (1) • Developers (1) • Testers (2) • System Integration SME (1)	1800
Release 14-18	5 sprints per RELEASE (2 weeks per sprint)	• Scrum Master (1) • Product Owner (3) • Solution Architect (1) • Lead Business Analyst – Onshore (1) • Business Analyst 1 – Offshore (1) • Business Analyst 2 – Offshore (1) • Developers (1) • Testers (1)	1500

The team constitutes GT&M resources and resources from our ADAM (Application Development and Maintenance) partners.

Any deviation from the project plan will be addressed through the SAFe agile ways of working. Through Programme Increment (PI) Planning sessions we will regularly re-prioritise EPICs to be delivered to ensure focus remains on delivering stakeholder value. There is ongoing backlog management through the Product Manager working with Product Owners and SMEs.

Risks

The Umbrella Document sets out our approach to understanding and assessing risk, the table below shows the assessment of the key risks to Enhance Asset Design project plan delivery and how the risk will be mitigated. This has been assessed using the following Risk Matrix, which is common across all re-opener papers.

Figure 5 Risk matrix

Impact

Likelihood

	Insignificant 1	Minor 2	Significant 3	Major 4	Severe 5
5 Almost Certain	Medium 5	High 10	Very high 15	Extreme 20	Extreme 25
4 Likely	Medium 4	Medium 8	High 12	Very high 16	Extreme 20
3 Moderate	Low 3	Medium 6	Medium 9	High 12	Very high 15
2 Unlikely	Very low 2	Low 4	Medium 6	Medium 8	High 10
1 Rare	Very low 1	Very low 2	Low 3	Medium 4	Medium 5

The table below shows the risks found through assessing the options and feasibility of the preferred option. All potential internal as well as external risks were evaluated by conducting a PESTLE analysis of the project. The identified risks were then scored using the risk matrix and mitigation options added to address the risks. The risks will be included in the Risk Register when the project starts delivery.

Table 7 Project risks and mitigations

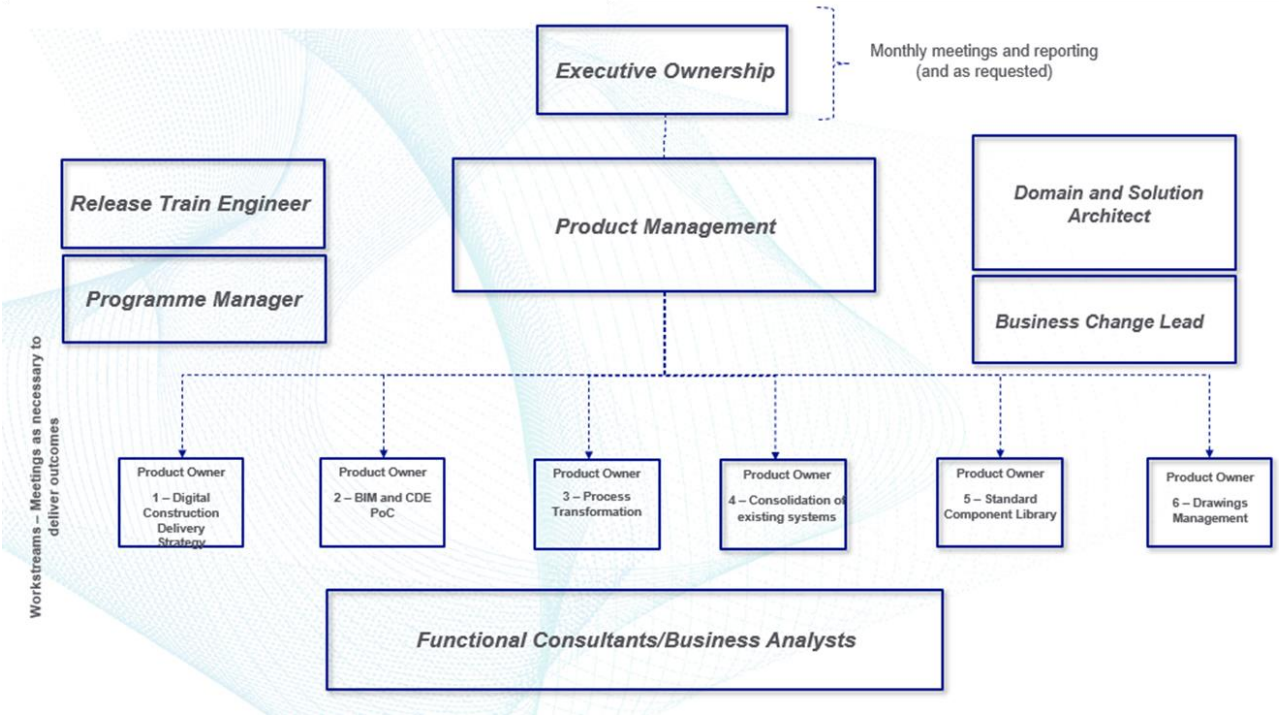
ID	Title	Description	Initial risk			Mitigation of options	Residual risk		
			Likelihood (1-5)	Impact (1-5)	Risk		Likelihood (1-5)	Impact (1-5)	Risk
1	Stakeholder Readiness	The digitisation of construction processes will require changes in business processes and there is a risk that internal as well as external stakeholders may need extra briefings / communication about the changed processes	3	4	12 High	Early engagement with the stakeholders within increased use of Business Change. Regular communications. Involve stakeholders throughout the project.	1	1	1 Very Low
2	Business Requirement	Evaluation of business requirements against available solution features in the proof of concept has shown that there is an element of bespoke requirements such as customized workflows to align with governance processes within construction which might not be solved through ready solutions	4	4	16 Very High	Identify the detailed business requirements through continuous workshops with the business stakeholders followed by engagement with vendors to communicate our requirements and understand the available options which fulfil our business needs.	2	2	4 Low
3	Resourcing	Drawings Management workstream requires more resources to meet the intended target of moving all drawings in-house as well as improving critical drawings processes	3	3	9 Medium	Accelerate the process of hiring for the drawings team and put in contingency of continuing to use 3rd party resource for the interim during the recruitment process.	1	1	1 Very Low
4	Deployment of new tool	The deployment strategy in the proposed option involves onboarding new construction projects and their users onto the platform. Lack of coordination on the training/onboarding aspect might lead to impacts on project delivery	3	4	12 High	Carefully planned deployment strategy including early upskilling and training programs for users with the support of third-party technical expertise. Thorough impact assessment of IT and construction before implementing any software/hardware change.	2	2	4 Low

ID	Title	Description	Initial risk			Mitigation of options	Residual risk		
			Likelihood (1-5)	Impact (1-5)	Risk		Likelihood (1-5)	Impact (1-5)	Risk
5	Data Security	Asset and non-asset historical data stored in numerous systems will have to be migrated safely to the new common data environment. This poses a significant security risk as the magnitude of data to be migrated is huge and most of it is confidential.	3	5	15 Very High	Meticulously planned and phased approach to data migration so that we are handling smaller datasets at a time to ensure that they are migrated with multiple safeguards to protect it from potential leaks or attacks during the transfer process.	1	2	2 Very Low

Project Management Structure

The diagram below shows the Governance structure of the team. The project is delivered using SAFe Agile, with a Product Owner for business input across the programme of work, and specific SMEs to input into delivery of relevant features.

Figure 6 Program management structure



4. COST INFORMATION

4.1 JUSTIFICATION AND EFFICIENCY OF COSTS

The costs given in Chapter 4: Cost Information are aligned with the Ofgem Submission Guidance, and additional information is evidenced throughout the submitted business case, and the specific details are in the following chapters:

- Justification and efficiency of costs – refer to Chapter 2. Needs Case.
- Requirement – refer to Chapter 2. Needs Case.
- Solution – refer to Chapter 2. Needs Case.
- Manage delivery – Project will be managed using SAFe Agile, as in section 3.3 and detailed in the Umbrella document Submission.
- Monitor delivery – see Program structure diagram below.

The detailed evidence and cost breakdown for costs provided in this chapter are in the supporting document: NG GT Non-Operational Summary Capex Cost Breakdown.

Cost base

The cost base approach followed is:

- The requested total amount is in 18/19 prices, and the yearly phasing is in 18/19 prices.
- Where figures are provided in this business case, they are clearly labelled as either 18/19 or 22/23.
- The costs in the supporting Cost Breakdown excel document are all in 22/23 prices, the conversion is shown in Conversion tab.

Costing methodology

To calculate the costs for this project we followed the Infrastructure Project Authority (IPA)4 guidance. The following steps align to stages 3 to 6 of the IPA cost estimating process. The approach is common across the four re-openers; however, the exact application differs slightly depending on specific circumstances for the project.

Step 1: T-shirt Sizing

After identifying the scope and requirements of the business case, we completed a t-shirt sizing exercise. This is a SAFe agile method to understand the time and effort required to deliver a project, the full process is covered in the NG GT Non-Operational Capex-Summary Cost Breakdown. Enterprise Asset Design was assessed to be an 'extra-large' project, which gives an indicative top-down cost of more than [redacted], and between 2.5 years estimated to deliver. The scoring for each section of the t-shirt sizing form is based on delivering IT projects within RIIO-2, and our experience delivering complex IT systems (expert opinion from Solution Architects).

Step 2: Bottom-up costing of resources

We have assessed the resources required to deliver the identified scope within the business case in a bottom-up costing approach. Specifically looking at each of the cost types below and costing how much of each to deliver, these are made of four 'cost buckets' that form a general IT project:

- ***Resources required***
  The personnel required, both internal and external includes resources from Business, IT & Business

[4] *Infrastructure and Projects Authority – Cost Estimating Guidance*
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/970022/IPA_Cost_Estimating_Guidance.pdf

Change, for implementing the four options which were compared using current industry wide rates for different levels of expertise to estimate the resource related costs for the projects.

- ***Software and Hardware***
  The calculation of costs originating from procurement of new software/hardware was done through benchmarking the quotes of their products. This was achieved through market research with potential vendors who provide the technological capabilities which form a part of the four options that we considered for implementation. Those quotes were then compared with each other, and we narrowed down on the most reasonable costs. The software costs mentioned above consist of the following:
  - Unlimited number of software licenses for the use of the common data environment across the organisation. They would be required to ensure that users in each time can have access to the common data environment as it would hold all the project information and commissioning data which might be required for asset interventions in the future.
  - Training and support that the vendor would provide both during and after the implementation.
  - Integration of the existing software used in construction projects to BIM platform.
- ***Risk***
  A sensitivity analysis has been done to understand the cost of the risks associated with each cost type and allocate a proportionate amount of risk. This approach and justification for risk amount is covered in the Sensitivity Analysis section of this document:
  - The final risk related costs for the selected option were then added to the overall implementation costs of the project.
  - Software risk costs include the potential costs to acquire 100 BIM [redacted] licenses in the future for real time collaboration on asset designs and drawings.

The supporting document 'Cost Breakdown' forms the Cost Estimate report, detailing the work breakdown structure (Requirements and Design through to Post Implementation Support project stages), the sources for costs, justification, and assumptions made, etc.

Step 3: Validation and Assurance

Validation is essential when completing costing, and our approach of combining top down to give the total figure estimate encompassing the whole project and bottom up providing individual costed items, which are then grouped. Three methods of validation were followed:

1. Check against cost against the range of the original T-shirt sizing exercise.
2. Compare cost to other similar IT projects.
3. Review costs through expert opinion by Release Train Engineers and Finance.
4. Assessed by [redacted]

Step 4: Sensitivity Analysis

The final step is to complete a sensitivity analysis against each of the cost groups. We followed the IPA guidance to assess our confidence in each of the costs, referring to the risk log and cost sources to assign a justified risk margin that is based on quantified monetary impact if the risk is realised.

From knowing this monetary impact, the corresponding risk percentage was calculated, and the overall risk required on the project.

Key cost drivers

The key cost drivers considered for this IT project are the resources (FTEs) required to deliver the project, the hardware and software licences required. The table below shows how the costs are split across these key cost drivers, and each stage of the project.

This cost is made up of:

- External third-party quote for delivery of all features within scope.
- Latest day rates from vendor.
- Internal rates forecast based on analogy and experience costing delivery.

- [redacted] on R&D is required to investigate into more depth business challenges and carry out market research, of which 20% of R&D was spent in FY21/22 and 80% in FY22/23.

Table 8 Cost distribution in project phases

(22/23)	Stages					Risk applied		Total
	R&D	Build	Test	Deployment	PIS	Risk %	Risk	RIIO-2
Cost Type	(£m)	(£m)	(£m)	(£m)	(£m)	%	(£m)	(£m)
Resource GT&M internal /ADAM Partner	[redacted]							
Resource 3rd Party	[redacted]							
Hardware	[redacted]							
Software	[redacted]							
Other	[redacted]							
Total CapEx (£m)	[redacted]							

After the delivery of the project in Q4 FY26, the costs for running the business would include an annual cost of [redacted] for sustaining the software license along with [redacted] for the drawings and design management resources hired to manage the asset drawings on the CDE.

Sensitivity analysis

We have completed a sensitivity analysis against each of the sections included in the cost breakdown for the chosen option. This analysis enables us to understand the confidence in the costs we have gathered, and the degree of risk to include in the cost distribution table above.

- ***Reasonably pessimistic***
  A position that takes into consideration pessimistic assumptions on rates, efficiency or quantities, and is therefore higher than expected.
- ***Most likely***
  A position based on the best-known data and judgement of the design, delivery and cost estimating team (usually the base cost estimate).
- ***Reasonably optimistic***
  A position based on assumptions of higher efficiency and therefore lower than the most likely cost.

Table 9 Sensitivity analysis

	Justification for current cost		Sensitivity analysis	
Cost section	Preferred option cost explanation	Assumptions and mitigation	Risk cost (Reasonably Pessimistic)	Opportunity (Reasonably Optimistic)
Internal	Most Likely Identified the areas of enhancement and change required but detailed scope could vary based on use cases and deployment	• Cost based on current construction operating model and processes. Mitigation: Deep dive workshops with stakeholders of various functions to refine and prioritise scope	• Cost of six months of delay during build phase is [redacted] on internal resources	

External vendor5	Most Likely Cost variation dependent on level of configuration required on the chosen operating model and processes.	• Estimation done through normalization of sample quotes from industry leading vendors. • Mitigation: Early identification of support required to aid contract negotiations.	• Current costs are based on sample quotes, and these may increase substantially when we go to the market for delivery due to inflation, this could increase cost by [redacted] • Delay to the build phase causes delivery to take an extra six months, results in increase of [redacted]	• Precise scope definition followed by early negotiations with vendors in the market can enable risk reduction.
Hardware	BIM-CDE is a Software as a Service (SaaS) solution. There is no hardware cost.	• N/A	• N/A	• N/A
Software	Most Likely Large variations between sample quotes from industry leading vendors and some configurations required to meet our needs.	• The estimated amount of new users requiring a licence is accurate and the cost considered is based on the sample quotes from industry leading vendors against the set of required capabilities. • Mitigation: Identify optimum compatible solution which meets our requirements and license costs remain the same.	• Cost includes software customisation and 100 [redacted] licences when BIM capability and competency mature in the business within this project timeframe, resulting in extra [redacted] risk costs.	• There are less licences required than estimated, resulting in saving about 5% of the costs.

4.2 PROPOSED PRICE CONTROL DELIVERABLES

By 31st March 2026,

[redacted]

[5] *External vendor referenced in this section includes support required during Build, Test, Deployment and Post Implementation Support (PIS)*

Table 10 Proposed price control deliverables

Output	Delivery Date	Allowance (18/19)				
		FY21/22	FY22/23	FY23/24	FY24/25	FY25/26
[redacted]	31st March 2026	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

4.3 DELINEATION OF REQUESTED FUNDING

Re-opener request (22/23)

The table below shows the phased funding requested for Enhance Asset Design, through this re-opener submission.

Table 11 Current investment request summary

Enhance Asset Design (DCI)							xxxxxxxx Benchmark Range		xxxxxxxx Rating
Investment (£m)	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	Totals	Low	High	
CAPEX	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	

Re-opener request (converted to 18/19)

Table 12 Investment request summary

Enhance Asset Design							xxxxxxxx Benchmark Range		xxxxxxxx Rating
Investment (£m)	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	Totals	Low	High	
CAPEX	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	N/A		

Original RIIO-2 Submission (18/19)

Table 13 Original RIIO-2 investment request summary

Enhance Asset Design to Improve Management Process for Operation & Control							xxxxxxxx Benchmark Range		xxxxxxxx Rating
Investment (£m)	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	Totals	Low	High	
CAPEX	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	N/A		

5. STAKEHOLDER ENGAGEMENT AND WHOLE SYSTEM OPPORTUNITIES

Table 14 Stakeholder engagement summary

Stakeholder	Engagement type	Summary of engagement
Distribution Networks	Whole System Opportunities	In support of our digital strategy and BIM ambitions, we continue to engage with other energy networks to drive the implementation of Ofgem's data best practice and to ensure alignment in standards for data and digitalization. This has been conducted with [redacted] Networks through one-to-one webinars, working on data standards to support network interoperability, and holding discussions on our Digitalization re-opener to encourage collaboration and best practice sharing. We are also in discussions with [redacted] where we are looking to collaborate across our BIM projects to ensure that there is alignment across transmission networks.
[redacted]	Benchmarking	According to the evaluation of the project costs done by [redacted], the estimate of the project falls within the range that they identified. [redacted]
[redacted] Consultant	Benchmarking	[redacted] were engaged to review the re-opener document. They evaluated the paper and provided feedback on whether it meets the Ofgem submission guidelines, and the needs case and costs are of sufficient detail. Their feedback was reviewed internally and then acted upon throughout the document.
Ofgem	Stakeholder	Continuous discussion and guidance through Energy Data Task Force and Digitalization Task Force to stay aligned with the national digitalization strategy proposed by Ofgem and to ensure that we continue to work towards implementing the six key recommendations where appropriate.

6. APPENDICES

6.1 GLOSSARY OF TERMS

Table 15 Glossary of terms

Acronym	Description
APM	Asset Performance Management
BIM	Building Information Modelling
CDE	Common Data Environment
CNI	Critical National Infrastructure
ECM	Enterprise Content Management
EPIC	Agile document that contains user stories.
GNCC	Gas Network Control Centre
GRC	Governance, Risk & Compliance
GRSC	Gas Remote Sites Communication
GSO	Gas System Operator
GT	Gas Transmission
GTO	Gas Transmission Owner
IoT	Internet of Things
GT&M	Gas Transmission and Metering
MWC	Main Works Contractor
SAFe	Scaled Agile Framework
UM	Uncertainty Mechanism

6.2 LIST OF TABLES

6.3 LIST OF FIGURES