Re-opener submission

Non-operational IT Capex – Asset Performance Management

January 2023

nationalgrid

Non-Operational Capex re-opener business case

Asset Performance Management

CONTENTS

1. EXECUTIVE SUMMARY

Our ideal world is one where gas always flows, network components never fail unexpectedly, there are zero safety incidents, assets on the National Transmission System (NTS) work flawlessly and maintenance is completed with 100% efficiency. Driven by this, GT&M is focused towards building an asset ecosystem that enables us to meet the challenges of Net Zero, allows us to respond to the rapid pace of progress, operate at peak performance and deliver a safe and de-carbonised energy system.

Asset Performance Management (APM) refers to a series of capabilities that encompasses:

- Improvement in the reliability and availability of physical assets.
- Efficient condition monitoring of assets.
- Predictive forecasting of asset condition and failures.
- Reliability-centred maintenance.
- Reduced asset outages.
- Reduced maintenance costs.
- Significant life extension of assets.
- Data capture, integration, visualisation and analytics.

A robust and reliable APM system helps provide a digitised view of our network and their condition and improves visibility of asset data, aligning with recommendations outlined by the Energy Data Taskforce (EDTF). This mitigates risks associated with equipment reliability and performance and delivers long-term benefits including supporting the journey to hydrogen, improved regulatory compliance, operational efficiency, cost improvements, services uptime and customer safety. Expanding our data capture and insights capabilities from our assets will create valuable insights and reports that can be shared with distributors and regulators as we transition to hydrogen and collaborate towards Net Zero.

Investment has been made to capture targeted condition data from our assets – [redacted] – however this paper presents the business case for further investment in a platform to ingest, continuously monitor and analyse the existing data collected from assets to enable predictive maintenance and integrate this data with our data platform for increased visibility of data and reporting. The scope of this paper is not to introduce additional data capture technologies on our assets however it will act as a platform to analyse further data once these technologies are introduced.

This paper assessed four options:

- Option 1 – Do Nothing.
- Option 2 – Delaying the APM implementation.
- Option 3 – APM enabled by [redacted]
- Option 4 – APM enabled by [redacted]

The detailed analysis and scoring can be viewed in Chapter 3 of this paper.

We remain focused on Net Zero and delivering on our hydrogen strategy – therefore Options 1 and 2 are not preferred as they will delay achieving these goals.

We then investigated two market-based solutions as presented in Options 3 & 4. Option 4 [redacted] aligns with our digitalisation strategy as our platform of choice and has been vetted and ratified through our due diligence process.

The request is seeking the approval for **£**[redacted] (£[redacted] in 22/23 prices), investment to achieve the outcome of the recommended option.

Option 4 will allow us to utilise the out-of-the-box features of the industry-standard product to deliver our APM requirements resulting in accelerated and cost-efficient implementation. The choice of APM enabled by [redacted] will deliver the following benefits:

- Integration of asset data from disparate systems into an APM platform that offers enhanced data analytics capability, enabling predictive maintenance.
- Access to real time asset data including asset condition data that can monitor the impact of introducing blended hydrogen gas to the NTS.
- Enhanced integration of asset data with the data platform to allow for reporting on asset data that can be used for internal business decision making, regulatory reporting and sharing with wider stakeholders including distribution networks.
- A cohesive solution for Asset Management, HSE and Asset Performance Management that will allow us to adapt and respond to external factors such as regulatory requirements, risks and guidelines.

[redacted]

Investment Request Summary

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

Table 1 Asset Performance Management (APM) - 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]	[redacted]

2. NEEDS CASE

The current system and application landscape does not offer an optimum preventative maintenance solution, resulting in operations that are reactive to failures and defects. The current maintenance schedule is driven by policies which define maximum timeframes between inspections and defects logged by the operations workforce. This does not highlight if an asset begins to show signs of deterioration before the designated inspection time window which can result in defects and the failure of assets before preventative maintenance can occur.

2.1 ALIGNMENT WITH OVERALL BUSINESS STRATEGY AND COMMITMENTS

We published our digitalisation strategy in March 2022[1], outlining several focus areas whilst driving towards the Net Zero target. The delivery of an effective APM solution directly supports these areas:

- ***Data Driven Asset Management***
  Effective integration and analysis of asset data will allow us to optimise our asset management capability and the value our assets can deliver throughout their lifecycle.
- ***Operations Enablement***
  High quality asset data and trusted insights will allow operations teams to focus their energy on maintaining assets before failures and defects arise, reducing operational overhead and the amount of time spent responding to failures.

[redacted]

[redacted]

Improvement initiatives were identified under five key themes which if implemented would result in greater performance efficiencies and value realisation for stakeholders. The introduction of an APM system enables us to close the gap on two of those themes:

- ***Enhancement and integration of strategic and tactical planning processes***
  Our asset investment planning Decision Support Tool uses a risk-based approach which provides a largely correct investment profile (cost and volume). The introduction of an APM system will allow us to cascade this and enable Risk-based Maintenance Regimes in accordance with the maintenance requirements analysis process for all appropriate asset types. The benefits of these actions lead to overall improvements in business and operational efficiency.
- ***Data management improvement***
  An increasing demand for digital tools and automation is forcing GT&M to be a ‘data rich’ organisation that needs governance and focus. The introduction of an APM system will enable asset and business performance improvements, including the efficient and effective capture of the data and information required to gain insights from the assets & Asset Management System.

Our strategies are aligned to the recommendations published by the Energy Data Taskforce (EDTF)[2] and Energy Digitalisation Taskforce (EDiT)[3]and this investment would act as an enabler for us to achieve three of these recommendations:

[1] https://www.nationalgrid.com/gas-transmission/document/139181/download
[2] https://es.catapult.org.uk/news/energy-data-taskforce-makes-five-key-recommendations/
[3] https://es.catapult.org.uk/news/energy-digitalisation-taskforce-publishes-recommendations-for-a-digitalised-net-zero-energy-system/

- ***Digitalisation of the energy system***
  The EDTF recommend collecting new data on our energy network and improving use of the data that exists. This investment would support us to achieve both these goals by implementing a platform to better analyse and action existing data and new data captured through other investments.

  The implementation of an end-to-end APM system will support us to progress through the stages outlined in the EDTF report towards a Digitalised Energy System. It supports greater understanding of data that exists via consolidation into a single repository and enhanced analytics capability of performance data improves visibility of infrastructure and assets. This will also help us predict asset replacements effectively and in time. Predictive maintenance optimises our operational workforce through accurate data and insights.
- ***Maximising the value of data***
  [redacted] To support the introduction of hydrogen to the network, this data can be viewed by regulators and distributors to share knowledge throughout the transition.
- ***Visibility of data***
  Expanding our data capture and insights capabilities from our assets will create valuable insights and reports that can be shared with distributors and regulators *as we develop a data sharing fabric* and transition to hydrogen and towards Net Zero.

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 stakeholders, to make sure we concentrate on the aspects that benefit them as well as our customers. The investment in APM will support the delivery of the following priorities and benefits:

<u>Key Stakeholder Priorities</u>

- ***Operate a safe, reliable and flexible transmission system***
  The proposed APM solution will provide us with the ability to analyse data generated from our assets and intervene proactively to maintain those assets. This will improve safety of the network through understanding the condition of our assets and lead to improved reliability of service through reduction of unplanned outages.
- ***Shape the gas market of the future***
  A unified, comprehensive and aggregated APM system will provide crucial asset performance data enabling the business to make critical decisions on the progression of a fully hydrogen or blended hydrogen ready network.
- ***Drive sustainable value for our customers, stakeholders and shareholders***
  Digital systems with rich data insights will help us optimise the operational and capital costs and improve procedural productivity and efficiency, enabling us to pass on benefits to customers and stakeholders.
- ***Invest in our people, grow our capability***
  Digitised and intelligent operational systems will ensure safety and security of our workforce by proactively alerting them and reducing unplanned interventions on assets.

<u>Consumer Benefits</u>

- ***Improved safety and reliability***
  The proposed APM system improves the safe management of assets by allowing for predictive and preventative maintenance meaning assets are managed before they fail. The solution will ensure effective safety system design and management by assessing and implementing integrity level requirements, conducting proof tests and providing continuous monitoring to ensure actual failure rates conform to specified failure rates as designed. E2E Asset Management combined with the

predictive Asset Performance management provides natural link to spares management improving overall efficiency and synergies.

- ***Improved quality of services***
  The proposed APM system can help business improve longevity of physical assets, MTTR (Mean Time to Repair), on-time shipments, safety and thus improving the uptime which means improved quality of service to the gas suppliers.
- ***Lower bills than otherwise the case***
  Optimised APM supports improved operational efficiency ultimately delivering greater value to consumers.

2.2 DEMONSTRATION OF NEEDS CASE

A reliable and systemised APM strategy should include the following:

- Comprehensive collection of accurate and timely asset datasets.
- Broader coverage of asset types, categories and locations.
- Cost effective asset maintenance tasks triggered and driven by intelligence.

The current set of legacy systems are purpose-built to cover specific asset types [redacted] and conditions and do not provide these end-to-end continuous asset performance monitoring capabilities, for reasons detailed below:

- ***Disparate and fragmented solutions***
  The present APM solution for a limited set of assets consists of multiple siloed applications that collect and report various disparate asset datasets.
  [redacted] however it is not built for a blended gas environment. Currently these applications do not collect performance parameters from all our assets and do not feed any of collected data into an APM system, meaning there is no unified source of information that enables visibility of data collected from our assets.
- ***Lack of central, integrated and intelligent orchestration engine***
  Current Asset Management capabilities lack a core engine to automatically capture timely, accurate and trustworthy asset performance metrics in a single location. These systems can't aggregate, analyse, and create information which can be used to make decisions. Frequent manual interventions in processes induce errors and inefficiencies in operations, and the incoherence in these systems create a major information gap for data driven asset management and optimising system operations.
- ***Sub-optimal operational efficiency***
  Erroneous data capture by field technicians and lack of correlation of events on asset conditions, failures and functional anomalies impede our ability to respond and recover rapidly. This can lead to unwanted disruptions and downtimes which have adverse impacts on customer experience and satisfaction.
- ***Health, safety and regulatory risks***
  Dynamic environmental regulations and emissions targets require a proactive perspective towards regulatory requirements and the ability to capture, report on and communicate asset performance and emissions data. Improvement to the present asset condition monitoring and regulatory data processing systems will allow us to achieve an efficient and real-time regulatory compliance reporting mechanism to avoid the possibilities of an unreliable service, increased costs due to unplanned down time and health and safety risks.
- ***Inability to analyse and share hydrogen data***
  The current asset data capture platforms involve technical complexities - such as proprietary data encryptions and data transmission mechanisms - which do not support the analysis of blended gas

data gathered from the assets to produce reports and dashboards that can be shared with regulators and distributors as we transition to hydrogen.

If we do not resolve these challenges then it restricts our ability to optimise assets maintenance, reduce the number of asset failures, improve cost effectiveness, and deliver an enhanced service experience to our customers.

An APM capability is required, aligned to the Net Zero strategy and the transition to Hydrogen blended gas, that will allow us to monitor our assets and understand how they are responding to the introduction of blended gas as we progress through the transition.

Figure 1 High level transitory states for the APM journey

The above diagram describes high level transitory states for the APM journey [redacted] This non-cohesive approach translates to primarily scheduled and reactive maintenance cycles, lacking ability and systemic levers for targeted and cost, manual effective maintenance.

Through various multi-pronged transformations, [redacted], strengthening the pillars for asset health and condition data collection in a secured manner while augmenting capacity for volumes, throughputs, and scale. Collectively, this will help us further our digitalisation strategy and future-proof our operations.

We aim to improve our abilities to predict asset failures, enable our workforce to use technical advancements effectively via accurate data, information, and actions at their disposal at every step of the way. We will also in process improve the industry wide interoperability, reporting, data sharing capabilities.

3. OPTIONS

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

3.1 CONSIDERATION OF OPTIONS AND METHODOLOGY

The list of options considered were selected by working with key internal business stakeholders and our Solution Architecture team to understand the requirements and then assessed using a broad range of parameters which 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. And 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.

Entry criteria and process for solution options identification:

We completed a rigorous process of finalising the best suited and preferred solution option for APM. During the process, different solution options were assessed, extending beyond the listed ones in the table. We also assessed the development of a bespoke APM solution; however, this was rejected due to the complexity of the solution and architecture, technical resource and SME availability, timeline estimation challenges and difficulty in cost ascertainment. The process and entry criteria for solution options identification are:

- ***Strategic alignment***
  Aligning with the organisational and enterprise architecture strategy including optimising the operational efficiency across the asset portfolio, decarbonising the energy systems and digitisation of processes. Delivering this solution will move us away from manual processes and outdated systems and will enable future integration with our enterprise asset management solution. All the options were weighed on these parameters.
- ***Software requirements***
  A comprehensive list of functional, usability, reporting and vendor requirements was created and mapped to our organizational goals to help select the solution options worth consideration.
- ***Research on relevant solutions***
  We did a comparative analysis of solution options available in the market that meet the requirements. This helped us shortlist the solutions which were then compared.
- ***Options screening***
  After shortlisting the solution options in the earlier step, options that didn't meet our requirements were screened out.
- ***Identify frontrunner solutions***
  This step helped us consider the two well established APM solutions available in market (excluding the remaining two options which are “Do nothing” and “Delaying the implementation”).
- **Due diligence**
  At this stage a final review of the two shortlisted market-based solutions alongside the other two options was completed using the four criteria: *Timeline, Dependencies, Cost* and *Strategy.* A score

carding was completed based on these assessment parameters. The shortlisted options and performance against the criteria are:

Table 2 Options comparison on shortlisted options

Options	Option 1	Option 2	Option 3	Option 4 (*preferred)
Option Type	Discounted Option	Delay Proposed Capex	Market Based	Market Based
Option name	Do Nothing	Delaying the implementation	APM enabled by the [redacted]	APM enabled by XXX Xxxxxx xxxxxxx
Description	Continue with the as-is state of legacy systems, capturing limited asset condition and pipeline inspection data	Postpone the transformation to a unified APM platform to a future date in RIIO-2 (or the next regulatory period)	Implement and configure APM solution offered by [redacted]	Implement and enhance the industry standard APM solution offered by XXX Xxxxxxx xxxxxxx
Key Features	NA	NA	• COTS product from leading technology supplier with rich feature list • Readily available modules like 'Risk & criticality assessment', 'Reliability centred maintenance (RCM)', 'Failure modes and effects analysis (FMEA)' • Modules which can help failure patterns and anomalies like 'Risk based inspection (RBI)','Condition based & predictive maintenance' and 'Preventive maintenance review'	[redacted] • Capability to perform Asset risk management and criticality assessment. • Maintenance based on reliability history and patterns. • Artificial Intelligence & Machine Learning based data analytics models to detect failures and its impact. • Predictive and preventive maintenance • Optimised inspections calculated on risk ratings, to improve maintenance lifecycle. • Condition based predictive maintenance. • Prescriptive analytics feature.
Performance against assessment criteria Criteria 1: Timeline Criteria 2: Dependencies Criteria 3: Cost	• Timeline: No lead times required to continue with as-is state • Dependencies: No external dependencies or immediate impacts • Cost: No capex or op-ex costs to	• Timeline: Delayed timelines will exponentially increase risks, costs and staggered technical debts • Dependencies: Multiple digital strategies and objectives	• Timeline: slightly higher deliverability timelines due to the configuration, customizations required before the core APM system can be operationalised and utilised to	• Timeline: Accelerated timelines as the APM solution is built on top of our strategic asset management platform. [redacted] This will enhance system components reusability, mitigate delivery risks and complexities.

Options	Option 1	Option 2	Option 3	Option 4 (*preferred)
Criteria 4: Strategy	be incurred with no changes • Strategy: Opting for the as-is state will severely hamper our ability to create cohesive, future ready platform for maintenance of assets with optimized costs, improved intelligence and higher safety, security of Gas network	heavily depend on our ability to efficiently and proactively manage our assets; delays will mean direct negative impact on these RIIO-2 objectives • Cost: Technical debts resolution, retrospective platform changes will contribute towards significantly increased costs • Strategy: Delays will hamper our digitisation strategy and our ability to be future ready	meet our requirements. • Dependencies: Higher dependencies on other products and [redacted] Skilled resources requirement and technical dependencies will add to the complexities. • Cost: Higher cost to deliver the solution as this requires large scale, complex system integration and transformation. Other contributing factors to costs are licensing, compute resources (hosting), product design and development and maintenance. • Strategy: This solution will enable us to meet various RIIO objectives and manage our assets effectively with readiness for hydrogen.	• Dependencies: APM capabilities can be delivered in a staggered manner, enabling the organisation for business and operational readiness thereby minimising dependencies external integrations, reporting and analytics platforms. • Cost: Total costs of the solution will be higher than option 1 and 2 but markedly less than option 3. [redacted] • Strategy: Strong enabler for our network and asset decision makers to arm them with a reliable system to protect the gas transmission network and transition to Hydrogen. As an organisation we can plan our investments better, report assets condition more accurately and use the risk data to protect and safeguard our workforce.

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. Delaying the APM implementation	[redacted]	[redacted]	[redacted]
2. APM enabled by [redacted]	[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, which in this paper carries a zero cost and investment. 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, APM enabled by [redacted], is supported by the output of this CBA analysis over the ten year timeframe, delivering a positive return on the investment. A delayed implementation is financially less favourable as additional costs of [redacted] are incurred by the [redacted]

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 proposed Capex	APM on [redacted]	Xxxxxx xxxxx	
Criteria 1: Strategic and Customer Alignment	Keeping gas flowing safely and efficiently (1 - Low, 5 – high)	3	3	4	4	The proposed option brings in more efficient and cohesive asset performance management capability driven by reliability centred maintenance approach.
	Alignment to Digitalisation Strategy (1 - Low, 5 – high)	1	1	4	4	The preferred solution is in strong alignment to the organization's digitalisation strategy focus area of Data Driven Asset Management.
	Does it support our stakeholder priorities (1 – meets 1, 5 – meets all)	1	1	3	4	The preferred option supports the stakeholder [redacted]
	Does it support the consumer benefits (1 – meets 1, 5 – meets all 5)	1	1	3	4	The preferred solution helps deliver the consumer benefits through decreased Totex.
Criteria 2: Cost	Cost Benefits Analysis score (1 – Low, 5 – High)	NA	1	3	4	[redacted] does score better on cost benefit analysis since integration with other in-flight [redacted] is easy and cost effective.
Criteria 3: Timeline	Ease of implementation (1 – Complex, 5 – Easier)	NA	1	3	4	Commercial off the shelf product; Option 4 [redacted] It enables rich performance data capture, make sense out of the data and alerts relevant stakeholders. It also provides on-demand reports helping efficient network and asset management.

Criteria Grouping	Parameter	Option 1	Option 2	Option 3	Option 4	Justification for selection of preferred option
	Dependency on other projects (1 – High, 5 – Low)	4	2	3	3	Market based options will be, to varying degrees, dependent on other projects. Mitigation of dependencies and risks will rely on parameters noted above (timelines, cohesion / ease and familiarity of the solution).
Criteria 4: Other Dependencies	Vendor partners (1 – Not available, 5 – Many)	NA	NA	3	4	Option 4 has strong, reliable vendor support from [redacted] and eco system.
	Does it have a dependency on separation from National Grid (1 – High, 5 – Low)	NA	NA	1	4	[redacted] has a lot of dependency on separation, whereas [redacted] is being implemented for DAM as a Gas specific application platform.
	Total score	10	10	27	35	

Having considered the options, the preferred choice is Option 4 - APM enabled by [redacted]

3.2 THE PREFERRED OPTION

Description

The preferred APM solution will help us drive value streams to maximise operational and maintenance efficiency, optimize Capex/Opex spends, improve operational safety, help avoid unplanned downtimes and help reduce environmental risks. New comprehensive asset monitoring capability will give us access to enriched, complete and accurate data and insights which can be used for effective cost analysis, tap into technical advancements [redacted] and confidently share insights with third parties including various market participants, distribution networks, hydrogen providers. This will propel us together towards our collective goal of Net Zero and clean, affordable and fair energy. The current assets in scope for APM are:

[redacted]

APM – enabled by [redacted]

As an outcome of the focussed discovery phase, optioneering feasibility and gap analysis [redacted] is identified as a preferred APM solution. The solution combines monitoring, maintenance, and reliability applications [redacted] modules help analyse underlying assets data with artificial intelligence to provide insights that enable us to make better decisions, enhance efficiency and perform preventive and predictive maintenance to maximize investment in physical assets.

Key Benefits and Enablers

- [redacted] utilises the risk assessment and AI features to create patterns to recognise the assets performance dips and fatal failures ahead of time, therefore protecting the health and safety of employees, the environment and business objectives by reducing incidents related to assets.
- [redacted] rich performance management capabilities will improve workforce productivity by prioritizing condition-based maintenance including factors like criticality and cost.

- Optimises maintenance, repair and operations (MRO) inventory levels to ensure inventory is available when needed to reduce unplanned asset downtime, cut costs and free up working capital.
- It will considerably reduce the total cost of ownership [redacted] offering flexibility and access to business insights where it matters.
- We have undertaken, through separate funding lines, a large-scale transformation to use [redacted] help us achieve quicker time-to-value with a standardized way to connect machines, data and people.
- [redacted] the solution will also enable us to rapidly identify, onboard and integrate any potential asset performance monitoring systems, such as vibrations analysis and geographical surveys, making us future ready and well equipped to adapt to technical advancements.
- Faster implementation and deployment due to reusability factors.
- Improved asset coverage through use of full asset portfolio data.
- In-built and configurable data analytics and prediction modules.
- Strong application user experience and product support.

Solution Description

The high level 'to-be' solution is described and depicted in following diagram "*APM Capabilities – High level 'To-be' context*". To achieve a comprehensive APM solution we will execute a phased transformation which the funding requested in this paper, alongside funding already approved, would support. The phases of the transformation are described below, with **the funding in this paper being key to deliver phases d) and e):**

- We have undertaken a multi-pronged system digitalisation strategy focusing on:
  - Identifying the assets requiring continuous monitoring.
  - Capturing data from these assets.
  - Transforming and translating data in consumable formats.
  - Enriching datasets by mapping relevant systems records and relevant data across systems.
  - Creating insights and business critical information from the data aggregation.
  - Creating channels for sharing applicable information with the wider market.
- [redacted] will enable us to redesign the way [redacted] data is collected and incrementally add additional sources. [redacted] will be rationalised onto our [redacted] addressing a major technical dependency on a third-party software provider, its intellectual property and complexity related to deciphering [redacted] Some of this transformation work has been proposed and approved in the "GT 039 - Data Sources (IT/OT) to Support Insights and APM" funding line.
- [redacted] of other contributing subsystems such [redacted] and ingesting captured data into the [redacted] also be undertaken via "GT 039 – Data Sources (IT/OT) to Support Insights and APM" funding line.
- Implementing the core engine and performance management orchestrator for all assets via the preferred option of [redacted] The funding requested in this paper would be used to deliver this component.
- Key configuration and customization tasks which will include:
  - Tailoring APM modules, making them 'fit-for-purpose' for our assets.
  - Creating the Data analytics rules, policies and outputs.
  - Redefining and reimagining the business processes.
  - Creating workflows and approval processes.
  - Seamless integrations with insights platform and creation of secured, reusable interfaces with plug-and-play capabilities for external entities.
- In future, [redacted] will integrate with other business critical systems such as [redacted] to collect and transmit relevant asset performance datasets.

Figure 2 APM capabilities 'TO-BE' context diagram

Dependencies:

Our re-opener projects will be delivered using SAFe Agile methodology which includes an approach to managing dependencies. Under the methodology, dependencies are identified as part of PI Planning, the cross-portfolio planning event that takes place every 10 weeks at the beginning of each Programme Increment. These dependencies are captured at a project level, a Release Train (programme) level and at a portfolio level, including external dependencies to the core Technology Delivery team.

To help plan the delivery of projects our investments are grouped into one of five focus areas based on the underlying capabilities they will deliver. This project falls within **Data Driven Asset Management** and has dependencies on the

Both upstream and downstream application impacts are considered, and dependencies are identified before releases are committed. Our 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 table 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	In flight IT projects	Internal	[redacted] Migration and transformation	The ALERT application and associated data are being migrated to [redacted] This supports part off the roadmap to deliver APM. Any delivery risk will be mitigated through frequent planning cycles to map dependencies.	2023/24
D2	GT&M business separation	Internal	[redacted]	Multiple separation activities, programmes will have impact on timelines, dependent systems, data and interfaces being available, this has potential impacts on APM delivery. Mitigation will be done via detailed planning, continuous tracking risks, dependencies.	2023/24
D3	Resource Availability	Internal	[redacted]	Niche technical competencies for [redacted], APM and Data science are required for various programmes in-flight simultaneously, resource demand peaking at same time will impact programmes. Mitigation via prioritization of products, early alignment of key partners and vendors.	2023/24
D4	In flight IT projects (migration)	Internal	[redacted]	Migrations happening around [redacted] are core to managing our assets in a better, efficient way, delays can impact our strategy of data driven asset management and hence APM. Parallel discovery, staggered delivery (MVP + enhancements) is planned to meet the timelines of separation.	2023/24
D5	Upcoming IT projects	Internal	[redacted]	Assets or equipment inventory data along with respective locations needed in APM for planning and work order execution. Absence of an interface agreement with the application will adversely impact APM activities planning and execution. Mitigated by creating interface agreement with the application team.	2024/25

3.3 PROJECT DELIVERY AND MONITORING

The APM project will be delivered using SAFe Agile project delivery methodology. The requirements will be segregated into 'Epics' (the term used in agile methodology for large body of work that can be broken down in user stories) and these requirements will be delivered incrementally through Product Increments (PIs). Each of these PIs will span across a duration of 10 weeks.

APM project delivery will be split into the following phases and will be followed in a cyclic manner for each product iteration.

Table 5 Project delivery phases

Phase	Description
Envision phase	Post business case approval, the team to collaborate and create a vision for the project. It reflects GT&M's vision of the APM as the target solution; key capabilities of the solution will be decided, business objectives will be set, participants and stakeholders for the project will be identified.
Speculate Phase	After creating a vision for the project, overall APM requirements will be gathered in this phase. A feature backlog will be created to define what work needs to be done and once that completes, a release plan with iterations will be created along with mitigation strategies for the identified risks. Towards the end of this phase, estimation of project cost will be determined.
Explore Phase	In "Explore" phase, the identified project manager will be required to manage the team's workload for optimal performance and will need to ensure that each of the team members is aligned with their expected output. The project manager will also be responsible for managing the different stakeholders and the steering committee.
Adapt Phase	The outcome of the "Explore" phase will be reviewed in this phase from all perspectives. The results will then be used to plan next iteration in the "Speculate" phase. This way, the Speculate-Explore-Adapt loop will be continued to refine the APM product until it meets expectations.
Close Phase	Once the APM product is ready, it will be handed over to GT&M. Lessons learned will be appropriately prepared to pass on to other project teams.

Figure 3 Overall project milestone plan

The proposal is to receive funding confirmation in July 2023, and to start delivery shortly after in October 2023. This allows the delivery to capitalise on alignment with the delivery of the [redacted] EAM solution. As per the delivery schedule shown in Section 3.4 of this paper, beginning APM delivery would allow for the delivery of the APM solution by the end of the RIIO-2 period.

The below table illustrates the effort split for each release of APM delivery using the lean agile approach, the number of user stories planned in each sprint is based on complexity of each story points.

Table 6 Resource requirements

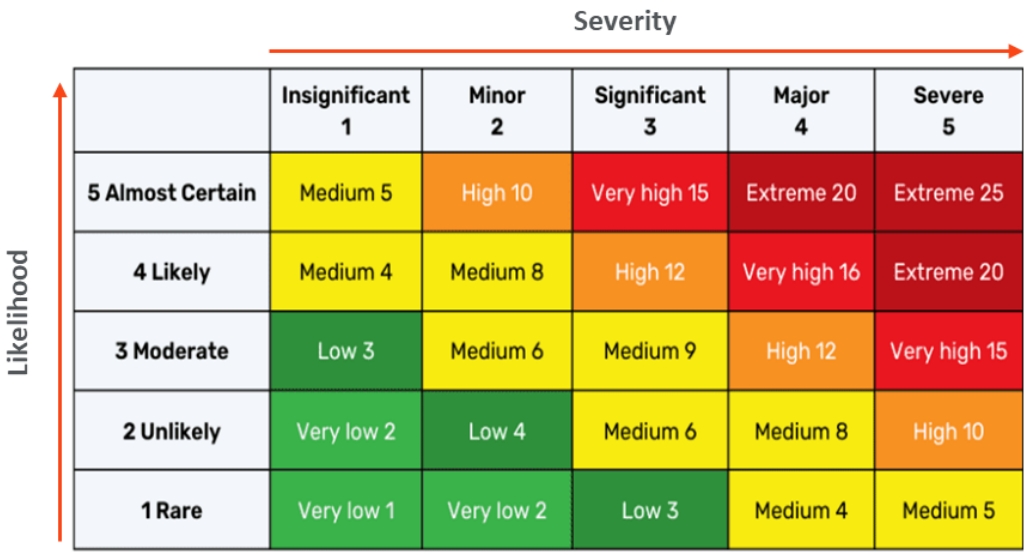
Release	Sprints	Resource Type	Estimated Scale (Days)
Release 1-7	5 sprints per Release (2 weeks per sprint)	• Project Manager / Scrum Master • Product Owner • Business Analyst • Solution Architect • Functional Consultant1 • Technical Architect • Tech Integration SME • Data Analyst • Lead Developer - Offshore • Developer 1 - Offshore • Developer 2 - Offshore • Tester 1	100 – 120 days for each release

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 APM project delivery and how the risks will be mitigated. This has been assessed using the following Risk Matrix, which is common across all re-opener papers.

Figure 4 Risk matrix



The below table provides an assessment of the key risks to delivering the programme, how they will be mitigated and an allowance for any residual risk.

Table 7 Project risks and mitigations

ID	Title	Description	Initial Risk			Mitigation Options	Residual Risk		
			Likelihood (1-5)	Severity (1-5)	Impact		Likelihood (1-5)	Severity (1-5)	Impact
1	Data availability, quality and integration	Data elements required for an effective APM systems	3	4	H 12	Follow data clean up strategy before gathering it on the central data platform.	2	2	L 4
2	Acceptance by users	Users' acceptance of implemented solution	3	2	M 6	Users' participation in design phase to develop the application suitable to their requirement.	1	1	VL 1
3	Regulatory compliance requirements	Conforming to the regulatory compliance requirements	5	4	E 20	Deep dive into the regulatory data calculation methods.	1	2	VL 2
4	Dependency on other value streams	Dependency on other projects	5	4	E 20	Plan activities in close coordination and alignment with other value streams to minimise impacts.	2	2	L 4
5	Technology expertise	Availability of technology expertise in multiple dimensions [redacted] and their collaboration	5	5	E 25	Resources requirements shared with programme manager in advance.	2	2	L 4

Legends: E – Extreme, H – High, L – Low, M – Medium, VH – Very High, VL – Very Low

Project Management Structure

The table below shows the Governance structure of the team, with a Product Owner for business input across all the workstreams, and SMEs for each of the different workstreams.

Figure 5 Programme management structure

4. COST INFORMATION

4.1 JUSTIFICATION AND EFFICIENCY OF COSTS

The costs provided are aligned with the "RIIO-2 Re-opener Guidance and Application Requirements Document: Version 2" and additional information is evidenced throughout the submitted business case with specific details 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 described in section 3.3 and detailed in the NGGT Non-operational Capex-0 Umbrella Submission document Submission.
- Monitor delivery – see Programme structure diagram above.

The detailed evidence and 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 and 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, a t-shirt sizing exercise was done. 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). APM was assessed to be a 'large' project, which gives an indicative top-down cost of [redacted] GBP, and between 2 and 3 years estimated time to deliver. The scoring for each section of the t-shirt sizing form is based on delivering IT projects within RIIO-2 (analogy) and our experience delivering complex IT systems (taking expert opinion from Solution Architects).

Step 2: Bottom-up costing of resources

We assessed the resources required to deliver the identified scope within the business case in a bottom-up costing approach. The bottom-up costing was made up of four 'cost buckets' that form a general IT project, with costing estimated for each bucket:

[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

Table 8 Cost buckets

Cost Bucket	Description	Assumption	Source of Information
Internal Resources	Who will be delivering the project and what type of resource are they. We utilise three approaches for delivery: Internal permanent resources (IT and business) which have a set internal rate card, contractors and partner resources through [redacted]		Internal GT&M Day rates card.
External Resources	This covers the estimated FTE costs for delivery by a third partner or vendor	Day rates provided by vendor will remain roughly the same.	External third-party estimate for delivery of scope.
Software	The licence cost is based on current [redacted] licence costs	[redacted]	[redacted]
Risk	We have completed a sensitivity analysis 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.		

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 gaining assurance in our approach of combining top-down costing (to give the total figure estimate encompassing the whole project) and bottom-up costing (providing individual costed items which are then grouped). There were three steps to the validation of costs:

1. Does the cost fall within the range of the original t-shirt sizing exercise?
2. Is the cost comparable to other similar IT projects?
3. Has the cost been reviewed through expert opinion by Release Train Engineers and Finance?

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, we were able to calculate the corresponding risk percentage, and then the overall risk required on the project. This is covered in the Sensitivity Analysis section.

Key cost drivers

We went through an option selection process based on strategic alignment, requirement mapping and comparative analysis of solutions on factors like cost and timeline. For cost ascertainment of different solution options, we benchmarked the cost incurred on [redacted] EAM implementation and reached out to the implementation partner for [redacted] APM implementation cost. For [redacted] APM, we referred to the [redacted] go-to-market cost benchmarking.

The detailed break-down of the amount of allowance is:

Table 9 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]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Resource 3rd Party	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Hardware	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Software	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Other	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total CapEx (£m)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Key Cost Driver Breakdown (22/23)

We evaluated the four options that were under consideration and the costs associated with it. The factors that were examined to calculate the costs of the three options are as follows:

- ***Resources required***
  Who will be delivering the project, and what type of resource are they. We utilise four approaches for delivery: Internal permanent resources (IT and business) which have a set rate card, contractors, [redacted] resources and third-party resources through the chosen vendor.
- ***Software***
  The licence cost is based on current [redacted] licence costs, of [redacted] License cost is split over the three core stages of delivery (Build, Test, Deployment).
- ***Risk***
  We have completed a sensitivity analysis 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.

Sensitivity analysis

A sensitivity analysis was completed against each of the sections included in the cost breakdown for the chosen option. This is in order to understand the confidence in the costs ascertained, and the degree of risk to include in the Costs chapter of the business case. This has followed the assessment scoring as set out in the IPA Guidance.[5]

- ***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 10 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	Reasonably Optimistic We will have experience delivering the [redacted] and 2 years of experience costing and delivering projects within RIIO-2 and successful SAFe agile delivery.	• Having same internal delivery team working on [redacted] will lead to more efficient delivery and lower cost. Mitigation: Complete resource planning and programme planning to ensure resource can stay aligned to [redacted] implementation.	• Delay to the build phase causes delivery to take an extra six months, results in increase of [redacted]	• The current cost is based on reasonably optimistic viewpoint and efficient delivery.
External vendor	Most Likely We have completed an RFP for delivery of [redacted] and used our chosen delivery partner to help cost the scope of the re-opener.	• Vendor has provided an estimate on the best-known data regarding identified features. Mitigation: [redacted]	• Going out to market for delivery partner ahead of delivery results in a much higher cost, either due to a different partner being selected or inflation, results in additional [redacted] • Delay to the build phase causes delivery to take an extra six months and will result in increase of [redacted]	• Leveraging the current delivery partner ahead of delivery results in a lower cost.

[5] *Link to IPA*

	Justification for current cost		Sensitivity analysis	
Cost section	Preferred option cost explanation	Assumptions and mitigation	Risk cost (Reasonably Pessimistic)	Opportunity (Reasonably Optimistic)
Hardware	[redacted] APM can be delivered in SaaS model and hence hardware cost is not applicable.	• N/A	• N/A	• N/A
Software	Most Likely The software costs are based on licence cost for delivery of [redacted] and expected amount of new users based on scope.	• The estimated number of new users requiring a licence is accurate. • GT&M will negotiate a separate contract with [redacted]	• There are [redacted] more licences required than estimated, resulting in extra [redacted]	• There are less licences required than estimated, resulting in potential saving of [redacted]

4.2 PROPOSED PRICE CONTROL DELIVERABLES

Table 11 Proposed price control deliverables

Output	Delivery Date	Allowance (18/19)				
		FY21/22	FY22/23	FY23/24	FY24/25	FY25/26
Deliver 95% of high priority features.	Q2 FY26	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

4.3 DELINEATION OF REQUESTED FUNDING

Re-opener request (22/23)

The table below shows the **22/23** phased funding requested for APM solution, through this re-opener submission.

Table 12 Current investment request summary

Asset Performance Management (APM) (22/23)								xxxxx Benchmark Range		xxxxx 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 2018/19)

The table below shows the phased funding when converted into **18/19** prices.

Table 13 Investment request summary

Asset Performance Management (APM) (18/19)							xxxxx Benchmark Range		xxxxx 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 (2018/19)

The table below shows the original phased funding requested in the RIIO-2 Final Determination, which was moved into Uncertainty Mechanism.

Table 14 Original RIIO-2 investment request summary

Asset Performance Management (APM) (original 18/19 submission)							xxxxx Benchmark Range		xxxxx 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 15 Stakeholder engagement summary

Stakeholder	Engagement Type	Summary of Engagement
Distribution Networks	Whole System Opportunities	There are ongoing meetings with other distribution networks (Northern Gas Networks, Southern Gas Network, etc).
[redacted]	Benchmarking	Similar to the original RIIO-2 submission, we have completed an external benchmarking exercise with [redacted] to ensure our costings are in line with the wider industry.
[redacted]	Consultancy	[redacted] will be engaged to review our reopener submission to ensure it is suitable and in line with OFGEM guidance.
Ofgem	Regulatory	We have had engagement sessions with Ofgem to talk through the plan for our re-opener submission and share early insight into what we are doing.

6. APPENDICES

6.1 GLOSSARY OF TERMS

Table 16 Glossary of terms

Acronym	Description
APM	Asset Performance Management
BIM	Building Information Modelling
CNI	Critical National Infrastructure
DAM	Digital Asset Management
EAM	Enterprise Asset Management
ECM	Enterprise Content Management
FY	Financial Year
GIS	Geospatial Information System
GNCC	Gas Network Control Centre
GRC	Governance, Risk & Compliance
GRSC	Gas Remote Sites Communication
GSO	Gas System Operator
GT	Gas Transmission
GT&M	Gas Transmission and Metering
GTO	Gas Transmission Owner
IoT	Internet of Things
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
MVP	Minimum Viable Product
OEE	Overall Equipment Effectiveness
PCD	Price Control Deliverable
SAFe	Scaled Agile Framework
UM	Uncertainty Mechanism

6.2 LIST OF TABLES

6.3 LIST OF FIGURES