national gas transmission

STRATEGY ANNEX

OFFICIAL- SENSITIVE

Asset Management Plan

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RIIO_GT3 NGT_A01

Contents

1 Executive Summary

1.1.1 Our Purpose in National Gas Transmission (NGT) is to 'Lead a clean energy future for everyone'. To achieve this, we aim to return the UK National Transmission System to levels of network risk seen at the beginning of RIIO-T2. We will optimise value to our customers and UK consumers throughout the energy transition in a sustainable, cost-effective way. We need to sustain our regulatory funding so we can deliver our core strategic ambitions and meet shareholder and investor expectations. Our 10-year Asset Management Plan (AMP) has been developed to deliver against this purpose and these priorities.

1.1.2 We are committed to achieving 'Excellent' asset management maturity levels by 2031. The development and iteration of our Strategic Asset Management Plan (SAMP) has ensured we make significant progress to improving our asset management capability. Our Network Asset Management Strategy[1] details the steps we have taken so far towards this ambition.

1.1.3 Our Network Asset Management Strategy[1] also describes the Network Asset Risk Metrics (NARMs) methodology and its Service Risk Framework (SRF). These are the foundation of our risk management system. The NARMs methodology describes the agreed method for calculating the monetised risk score of an asset. The NARMs asset risk score is a combination of how likely an asset is to fail (probability of failure), and the consequences of that failure (cost of the consequence in R£/s).

1.1.4 Our long-term objective is to reach a monetised risk which is at or below the risk position seen at the start of the RIIO-T2 price control period (FY2022). We will work toward this objective throughout RIIO-GT3 and beyond.

1.1.5 The graph in Figure 1 shows that, through the proposed RIIO-GT3 interventions during RIIO-GT3, £17m of risk will be removed from the network. Network risk is reduced during RIIO-GT3 to levels below the start of RIIO-T2 with the end position of RIIO-GT3 being 98% compared to the end of RIIO-T2. Addressing the level of network risk is critical for consumers and customers. We are going to submit Uncertainty Mechanisms submissions during RIIO-GT3 to address single points of failure on our network, where risk is unacceptably high.

1.1.6 The initial, unconstrained AMP aimed to maintain RIIO-T2 starting risk levels throughout RIIO-GT3, as agreed with the Department for Energy Security and Net Zero (DESNZ). After reviewing deliverability, supply chain constraints and site access, we removed some undeliverable work from the plan. We now expect the absolute monetised risk by the end of RIIO-GT3 to be 3.2% higher than at the start of RIIO-T2, and with ongoing investment, we anticipate bringing risk levels back below the levels seen at start of RIIO-T2 by 2032.

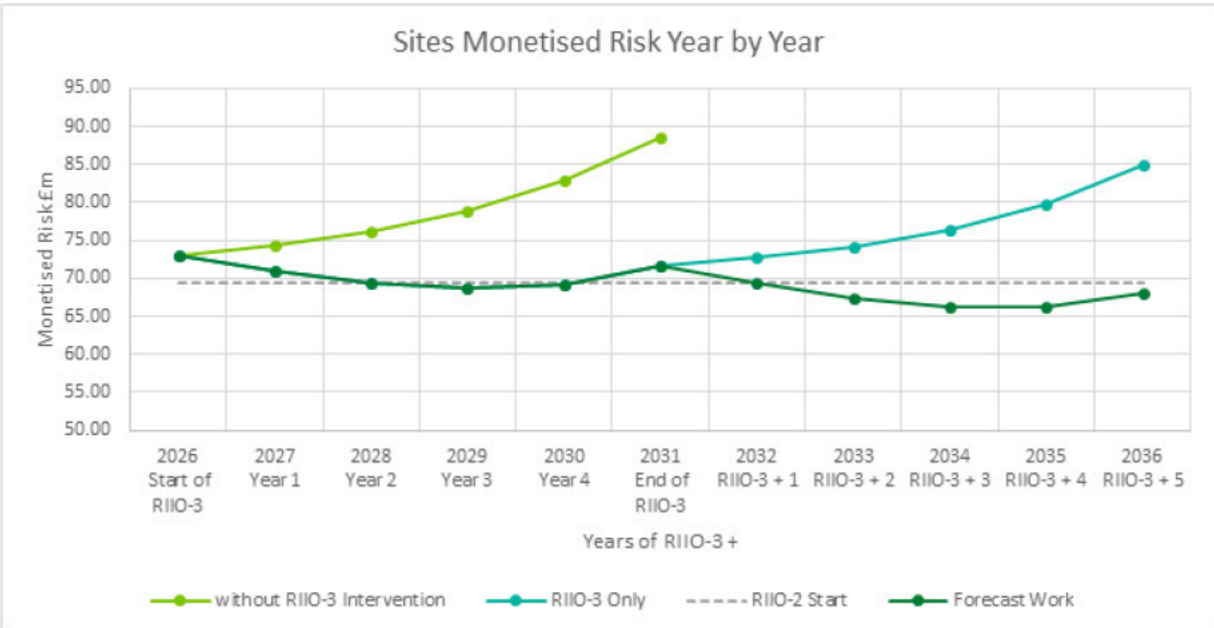

Figure 1: Forecast monetised risk profile across RIIO-GT3 and beyond

[1] NGT_A08_Network Asset Management Strategy_RIIO_GT3

1.1.7 Our AMP, compared to our RIIO-T2 business plan and final determination outcome, is summarised in Figure 2. We are requesting a similar amount of funding in our baseline plan, and across Uncertainty Mechanisms (UMs). We are also planning to deliver £430m, which is the RIIO-GT3 portion of UMs funding agreed in RIIO-T2 e.g., Emissions compliance, Bacton Final Options Selection Report (FOSR) etc.

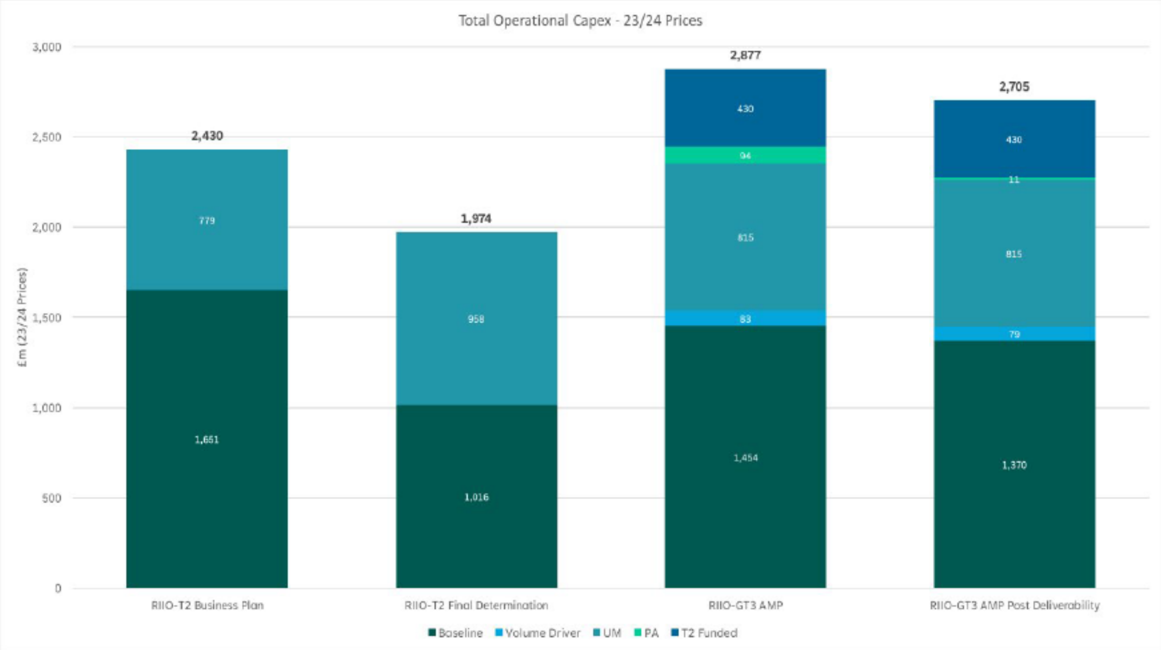

Figure 2: Comparison of RIIO-T2 plan, Final Determination and RIIO-GT3 plan

1.1.8 We have assessed deliverability of the RIIO-GT3 plan, against network outage constraints and organisational capability (including supply chain) and we are confident we can deliver the work within the plan. Please see chapter 9 for more information on deliverability.

1.1.9 The AMP has been developed across the business, working with subject matter experts by engineering discipline, and by site locations with our operations teams. It has then been valued against our Single Value Framework within the NARMs methodology and optimised using our Predictive Analytics module within Copperleaf, which has identified anywhere in the plan where we do not remove enough risk through bottom-up investment. The plan is then optimised for delivery to ensure that all investments we propose can be delivered in RIIO-GT3.

1.1.10 A high-level end-to-end AMP development process map is demonstrated below, Figure 3. A more detailed explanation of how interventions are created is provided in the Development Process Chapter.

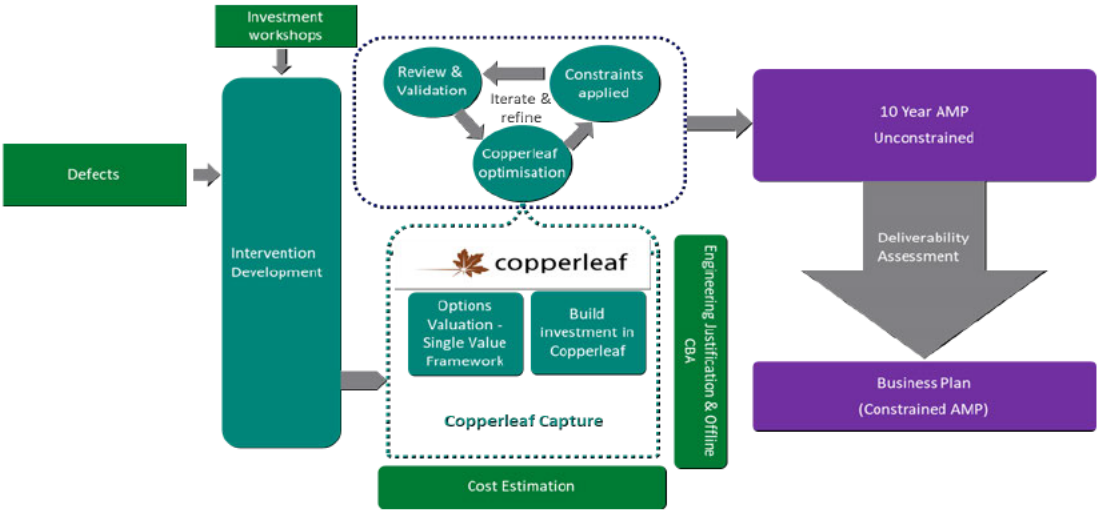

Figure 3: AMP Development Process Diagram

2 Scope of this document

2.1.1 In line with asset management best practise, we have developed a proactive 10 year rolling AMP against a set of Asset Management Objectives. Enabling the business to meet its long-term business priorities.

2.1.2 An internal rolling AMP will enable the business to adapt to regulatory and commercial changes and wider challenges to the energy landscape. It will support regulatory business plan creation from a live, up to date data set, created using a common set of assumptions and goals.

2.1.3 Our AMP includes asset capex investments against all site types and assets on the National Transmission System (NTS), including terminals, multi-junctions, offtakes, pig trap sites and block valves.

2.1.4 This document is a five-year view of our AMP. It presents our RIIO-GT3 business plan, explaining the inputs, assumptions, and decision processes employed to develop our business plan submission.

2.1.5 Key objectives of the AMP are:

- Provide details on how the asset management objectives will be achieved, reflecting customer, stakeholder and business priorities.
- Demonstrate how we manage the balance of cost, risk and performance in our investment decisions – optimising the plan to minimise asset lifecycle cost and keep the network risk within the required limits.
- Offer justification and evidence for the proposed asset management activities and the benefits of undertaking such activities.
- Establish the foundation on which price control submissions are developed.
- Be the primary means through which the organisation communicates how it intends to manage its portfolio of assets - accessible and understood by all concerned.
- Provide an assessment of deliverability - outage requirements, supply chain, resource requirements.
- Identify gaps within the organisation to deliver the asset management strategic objectives. Where applicable provide details on initiatives to address respective gaps.
- Create part of the evidence on which the organisation's asset management maturity is assessed.

2.1.6 Further detail on the investments within this five-year period of the AMP are provided in Engineering Justification Reports (EJPs), supported by Cost Benefit Analyses (CBAs) and Excel EJPs (also referred to as portfolio EJPs). The overall structure of these various documents is summarised in Figure 4.

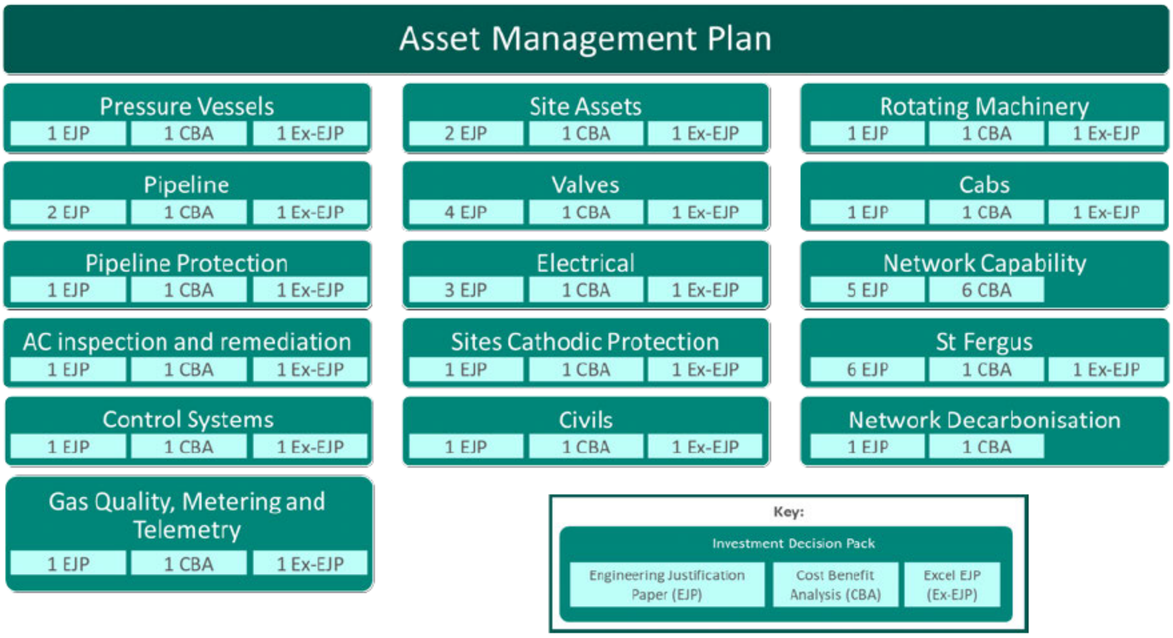

Figure 4: AMP Submission Structure for RIIO-GT3

3 Our RIIO-GT3 Plan

3.1 Plan –Summary

3.1.1 Our RIIO-GT3 asset capex plan totals £2.274bn (2023/24). This means we are delivering work valuing £2.705bn (2023/24) including the RIIO-T2 funded UM projects. It is split by theme in Figure 5.This value includes costs for work starting in RIIO-GT3, even if they end after this date, providing full cost transparency. Our data tables include work to the end of the RIIO-3 period.

3.1.2 We have proposed a mix of work, with a strong focus on delivering asset health investment to drive network risk down towards the levels we saw at the beginning of RIIO-T2, as well as delivering on our RIIO-T2 UM commitments for building new compression at various sites to comply with the 2030 Medium Combustion Plant Directive (MCPD).

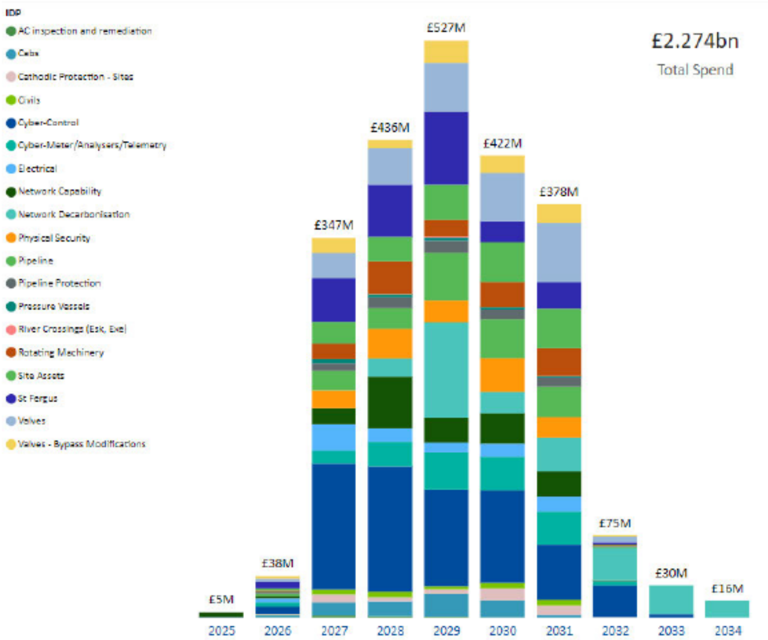

Figure 5: RIIO-GT3 asset capex plan by theme

3.1.3 Cut by driver, as in Figure 6, we can demonstrate that the majority of our RIIO-GT3 investments are to maintain safe and secure supplies to consumers i.e. network resilience and ensure compliance with relevant legislations.

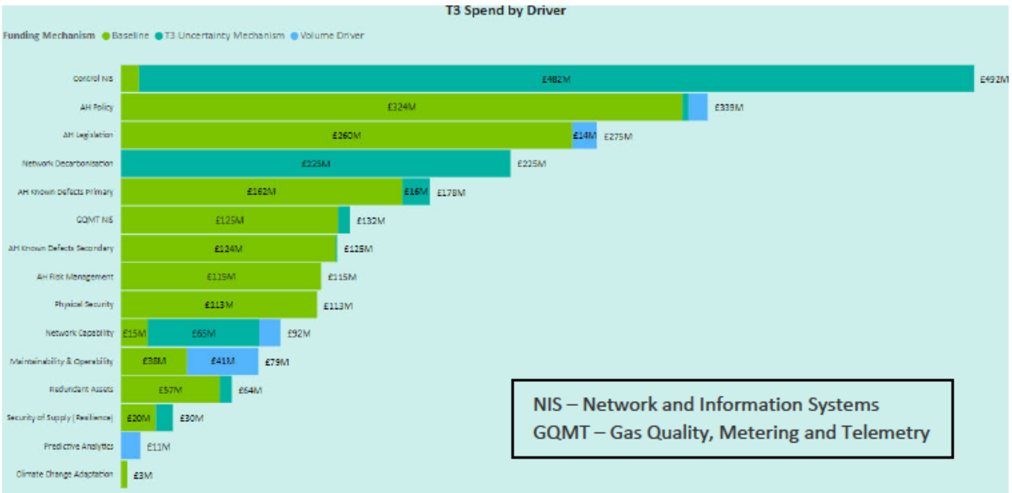

Figure 6: RIIO-GT3 asset capex plan by driver[2]

[2] Overall, £12.38m of investment is driven by Climate Change Adaptation, however £9.93m of this is a component of a wider investment in air intakes which therefore cannot be split between the two drivers so is included within AH Risk Management

3.1.4 In RIIO-GT3, we have focused on making the most of the assets we already have, as well as delivering agreed RIIO-T2 UM funded projects. We have submitted requests for Uncertainty Mechanisms, detailed in the UM chapter.

Figure 7: Proportion of RIIO-GT3 spend across the NTS by site.

3.1.5 Showing the spend geographically, in Figure 7, we can see a spread of investments across the whole network. In this visual, the darker the colour and larger the circle, the more spend in that location.

3.1.6 Building our business plan in Copperleaf has allowed us to visualise our plan in more granularity than previously. In turn, this has helped us to review the plan with different audiences and interrogate it from various angles. We have completed site-by-site assurance to build confidence that we have captured all investment required, and no conflicting work is planned. We have also used these graphics externally to support stakeholder engagement.

3.2 Plan – Baseline Risk Management

3.2.1 The charts below show the baseline risk by product and by service risk measures. This assumes no investment whereas subsequent versions will show the impact of our plan on this baseline risk. Without investment, our baseline risk increases by £20.069m

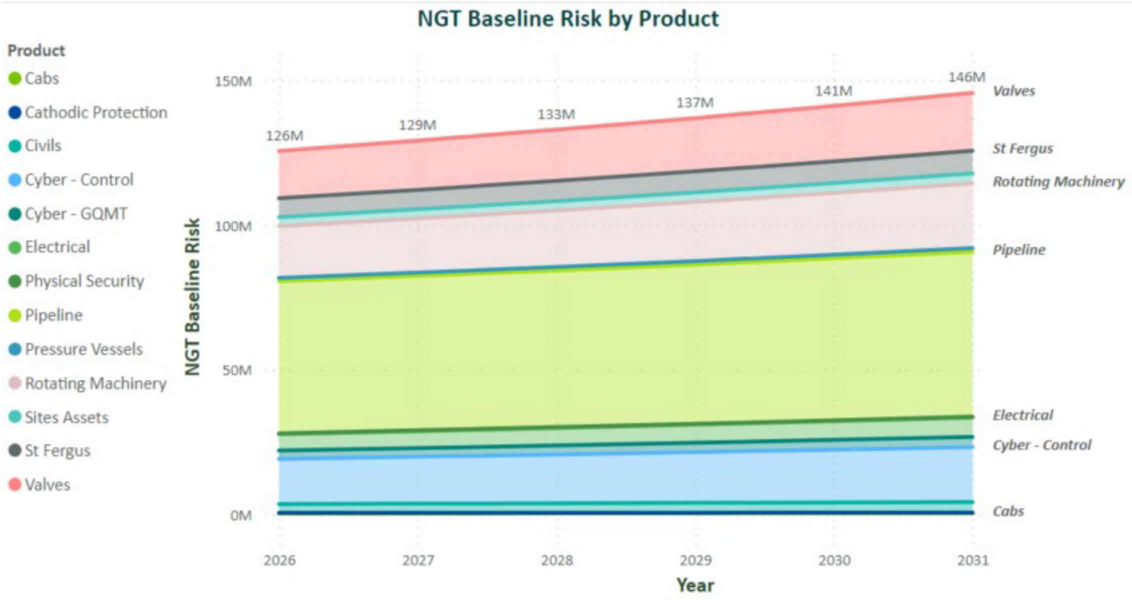

Figure 8: Baseline risk by product

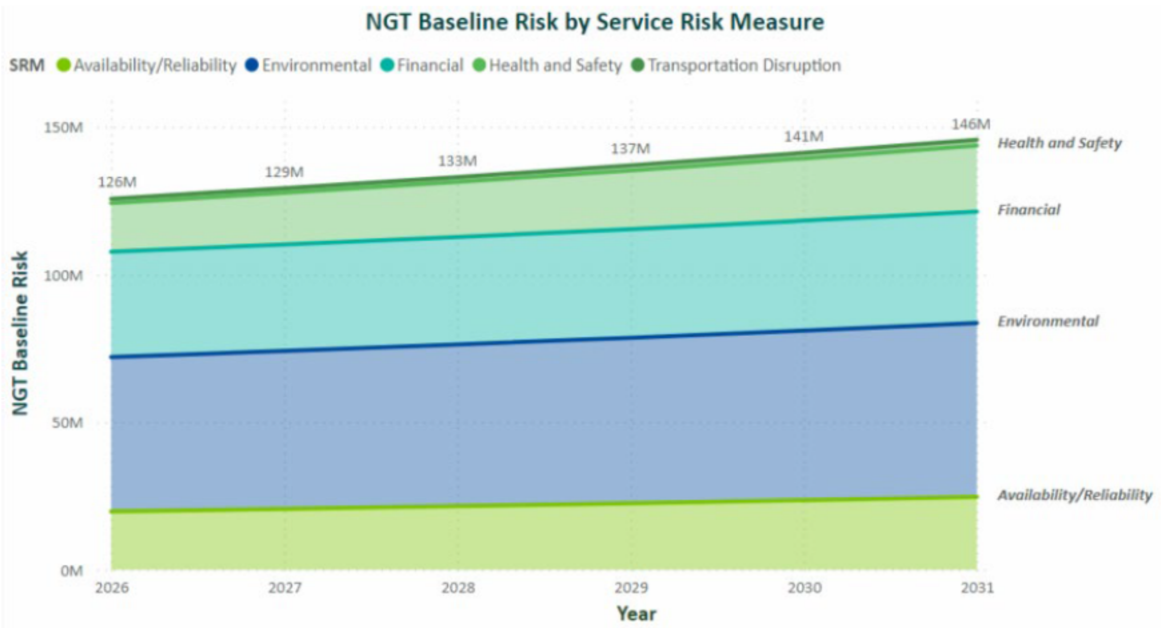

Figure 9: Baseline risk by service risk measure Category

3.3 Plan - Funding

3.3.1 This section explains our proposed funding approaches across the plan. We have indicated a mix of Price Control Deliverables (PCDs), Volume Drivers and Uncertainty Mechanism reopeners. We know the UK energy industry is undergoing a significant period of transformation and we believe that this mix of funding driver protects the UK consumer from avoidable cost.

Price Control Deliverables

3.3.2 Price Control Deliverables (PCDs) are defined by Ofgem as a mechanism "to capture those outputs that are directly funded through the price control" and where the funding provided is not transferrable to a different type or project. The purpose of a PCD will be to ensure the conditions attached to the funding are clear up-front.

3.3.3 Ofgem has established a framework for RIIO-GT3 with three ways in which companies are held to account for delivering outputs, set out within Ofgem's RIIO-GT3 sector specific methodology decision; Licence Obligations, Output Delivery Incentives (ODIs) and Price Control Deliverables.

3.3.4 In line with Ofgem's RIIO-GT3 Sector Specific Methodology document, we have proposed PCDs to cover the largest areas of our capital expenditure. These PCDs are retained from our RIIO-T2 submission:

- NARMs PCD
- Non-Lead Asset PCD
- Redundant Assets PCD

3.3.5 Figure 10 below shows a summary of these three PCDs with our proposed PCD type (Mechanistic, Evaluative), the RIIO-T2 NARMs category, the proposed RIIO-GT3 NARMs category and our proposed PCD measure. For each PCD we have proposed the allocation of one of three NARMs funding categories:

- A1 – NARMs Funding Adjustment and Penalty Mechanism
- A2 – Funding Under a Separate Mechanism
- A3 – Ring-fenced Project/Activity

PCD	NARMs PCD		Non lead Asset PCD	Redundant Assets PCD
Type	Evaluative		Mechanistic / Evaluative	Evaluative
RIIO-T2 NARMs Category	A1		A3 + B	A3
RIIO-GT3 Proposed NARMs	A1	A3	A3	A3
Measure	Risk £	Volume	Volume	Volume

Figure 10: PCD summary

3.3.6 More details on each of the PCDs is given in sub sections below.

NARMs PCD

PCD Summary

3.3.7 As explained earlier in this document, all network assets carry some risk of failure, with this increasing as assets age. Risk is reduced through our asset health investment programme, addressing known defects, managing obsolescence, and preventing damage from climate change and third-party interference (malicious or otherwise).

3.3.8 Our asset health investment programme is vital to maintain the necessary safety and reliability of our network and ensure we comply with relevant legislation.

3.3.9 NARMs is an Ofgem approved methodology, used across the sector to help network companies balance short- and long-term costs and benefits ensuring maximum value for consumers. By incentivising optimal investments, NARMs enables companies to maximise risk effectively while controlling costs.

3.3.10 The needs case and options analysis relating to specific asset health investments covered by this PCD are set out in the relevant Investment Decision Packs.

What the PCD will deliver

3.3.11 In summary, NARMs allows us to assign a common value across all risk areas on the network, translating Availability and Reliability, Safety, Environmental, Societal and Financial risks into a monetised risk (R£s). Using our single value framework and the principles of our NARMs methodology we can forecast cost, risk and service performance of the assets. We can also deliver a target level of risk reduction on the network, by reprioritising our investment mix as required though the period.

3.3.12 Our investment plan for RIIO-GT3 has been developed against the Ofgem and DESNZ resilience standard pillar of reducing monetised risk to those seen at the start of RIIO-T2.

3.3.13 Our NARMs PCD uses the NARMs methodology to estimate a Long Term Risk Benefit (LTRB) for all asset health investments within our RIIO-GT3 plan. Our RIIO-GT3 plan forecasts LTRB of R£165m of sites and R£13,543m for Pipelines for NARMs A1 with a further R£50m of A3 LTRB.

3.3.14 Through the evolution of our NARMs methodology and asset management decision making tools, we can now assess the NARMs benefit for interventions on all assets on the NTS. However, in assessing the allocation of the PCDs between Asset Health NARMs and Non-Lead Asset Health we have undertaken a theme-by-theme analysis.

3.3.15 A split A1 and A3 NARMs funding category is currently proposed within the Asset Health NARMs PCD to ensure the delivery of our asset health investment programme against our objective to stabilise risk, whilst maintaining our fair cost of service to consumers.

3.3.16 An A1 category is proposed for all investments within the EJPs as shown in Table 1 below. In addition,, we propose to ring-fence some investments where volume driver mechanisms are proposed on top of the requested investment. For these investments, we propose a volume measure is utilised within our NARMs PCD, facilitating the application of volume driver uncertainty mechanisms. These would sit in a ring-fenced NARMs A3 category for reporting purposes. More details on this mechanism can be found in the NARMs Annex with specific details included in our EJPs.

Table 1: NARMs PCD EJP Alignment

NARMs PCD Category	Engineering Justification Papers	
A1	NGT_EJP03_Cabs_RIIO-GT3 NGT_EJP06_Gas_Quality,_Metering_and_Telemetry_RIIO-GT3 NGT_EJP026_Pipeline_Protection_RIIO-GT3 NGT_EJP018_Pressure_Vessels_RIIO-GT3 NGT_EJP04_Rotating_Machinery_RIIO-GT3 NGT_EJP02_Site_Assets_-_Preheating,_Filters_&_Pipework_RIIO-GT3 NGT_EJP01_Site_Assets_-_Asbestos,_Stabbings_and_Redundant_Assets_RIIO-GT3 NGT_EJP024_Valves-_PCVs_and_FCVs_RIIO-GT3	NGT_EJP032_St Fergus-_Civils_RIIO-GT3 NGT_EJP028_St Fergus-_Electrical_Assets_RIIO-GT3 NGT_EJP030_St Fergus-_Pressure_Vessels_RIIO-GT3 NGT_EJP027_St Fergus-_Rotating_Machinery_RIIO-GT3 NGT_EJP031_St Fergus-_Site_Assets_RIIO-GT3 NGT_EJP029_St Fergus-_Valves_and_Actuators_RIIO-GT3 NGT_EJP023_Valves-_Actuators_RIIO-GT3 NGT_EJP022_Valves-_Valves_RIIO-GT3
A3	NGT_EJP025_Valves-_Bypass_Installation_and_Modification_RIIO-GT3 NGT_EJP020_Pipeline_Cathodic_Protection_RIIO-GT3 NGT_EJP013_Compressor_Fleet_-_Network_Investments_and_Zone_1_(Scotland)_RIIO-GT3 NGT_EJP014_Compressor_Fleet_-_Zones_2_and_3_(Central)_RIIO-GT3 NGT_EJP015_Compressor_Fleet_-_Zones_4_and_5_(South_Wales_and_South_West)_RIIO-GT3 NGT_EJP016_Compressor_Fleet_-_Zones_6_and_7)_(East_Midlands_and_South East)_RIIO-GT3	

Proposals for setting outputs and monitoring delivery.

3.3.17 The outputs are proposed above. Monitoring of any changes and descriptions of why any changes are made will be reported through the annual regulatory reporting pack process.

Non-lead Asset PCD

PCD Summary

3.3.18 Our asset health investment programme is vital to maintain the necessary safety and reliability of our network and ensure we comply with relevant legislation.

3.3.19 Historically the Non-lead Asset PCD has been utilised to cover asset health investment on assets that were not covered by NARMs (non-lead assets). In addition, it was utilised to protect consumers by ensuring the appropriate volume of interventions were delivered for the awarded allowances.

3.3.20 In RIIO-T2, this covered the following areas:

- Re-lifing of compressor cabs
- Civils interventions on site fences, pipe supports, pits and site roads.
- Electrical interventions on site lighting systems.

3.3.21 Through the evolution of our asset management capability, we can understand risk and assign benefit to interventions on all assets across the NTS. However, in order to manage volumes and associated allowances for certain assets on the NTS, we propose some assets retain a Non-lead Asset PCD.

What the PCD will deliver

3.3.22 Our investment plans have been developed against the Ofgem and the Department for Energy Security and Net Zero (DESNZ) resilience standard pillar of maintaining stable risk from the start of RIIO-T2 to the end of RIIO-GT3. Through our deliverability assessment, we have completed a network access/outage assessment, procurement assessment and developed a contracting strategy.

3.3.23 In developing our RIIO-GT3 plan, we have recognised there are areas where deviation is proposed against the RIIO-T2 awarded allowances, or the volume of investment historically delivered. Whilst our needs case is well defined, we are proposing this Non-lead Asset PCD mechanism is utilised to measure our delivery and protect consumers.

3.3.24 We have undertaken a robust process for the development of our investments giving confidence in our RIIO-GT3 plan, and we propose that non-lead asset PCD is applied to measure our performance within the themes of work shown in Table 2.

Table 2: Non-Lead Asset Health PCD

Theme	Engineering Justification Papers	Interventions	Funding
Electrical Infrastructure	NGT_EJP010_Electrical_Infrastructure-_Switchgear_and_Transformers_RIIO-GT3 NGT_EJP011_Electrical_Infrastructure-_ Standby_Power_Systems_and_LV Distribution_RIIO-GT3 NGT_EJP012_Electrical_Infrastructure_:_Site_Lighting,_Earthing_and_Lightning_Protection_RIIO-GT3	All investments within these EJPs are proposed to be covered by this PCD	Baseline
Civils	NGT_EJP019_Civils_RIIO-GT3	All Investments within this EJP are proposed to be covered by this PCD	Baseline
Nitrogen Sleeve	NGT_EJP026_Pipeline_Protection_RIIO-GT3	'Nitrogen Sleeve grouting' and 'Nitrogen Sleeve minor refurbishments' interventions to be included in this PCD	Baseline
Easement Reinstatement Campaign	NGT_EJP017_Pipeline_RIIO-GT3	Easement reinstatement campaign for tree and scrub clearance interventions to be included in this PCD, and have measures of km	Baseline

Electrical Interventions

3.3.25 All investments within IDP02 – Electrical Infrastructure are proposed to be included within our non-lead asset PCD, with volumes per intervention proposed to be defined within the PCD. Our proposed RIIO-GT3 investment in Electrical Infrastructure is a step change compared to our RIIO-T2 programme to ensure compliance with legislation, the management of asset deterioration and ensuring the safety of our operatives. It seeks to address defects and significant obsolescence issues.

3.3.26 A volume PCD within this non-lead asset PCD is the appropriate mechanism to measure our delivery in this theme.

Civil Interventions

3.3.27 537 Civils interventions are required to ensure that stable network risk is maintained during RIIO-GT3 within this asset class. Investment on access, building, security fences and gates, ducting, drainage and tank and bund assets is included within this PCD, with volumes per intervention defined.

3.3.28 Our RIIO-GT3 investment request within the IDP08 – Civils, is broadly in line with our RIIO-T2 investment forecast and business plan final determination, although it should be noted that pipe support and pit interventions have moved into IDP01 – Site Assets. Given the forecast volume derivation approach, through extrapolating RIIO-T2 survey condition data, we believe it will be appropriate to measure our delivery in this theme against a volume PCD within the non-lead asset PCD mechanism.

Nitrogen Sleeve Interventions

3.3.29 In RIIO-GT3, through our Pipeline Protection EJP[3], we propose that the delivery of our interventions "Nitrogen sleeve remediation – Minor" and "Nitrogen Sleeve – Grouting" are included within the non-lead asset volume PCD. We have identified a programme of investment to address known defects on nitrogen sleeves, however this has resulted in a programme that is higher than our RIIO-T2 delivery volume. Therefore, to protect consumers, the delivery of the volumes for these investments are proposed to be included within this non-lead asset PCD.

Easement Reinstatement Campaign

[3] NGT_EJP26_Pipeline_Protection_RIIO-GT3

3.3.30 In RIIO-GT3 we are proposing a one-off Easement Reinstatement Campaign to target areas of the NTS where trees and vegetation have encroached on the rights of way. The purpose of this campaign is to achieve compliance with Pipeline Safety Regulations (PSR) 1996. Our Pipeline EJP[4] seeks funding to seeks the one-off funding to rectify historic under investment in the management of vegetation clearance, which will subsequently enable us to maintain good levels of clearance through on-going BAU effort. Stretches of easement are proposed to be reinstated, 253km Scrub clearance and 185km for tree clearance, each measured individually within this PCD. We need to complete this investment to ensure we can complete the necessary pipeline inspection and maintenance activities, measured through this non-lead asset PCD.

Proposals for setting outputs and monitoring delivery.

3.3.31 The outputs are proposed above. Monitoring of any changes and descriptions of why any changes are made will be reported through the annual regulatory reporting pack process, with final assessment of the delivered outputs completed following the end of the RIIO-GT3 regulatory period.

Redundant Assets PCD

3.3.32 Customers and consumers benefit from responsible decommissioning activities. These can have a positive impact on nature and communities through reconstructing the environment and releasing materials back into the value chain to reduce the need to mine raw materials.

3.3.33 This PCD tracks how we address our redundant asset base in RIIO-GT3, ensuring that local communities benefit from the removal of industrial assets/sites in close proximity to their location, and how we mitigate the potential hazard to the environment (e.g., through contamination). It is also socially fairer to address these assets now as customers who have had the benefits of these assets will pay for decommissioning rather than leaving a burden on a potentially smaller group of future consumers to deal with.

3.3.34 We propose a PCD is utilised to track the delivery of these outputs.

What the PCD will deliver

3.3.35 The PCD will track the delivery of the 33 projects listed across our engineering justification papers, presented in the Business Plan Data Tables[5] 6.5.

3.3.36 The RIIO-GT3 base revenue allowance for addressing these will be determined by Ofgem as part of the RIIO-GT3 price control review.

Proposals for setting outputs and monitoring delivery.

3.3.37 The outputs are proposed above. Monitoring of any changes and descriptions of why any changes are made will be reported through the annual regulatory reporting pack process, and through PCD reporting at the end of the RIIO-GT3 regulatory period.

3.4 Uncertainty Mechanisms

3.4.1 Our proposals are designed to allocate risk to whoever is best placed to manage it. We have protected end consumers and shareholders from anticipated risks or change in circumstance, by proposing Uncertainty Mechanisms where we have reduced scope and / or cost certainty. This ensures that if customer or consumers' needs change so do our allowances.

3.4.2 We are proposing volume drivers on valves bypass installation and modifications, pipeline cathodic protection and for compressor re-wheels. Full justification can be found in the relevant IDPs, in summary:

- Valves bypass is a new intervention, so we have proposed baseline funding for 47% of the plan, with the rest in volume driver. We are confident we can deliver the baseline portion of the plan, but due to deliverability constraints, we are not confident that we can deliver enough work to reach the risk levels we aim for. In this case, it is prudent to protect the consumer from the risk of under-delivery by using a volume driver for the rest of the work.

[4] NGT_EJP17_Pipeline_RIIO-GT3
[5] NGT_Business_Plan_Data_Tables_RIIO-GT3

- We need to complete an accelerated programme of investment to maintain the performance of our Pipeline Cathodic Protection (CP) assets to ensure the continued protection of National Gas Transmission (NGT) buried pipeline assets from corrosion. To protect consumers from the increase in investment compared to our RIIO-T2 programme we propose baseline funding equivalent to our RIIO-T2 delivery with a volume driver to facilitate the additional volumes.

3.4.3 Table 3 summarises our proposals for uncertainty mechanisms in RIIO-GT3, based on Ofgem's Sector Specific Methodology Decision (SSMD) guidance for the management of uncertainty. Further explanation of each of these mechanisms is provided below.

Table 3: RIIO-GT3 Uncertainty Mechanisms

Uncertainty Mechanism	Description
Network Decarbonisation (net zero)	To reduce our carbon emissions and contribute to meeting the goal of net zero emissions by 2050, we have considered a range of portfolio options including compressor and pipeline decarbonisation technologies. Innovation projects are underway to trial these technologies, the results will then inform future investment requirements. More information is available in the Network Decarbonisation EJP[6].
Network Capability	Our Network Capability Assessment has identified the need to modify compressor stations to facilitate a change in compressor capability to meet network needs. To enable a full assessment of the technology and options, further time was required before investment could be included within our investment plan. There are also investments which are not justified at this point in time but could be triggered by changes to supply and demand patterns. The investments relevant to this UM are captured in IDP03 – Network Capability.
Uncertain costs	**Pipeline Diversion** - To divert our pipelines in response to a force majeure event, quarry and loss development claims, to mitigate the effects of a significant environmental disturbance or to manage third-party encroachment.
Single Points of Failure (SPOF)	During RIIO-GT3 we will conclude Front End Engineering Design (FEED) studies that consider the full range of options to reduce pipeline failure risk on DESNZ agreed Single Points of Failure. Proposed investment options for each section to mitigate this risk will be determined within RIIO-GT3.
Gas Strategic Planning	NESO will publish a plan for Clean Power by 2030; investment requirements associated with this condition are not yet known.
Asset Health	There are several investments for asset health projects where further time is required to assess the correct option and confirm cost confidence and therefore, we propose a mechanism to manage the risk.
Volume Drivers	We propose the application of volume drivers on three investment themes within our RIIO-GT3 submission. • Valve Bypass • Pipeline Cathodic protection • Compressor Re-wheel (Capability Change)

[6] NGT_EJP21_Network_Decarbonisation_RIIO-GT3

4 Taxonomy and Asset Groups

4.1.1 As described in the Network Asset Management Strategy[1] section 3.5, our equipment units have changed from RIIO-T2 to RIIO-GT3 to align with the ISO 14224 standard. This approach enables a top-down asset class investment view which helps to avoid gaps in our plans and build cost confidence in our RIIO-GT3 planning. This lets us consistently describe our assets, and any interventions on a "per asset" level.

4.1.2 An **Equipment Unit** (EU) is now the standard method of defining an asset in terms of its constituent parts (or components). A standard EU asset definition allows unit costs to be calculated consistently.

4.1.3 A core principle of our RIIO-GT3 ways of working process is to allow investment engineers to scope out current and future investment projects using a recognisable and usable asset unit of measure, which may comprise one or more assets in Maximo, the Central Maintenance Management System (CMMS) which doubles as our Asset register.

4.1.4 We have termed this an **Intervenable Unit** (IU). An IU is a unique occurrence of an EU and relates to a physical asset (e.g., Actuator is an EU; Actuator 1234 at Aberdeen Compressor Station is an IU).

4.1.5 The IU can be formed in many ways depending on the nature of the investment. For example, an IU could be the whole site (ISO3), or a single component (ISO8). For the former example, the IU could consist of many hundred assets: for the latter only a single asset.

4.1.6 In RIIO-T1 and RIIO-T2, our regulatory assets were grouped into Secondary Asset Classes (SAC), which is the level we report to our economic regulator. This ensures consistency between RIIO-T1 Monetised Risk (NOMs) target rebasing, RIIO-T1 monetised risk outputs reporting and RIIO-T1 close-out, Cost Benefit Analysis presented with the RIIO-T2 business plan and setting of Baseline Network Risk Outputs (BNRO) targets for RIIO-T2. Overall, there are ~47000 items.

4.1.7 In Maximo, there are ~220,000 assets at the lowest level, indicating assets, components or equipment for which data is captured, maintenance is conducted, and defects raised. There are a number of hierarchical levels to group assets into process, subsites and sites.

4.1.8 Monetised risk is calculated at individual equipment asset level in accordance with the approved NARMs Methodology, using data from Maximo. A SAC asset used for RIIO-T1 reporting (as retained to date for Network Asset Risk Metric (NARM) to ensure consistency) is much less granular than the level we calculate monetised risk. Therefore, aggregation is required to create the SAC assets used as the basis for Long Term Risk Benefits (LTRB) calculations.

4.1.9 There is no direct correlation between a SAC asset and the asset register, so assumptions and gap filling are required. This process is documented as part of our RIIO-T1 monetised risk rebasing process and has been subject to full consultation and Ofgem approval through the modification of RIIO-T1 License Special Condition 7E.

4.1.10 An overview of NARM Methodology is included in the Network Asset Management Strategy[1].

4.1.11 As part of preparing for RIIO-GT3, EUs replaced SAC assets as the unit of measure for NARMs analysis and reporting.

4.1.12 We have aligned our entire asset data structure to an Asset Taxonomy based on the ISO 14224 standard, enabling a range of improvements:

- standardisation of all investment strategy and delivery data,
- consistent cost capture and unit cost development,
- ability to benchmark with other TSOs and
- standard interventions and maintenance activity.

4.1.13 ISO 14224 was developed for use in the offshore sector. We own assets, particularly in the Civils category, which were not featured in the original standard and were added into the adapted taxonomy.

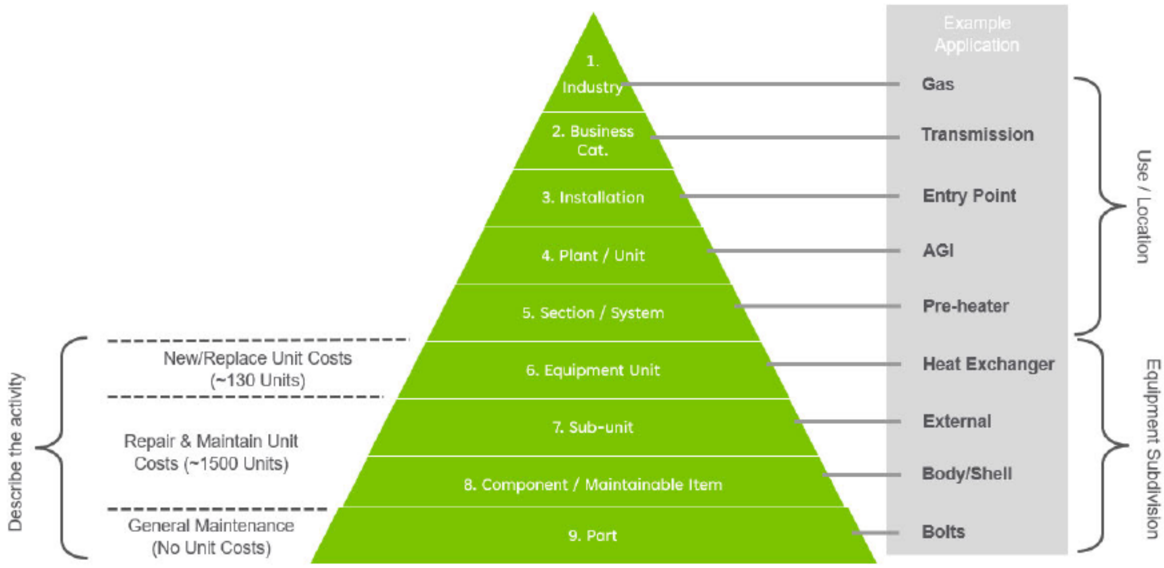

Figure 11: Equipment unit taxonomy

4.2 ISO 6 Categories

4.2.1 Within our standard Equipment taxonomy, there are seven ISO 6 categories:

- **Auxiliaries (A.2.12)** - The smallest equipment category currently – contains Heating Ventilation and Cooling (HVAC) equipment only currently.
- **Civils (GT.1.1)** - Contains all Civils including buildings, bunds, fencing (ISS and non-ISS) and some pipeline protection. ISS Fence Cameras are included in this.
- **Electrical (A.2.4)** - Concerned with the supply, cleaning and creation of power. This includes Cathodic Protection Equipment, Data Cables, Site Earthing and Lightning systems, as well as Site lighting. This is the largest category.
- **Mechanical (A.2.3)** - This is a broad equipment category, covering a range of mechanical items that would be under plant and equipment. This category also features Pipes, Pipelines, some Pipeline Protection as well as mechanical/metal pipe supports.
- **Rotating (A.2.2)** – This contains the Gas and Electric driven compressor equipment, including the compressor and power turbine. This also includes some standby generators as well as pumps.
- **Safety and Control (A.2.5)** – This category contains control systems, fire detection and suppression equipment, and metering. This also includes valves and their actuators.
- **Utilities (A.2.11)** – Contains air and nitrogen supply equipment, heating, extractor fans and air conditioning units.

4.3 Asset Quantities

4.3.1 For the RIIO-GT3 submission, the data set is based on 225,848 Maximo assets which are grouped into Intervenable Units and reported at ISO Category levels.

Table 4: Volume of intervenable units in each asset type

Asset Type	Count of Intervenable Units
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
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[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

Asset Type	Count of Intervenable Units
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
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[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

4.4 Investment ID (InvIDs)

4.4.1 In RIIO-2, Unique Identifier (UID) is a description of a repeatable activity defined by NGT and recognised by Ofgem, to use for target setting and cost/risk output tracking across a regulatory period. It is the defined unit of work and carries the total cost, unit cost, volume and LTRB values used for BNRO target setting and regulatory reporting.

4.4.2 As a UID is a repeatable activity, it has several definitions assigned to it. It will have an expected EU (or EUs) and SAC that it applies to (ISO 6 and 7) as well as a definition of the intervention i.e., what we are doing to that EU, expected unit cost. It will link to a single PCD to ensure we report on and track work effectively. All investment types have UIDs, Cyber, Decommissioning, Asset Health etc.

4.4.3 The diagram below demonstrates the different UIDs for interventions on an Actuated Valve.

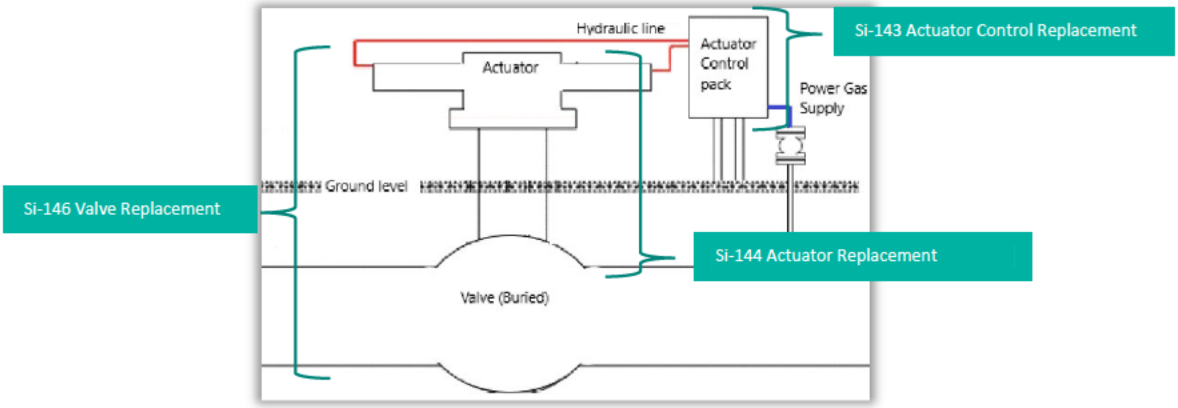

Figure 12: Actuated Valve UID differentiation

4.4.4 As part of the movement from SACs to EUs, new UIDs, often called Investment Identifiers (InvID) codes have been created for RIIO-GT3. These are in the form of a letter then a number. These are a necessary evolution of the RIIO-T2 UIDs, some items are directly aligned to RIIO-T2 UIDs, built from the data collected in the RIIO-T2 Period, as well as refinement, combining or splitting of existing UIDs. For new interventions not seen in the RIIO-T2 periods, new codes have been raised.

4.4.5 UIDs have been incredibly beneficial, and we see InvID as a logical successor to UIDs, fulfilling the same purpose, and having a range of definitions to describe it as a trackable piece of work assigned to a PCD. In RIIO-GT3, our entire Asset Health plan has been described based on InvID codes.

5 AMP Development Process

5.1.1 A schematic of our full AMP development process is shown in Figure 13. This highlights the interaction between our high-level outcomes and objectives, the different drivers for investment, our optimisation tool and the various assessments we complete in order to refine the original unconstrained plan.

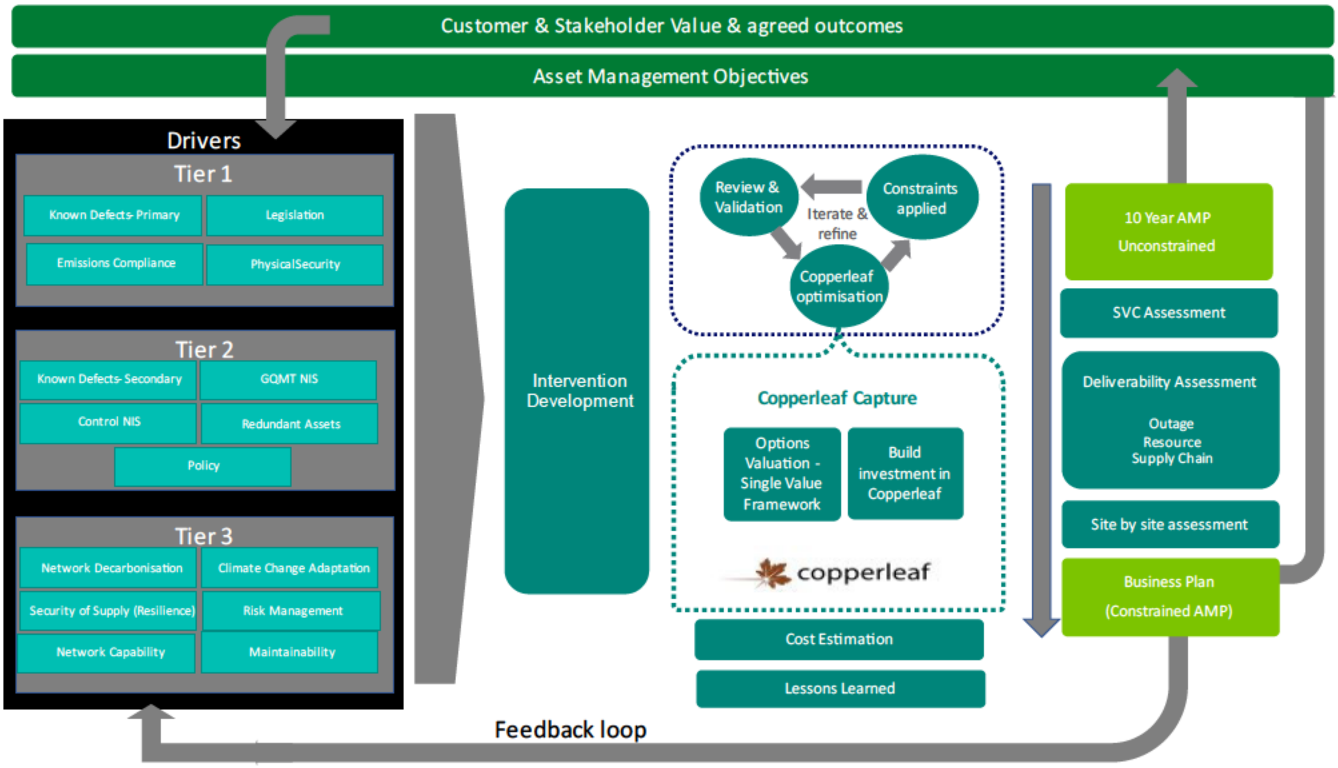

Figure 13: AMP development process

5.1.2 Drivers for investment will be covered in more detail in the next chapter. Each driver was assigned to an indicative 'tier' to aid our deliverability assessment so that we could prioritise investments and therefore outages and resources. This is covered in more detail in our Deliverability Assessment chapter.

5.1.3 Interventions were developed to address these drivers with support from across the business. The majority of interventions are one that we've carried out in the past but these were reviewed to ensure they were still the best/only options and additional interventions were also identified where needed.

5.1.4 These interventions were then modelled in our optimisation tool, Copperleaf, which is covered in more detail in the Value Framework and Copperleaf chapter.

5.1.5 Over the course of this whole process there are numerous inputs which are summarised below.

5.2 Legislation

5.2.1 Our assets are subject to multiple layers of legislation and compliance is a key driver for investment. Relevant legislations are described in each EJP and summarised in section 6.2.33 of this document. Our plan must ensure we deliver gas safely and reliably to the consumer under our Gas Transporter License.

5.3 Asset data

5.3.1 Understanding the assets we have, their condition and the challenges that affect them is critical to building a robust plan that delivers the overall network capability needed.

Asset condition

5.3.2 Asset Health Grade is collected for each Level 3 asset as part of maintenance work orders. It is assessed using a grading system of AH Grade 1 – 5, 1 being the best and 5 being the worst. Table 5 shows the definitions of the scores. Only AH Grade 5 is considered in calculations. For assets with AHG 1-4, an age-based with consequence approach is mainly adopted to inform condition of the asset and its associated monetised risk.

Table 5: Asset Health Scoring System

AH Grade	Description
1	New or as new
2	Good or serviceable condition
3	Deterioration requires assessment or monitoring
4	Deterioration, consider intervention
5	End of life (Intervention required)

Asset age data

5.3.3 Whilst asset age alone is not a driver for investment, condition and defect data suggests that there is a correlation between age, defects and deterioration. Asset age data is captured within our asset repository Maximo.

5.3.4 Copperleaf uses this data, alongside condition data, to assess our top-down asset management decisions. While we have improved our asset data significantly in RIIO-T2, we still have more work to do in this area. Please see NGT_A11_IT and Telecoms Strategy_RIIO_GT3[7] for further information.

Theme/asset group specific metrics

5.3.5 Some assets will have very specific metrics of interest. For example, compressor running hours are a measure that informs us of the utilisation of a compressor unit. It varies depending on a range of factors such as availability of other compressor unit(s), the supply level from terminal(s) upstream and demand level from downstream offtakes. compressor running hours is also used as one of the factors for determining the criticality of the assets, and subsequently forms part of the justification for an investment decision on the asset.

Obsolescence

5.3.6 Asset obsolescence is a known issue across a number of assets on our network. There are many manufacturers/models of equipment that are approaching or exceeding their original design life and have become obsolete. Some manufacturers are no longer trading, others are no longer supporting or providing spares for some of the assets leading to challenges in maintaining and operating some of our assets. We need to manage obsolescence in a planned manner due to the risks associated with failure of unsupported assets and the subsequent network impact. We have discussed it in detail in the relevant EJPs.

[7] NGT_A11_IT_and_Telecoms_Strategy_RIIO-GT3

Asset Probability and Consequence of Failure (Risk)

5.3.7 Our assets are modelled under the NARMs Methodology[8], which calculates the probability and consequence of failure for both pipeline and site assets. For more information on our NARMs methodology, please see the Network Asset Management Strategy.

Asset Purpose	Asset	Failure Mode	Consequence of Failure				
			H&S	Env	A&R	Fin	C&S
System	Asset Type 1	Failure Mode 1	Y	-	Y	-	Y
		Failure Mode 2	-	-	-	Y	-
	Asset Type 2	Failure Mode 2	-	-	-	Y	-
		Failure Mode 3	-	Y	-	-	Y

Figure 14: NARMs methodology framework

Probability of Failure (POF)

5.3.8 The methodology applies deterioration curves to predict failure rates and future risks.

5.3.9 In pipelines, our model divides the network into 12-meter sections to allow for localised consequence assessment. Based on the properties of each 12-meter segment, probabilities of leak and rupture are determined. For site assets, individual equipment failure modes are analysed, each with distinct potential consequences.

5.3.10 The NARMs methodology often predicts higher failure rates than the defects reported on the network due to the following factors:

Comprehensive Risk Consideration

5.3.11 The NARMs methodology considers a broad range of failure scenarios, including minor failures that may not yet be detectable or considered a requirement to be reported during inspections as a defect. An example of this is minor corrosion. This leads to a more cautious and forward-looking estimate of failure rates.

Data Granularity

5.3.12 Failure rates in the NARMs model are often calculated at a more granular level (e.g., [redacted] pipeline sections). This detailed approach can aggregate minor risks across thousands of sections, resulting in higher cumulative failure rate estimates compared to observed defects. This similar effect can happen on a singular asset with five failure modes being reported with a failure rate of [redacted] summing to [redacted].

Conservative NARMs Approach

5.3.13 Not all defects are immediately visible or measurable through standard inspections. The model incorporates the likelihood of latent defects that could manifest in the future. Predictive models consider the aging profile of assets and forecast deterioration over time, potentially projecting higher failure rates than those currently observed. Ultimately NARMs aims to ensure network reliability and safety by using a precautionary approach. NARMs uses these failure rates relatively to prioritise interventions and mitigate risks proactively.

5.3.14 The discrepancy between the modelled failure rate and defects highlights the importance of combining predictive models with real-world observations to maintain a balanced and accurate understanding of network risks.

[8] *https://www.nationalgas.com/our-businesses/network-asset-risk-metric-narm*

Consequence of Failure (COF)

5.3.15 Consequences of failure can be described using the Service Risk Framework. This framework enables us to report our monetised risk to stakeholders and OFGEM under the following categories: Safety, Environment, Availability and Reliability, Financial and Societal.

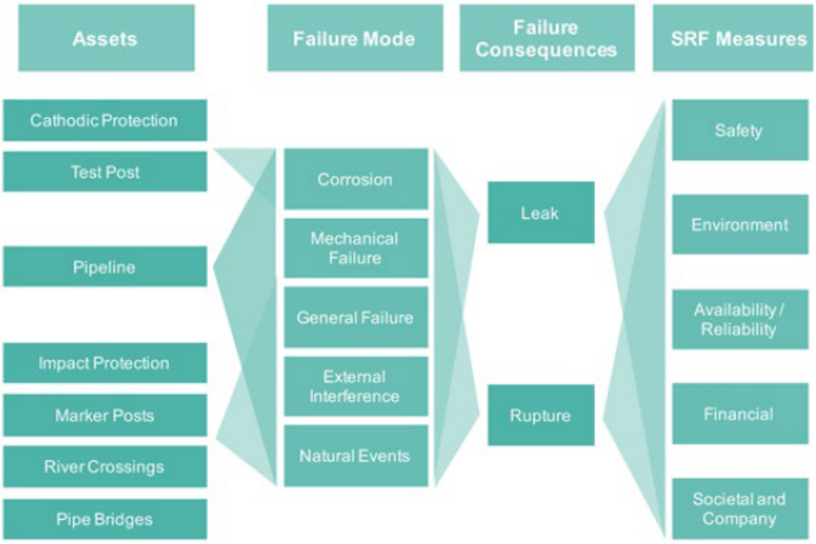

Figure 15: Mapping of assets and their failure consequences to the service risk measures.

5.3.16 The consequence of failure can be broken down into three areas:

- **Probability of consequence** – This is different to the probability of failure and reflects that not all failures of a given failure mode will lead to the consequence. For example, the probability that a corrosion defect will lead to a corrosion hole, and subsequent gas emissions and fire/explosion risk.
- **Severity of consequence** – This reflects the potential different types and severities of the eventual consequence. For example, the mode of transport disrupted (e.g., motorway or minor road), or the severity of the health and safety event.
- **Quantity of consequence** – This reflects the scale of the consequence. For example, the duration of the disruption event or the number of people affected.

5.3.17 The assessment of probability and consequence of failure is developed in this way to ensure that the final risk assessment can be valued in monetary terms known as monetised risk.

5.4 Network data

Network reliability data

5.4.1 We've maintained 99.996% reliability for our customers to input and offtake gas from our system.

5.4.2 We have strategies in place to plan the delivery of our RIIO-GT3 plan with minimal disruption to the customer and are focusing on optimising efficient delivery, we consistently identify opportunities to package works appropriately and apply innovative thinking to drive value for our customers and stakeholders.

Network capability

5.4.3 We carry out network analysis to analyse and define the capability of the NTS over the short (current year), medium (5 years) and long-term (10 years) to address our drivers of change.

5.4.4 A standard set of documented assumptions that are reviewed and updated annually is used for all analysis undertaken. This assessment is undertaken against a range of future supply and demand scenarios using the Future Energy Scenarios (FES).

5.4.5 Analysis results are presented in the annual publication of Annual Network Capability Assessment Report (ANCAR). Future requirements on the network capability illustrated by these flame charts are discussed in the Network Capability Assessment (within the System Operator Annex[9]).

5.5 Future requirements

5.5.1 The AMP is sensitive to any changes that happen outside of our direct control. We are part of a broader energy industry, with many interlinked functions working together to provide security of supply to the UK.

5.5.2 The energy industry and political backdrop changes around us, and we must be resilient to be able to respond to those changes appropriately.

5.5.3 Examples of include, but are not limited to:

- Annual expected changes to Future Energy scenarios,
- Changes to Government structure – e.g., DESNZ and NESO
- Changes to legislation and policy ay UK level, or industry level
- Environmental targets – e.g., Net Zero and Clean Power by 2030
- Decisions on the future of energy, such as hydrogen transition and Carbon Capture, Use and Storage.

6 Drivers for investment

6.1 Driver classification

6.1.1 For every investment decision that makes up the AMP, there is a driver which describes the reason we are carrying out that intervention. The drivers for decisions and a framework for how we differentiate between them in our RIIO-GT3 plan are shown in Figure 16. More information on each driver is provided below.

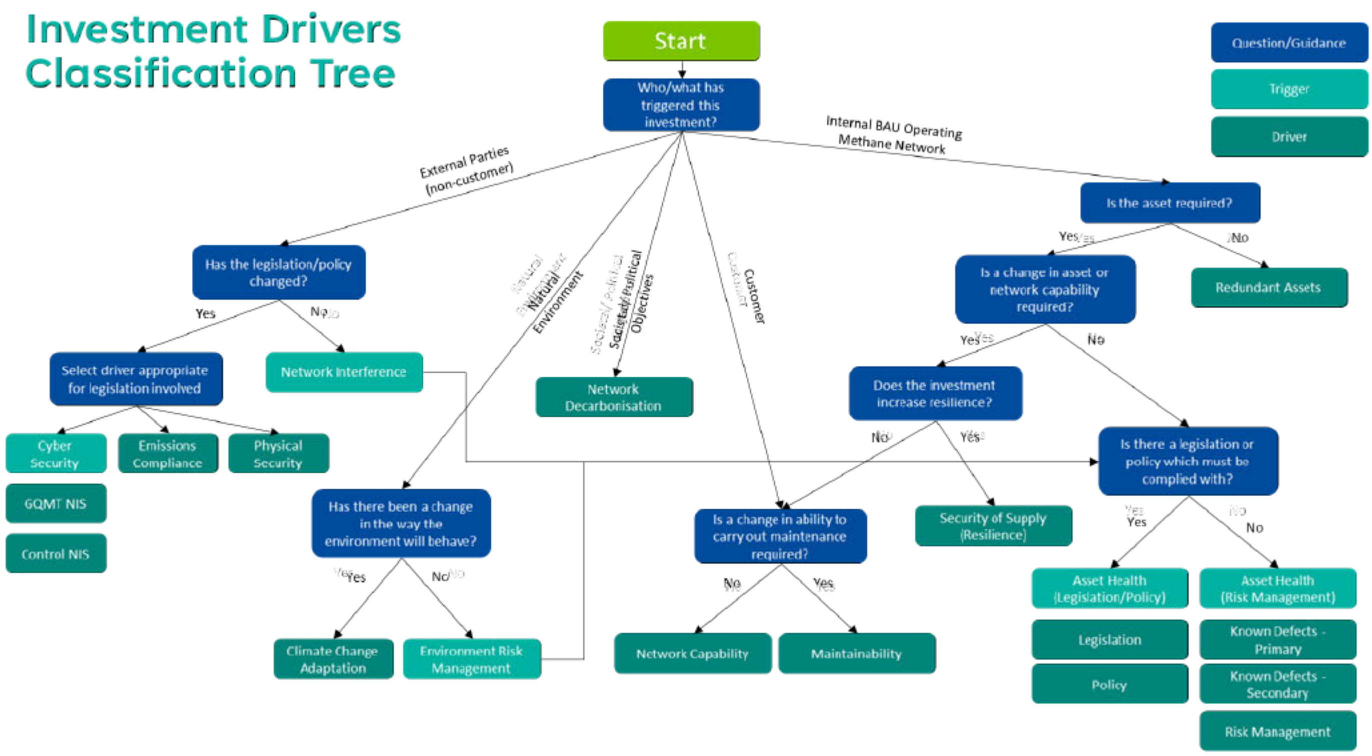

Figure 16: RIIO-GT3 investment drivers

[9] NGT_A10_System_Operator_Annex_RIIO_GT3

6.2 Drivers

Gas Quality, Metering and Telemetry (GQMT) Network Information Systems (NIS)

6.2.1 GQMT systems are integral to enabling the safe and reliable operation of the National Transmission System, essential for monitoring the quality of gas, billing and energy measurement and providing data for real time control and safety measures.

6.2.2 Assets in scope of these systems are gas analysers, odorization plant, fiscal metering, fuel gas metering and network control and instrumentation (telemetry systems).

6.2.3 Our GQMT RIIO-GT3 investment programme is a continuation of the original December 2019 business plan prioritisation. This was assessed based on the criticality of the sites, vulnerabilities, and asset condition/obsolescence with minor investment in lower criticality sites relating to operational resilience.

6.2.4 Disruption to the operation of these assets could impact on our license to operate and the requirements of our safety case. It will result in non-compliance with legislation, such as the Gas Safety (Management) Regulations (GS(M)R) and the Network and Information Systems Regulations 2018.

6.2.5 NGT is defined under the Network and Information Systems (NIS) Regulations as an Operator of Essential Services (OES). Section 1.3 of the Ofgem NIS Guidance for Downstream Gas and Electricity Operators of Essential Services in Great Britain v2, clearly states that Accountability for compliance with the NIS Regulations lies with the OES. Gas Quality, Metering and Telemetry systems are classed as NIS systems.

Control NIS

6.2.6 Our control system assets include station control and protection systems, unit control and protection systems, fire and gas detection and anti-surge systems. These are also Network and Information Systems (NIS) assets. These form part of the Cyber Resilience Operational Technology (OT) Plan.

6.2.7 Our control systems are required to maintain security of supply and to safely operate the NTS. Control systems have hardware and software elements which the NTS relies on for operational control and protection.

6.2.8 NIS with respect to control is identical to and summarised under the preceding GQMT NIS section.

Emissions Compliance

6.2.9 Our assets must be compliant with emissions legislation. Many decisions made for our assets can be justified as ensuring emissions compliance. How we come up with specific interventions for our assets, depends on which assets are impacted, such as compressor machinery trains and their ancillaries, and how exactly they are impacted.

6.2.10 The following are examples of emissions legislation we must be compliant with:

- **Industrial Emissions Directive (IED)** is a European legislation that specifies installations must operate under Emission Limit Values (ELVs) for pollutants like Nitrogen Oxides (NOx) and Carbon monoxide (CO). These affect our gas-fired compressors. It also introduced an emphasis on using Best Available Technique (BAT) for sectors to comply with IED requirements. For us, this has included the use of Dry Low Emission (DLE) compressors and incorporation of Specific Catalytic Reduction (SCR) into the exhaust of our compressors. Within this legislation sits the **Large Combustion Plant Directive (LCPD)** which aims to limit gas emissions from combustion plants having greater than 50 MW thermal input.
- **Medium Combustion Plant Directive (MCPD)** targets combustion plants having between 1 – 50 MW of thermal input. Both legislations directly impacted operation of our gas compressor fleet.

6.2.11 LCPD affected the SGT-A35 (previously RB211) compressors while MCPD affects the SGT-A20 (previously Avon) compressors in the fleet.

Examples of Emissions Compliance Decision Making

6.2.12 In 2030, the emissions limits set out by the Medium Combustion Plant Directive (MCPD) will come into effect which will reduce the emissions that our assets are legally allowed to emit. All the SGT-A20[redacted] units in the fleet are expected to not meet these new emissions limits through their operation. As a result, action is required on all of these units to ensure that they comply with this legislation. The decision to be made will be specific to each unit, with a needs case for each option to determine which is the most efficient and economic.

6.2.13 The options for compliance include:

- Derogation (restricted to 500 operational hours per year)
- Decommissioning
- Emission Abatement technology, including [redacted] retrofit which is in development.
- Replace with New Unit(s) either Gas or Electric

Physical Security

6.2.14 Our network is a critical part of the energy industry and is specified as Critical National Infrastructure (CNI) by the government and wider stakeholders. Therefore, there is a need to protect our gas transmission assets against external threats. Our approach on physical security is in line with the information and guidance published by the Centre for Protection of National Infrastructure (CPNI).

6.2.15 Our network is subject to a multitude of security threats, which are ever-changing and increasing in sophistication and persistence. These threats include criminality, espionage, activists and extremists, vulnerabilities within systems and vulnerability from insider action. The enhancement of our sites' physical security is determined with the competent authority the Department for Energy Security and Net Zero (DESNZ).

Climate Change Adaptation

6.2.16 The impacts of climate change are on the increase due to the rise in the earth's global average temperature which leads to phenomena such as temperature extremes and precipitation extremes including sea level rise. This results in changes in environmental behaviour which require investment to address, with climate change adaptation as the driver. Further detail is provided in our Climate Resilience Strategy[10].

Network Decarbonisation

6.2.17 The UK government's commitment of net zero by 2050 is a significant driver as it mandates us to act quickly to reduce our emissions. We have therefore created a glide path which sets out emissions targets we need to reach each year to meet our 2050 target. This glidepath contains a target of 21% reduction in scope 1 and 2 emissions by end of RIIO-GT3 compared to FY2023. Further detail on this is provided in our Environmental Action Plan[11].

6.2.18 This particularly for our compressor machinery train fleet, as we will need to know the requirements for our compressors within a decarbonised world, if any.

6.2.19 With continued reliance on methane transmission for the foreseeable future to ensure security of supply for customers, technological solutions are required which can be installed easily as new or retrofitted to existing equipment.

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[10] NGT_A06_Climate_Resilience_Strategy_RIIO_GT3

[11] NGT_A03_Environmental_Action_Plan_RIIO_GT3

Network Capability

6.2.20 To meet the changing needs of our customers and continue to meet our licence obligations, changes to our assets or the physical capability of the NTS may be required.

6.2.21 To determine where and when there will be changes to capability, network capability analysis is carried out every year, utilising the Future Energy Scenarios (FES). FES sets out four potential scenarios for the future, with analysis carried out against the range of future supply and demands we would expect to see. Within our Future Requirements chapter, we set out details of the Network Capability Analysis and the publications containing this information.

6.2.22 The output of this analysis helps to inform the potential changes and needs case, which sets the foundations for decisions required to our assets to ensure the continued safe and economic operation of the NTS in meeting customers' needs.

6.2.23 Network zones with insufficient or excess capability will be highlighted and this can trigger different asset management interventions, with the outputs from the analysis being utilised for the justification of specific interventions.

Maintainability

6.2.24 This driver seeks to ensure that we retain the required access and space to maintain assets in a timely and efficient manner on the NTS. Examples of such assets are valves, where bypasses need to be installed or modified to ensure valves can be maintained. If unresolved, this presents both safety and operational challenges which are detrimental to supply of gas to consumers. Maintainability is key in ensuring risk levels are maintained across our network.

Security of Supply (Resilience)

6.2.25 Gas remains an integral part of the GB energy system, underpinning our energy security. As such, maintaining security of supply and meeting our 1-in-20 obligation is of the upmost importance.

6.2.26 In anticipation of supply and demand patterns changing, capability requirements for supplier and consumers are expected to change along with them. As a result, it is key to identify whether we have enough resilience within our network to meet these changes and adapt to issues that may occur, being confident that assets on our network are appropriate for the purposes in which we will need them – we will continue to address this though UM submissions.

6.2.27 In addition to having the right capability on the network, it also requires the ability to recover from unforeseen conditions such as asset failure. For example, if there is a back-up unit at a compressor station, the resilience is much higher. Resilience can also be increased by the appropriate holding of spares to reduce the duration of outages resulting from asset failures.

6.2.28 As part of the same analysis carried out to assess capability, we review the resilience of the network which includes identifying Single Points of Failure (SPOF).

Redundant Assets

6.2.29 Assets that are no longer required for NTS operation are considered to be redundant assets. This could be because they have been replaced due to condition, performance or obsolescence. It could also be that they have become surplus to requirements. Redundant assets range from whole AGIs being made redundant due to a change in customer requirements, to individual assets on operational sites. These assets have a range of operational statuses, some are already disconnected from the NTS and isolated from all sources of energy, others are located on operational flow paths.

6.2.30 Due to their state, there is a need to proactively ensure they do not adversely impact network operations, the environment, stakeholders or pose a health and safety risk. There is also the ongoing financial burden associated with managing and maintaining redundant assets.

6.2.31 Following the identification of each redundant asset, group of assets or site a needs case assessment is completed to confirm the asset is no longer required. Following this, optioneering is undertaken in line with our T/SP/G/33 policy. Considerations include do nothing, disconnect and maintain, decommission.

6.2.32 Proactive management particularly through disconnection and removal, mitigates the need to sustain redundant assets and leaves sites safe and secure to the public.

Legislation

6.2.33 There are several legislations which our assets must comply with. Many decisions made for our assets can be justified as ensuring legislative compliance. How we come up with specific interventions for our assets, depends on which assets are impacted by these legislations, and how exactly they are impacted. Examples of legislation we need to comply with include:

- **The Pressure System Safety Regulations (PSSR)** applies to all pressure vessels on our network and requires us to use and maintain written schemes of examination for the inspection of relevant assets at defined frequencies and subsequent defect remediation. Pipeline Safety Regulations (PSR) is specific legislation for pipeline operators and obligates us to manage the safety risks this poses to the public and our employees.
- **The Gas Safety (Management) Regulations (GSMR)** deal with the management of the flow of gas through the network and are aimed at ensuring the safe management of gas systems and appliances in non-domestic premises. The regulations apply to employers, self-employed individuals, and anyone who has control over gas fittings and appliances in workplaces.
- The **Dangerous Substances and Explosive Atmospheres Regulations (DSEAR)** require the risks from dangerous substances to be removed or controlled to protect people from explosion and fire. Dangerous substances are flammable gases, mists or vapours or combustible dusts.
- The **Control of Major Accident Hazards (COMAH)** Regulations are there to ensure that businesses: "Take all necessary measures to prevent major accidents involving dangerous substances. Limit the consequences to people and the environment of any major accidents which do occur.

Example of Legislative Driven Decision Making

6.2.34 To assess and maintain their asset health, pipelines require regular inspections to examine their condition and identify any corrosion/defective features that require addressing. The frequency of a pipeline’s inspection is determined using Intervals 2 which updates the frequency of inspection based upon risk.

6.2.35 Intervals 2 is the accepted industry tool for this purpose that looks at individual pipeline risk. It is ratified by the HSE and is updated on an annual basis. We then take information from Intervals 2 to create our In-Line Inspection (ILI) investments to ensure that the inspections are carried out to the correct frequencies i.e., the higher the risk of a pipeline, the more frequently ILI runs are required.

Asset Health – Policy

6.2.36 Ensuring we maintain the health of our assets is a significant driver for many of the investment decisions in our AMP. Within the asset health program, there are several drivers which influence decision making, such as obsolescence, defects and asset deterioration, age, external Interference, Climate change.

6.2.37 Coming up with the specific interventions to manage asset health requires input and data from various teams across the business including Asset Engineering and Operations. These stakeholders have an intricate knowledge of the requirements and expectations for running our assets day-to-day, therefore their input is key to driving the right decisions that ensure our assets remain reliable and can continue to meet desired risk levels.

6.2.38 Carrying out frequent inspections and surveys on our assets, such as compressor overhauls or In-Line Inspections for pipelines, also help to identify where interventions are needed, pointing any issues with the health of our assets. Understanding the results of these inspections also requires input from experts to support the justification of specific interventions.

Example of Policy Based Decision Making

6.2.39 To assess and maintain asset health, compressors require regular overhauls to determine the condition of the gas generators and power turbines and identify any issues or defects with them. The frequency of compressor overhauls is determined by the following factors:

- **Time since last overhaul** – There is a specified maximum on the interval between overhauls; the older the compressor unit, the shorter this time window is likely to be.
- **Effective hours** – A set maximum number of effective hours which combines running hours and other elements such as running trips, years in berth, quantity of stops and starts.

6.2.40 The Original Equipment Manufacturers (OEMs) set out guidance for each compressor which may use either or both of these factors. If both are included, then whichever occurs first dictates when an overhaul should be carried out.

Asset Health – Risk Management

6.2.41 Due to the critical nature of our assets and associated operations we are faced with numerous safety, environmental, operational and financial risks. Realisation of these risks would have detrimental impacts on the flow of gas to customers. Failure to proactively manage risk will result in unacceptable levels of deteriorating asset health.

6.2.42 As a responsible business we must therefore ensure that all asset health risks are reduced to As Low As Reasonably Practicable (ALARP). Examples of proactive AH Risk management are:

- Replacement of faulty and/or defective system components.
- Removal of fittings that present an integrity risk and are no longer fit for purpose.
- Undertaking monitoring and condition assessments to ascertain the integrity and safety of assets in their operational environment

Example of Asset Health Risk Management Decision Making

6.2.43 Pipelines should be a certain depth below ground level. Over time factors such as erosion and third-party activities (e.g., intense farming) results in the depth of cover above a pipeline reaching a point in which we need to intervene to resolve a lack of ground cover. The decision of which remediation measure to take will be specific to each instance. The factors involved in the decision include land use, level of residual risk following intervention, agreement with landowner and the cost of the measure.

7 Value Framework and Copperleaf

7.1.1 Our Value Framework allows for all interventions, and hence investment plans, to be valued against a common set of criteria, and then compared against one another as well as our business objectives.

7.1.2 Our five service risk measures are: Availability, Financial, Safety, Environment and Societal. Both the probability of an asset failure and the consequence of the failure are assessed, allowing us to express our risk.

7.1.3 Consequences are valued against monetary value (i.e., cost of an environmental incident or the cost of an injury), so they can be expressed in the common currency of monetised risk. It underpins our Decision Support Tool (DST) capability, Copperleaf.

7.1.4 This software allows for the optimisation of investments on the network to deliver the required service levels and outputs (i.e., cost, risk reduction and workload) as well as the control of project delivery and outputs through the investment management lifecycle.

7.1.5 It allows us to scope out future investment plans based on the deterioration of assets and required service levels, identifying where asset intervention options allow us to achieve the required service values.

7.1.6 The optimiser within Copperleaf uses the output of the value framework to assess the benefit that an intervention would have on the network. It then compares it to a variety of possible options for the investments. This ensures we make the best asset investment decision based on the value delivered to customers.

7.1.7 Copperleaf Optimisation has been used to assess and adjust a planned packaged of interventions against a range of delivery constraints and required outcomes. This creates two scenarios, one of the works before optimisation and another post deliverability where elements may have shifted based on constraints and bundling. For more detail see the later Deliverability Assessment chapter.

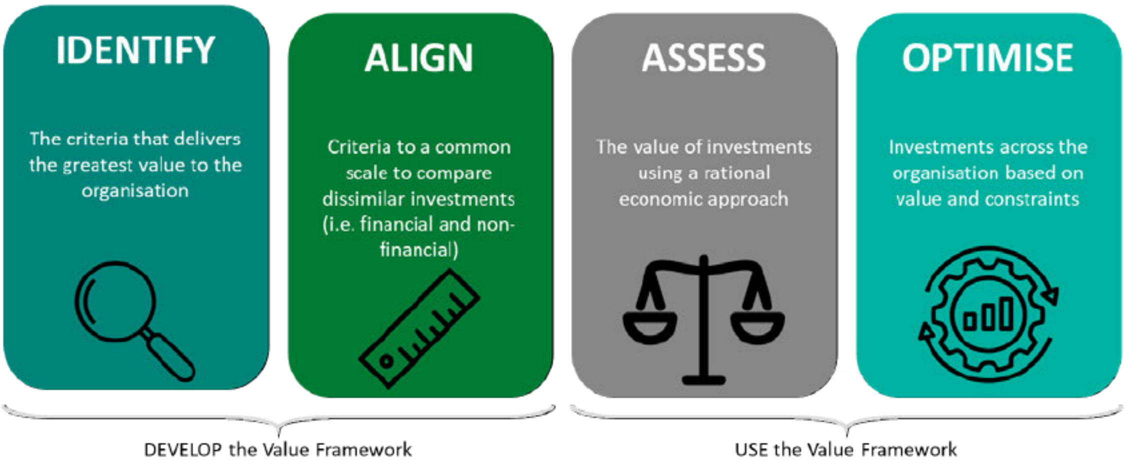

Figure 17: Development and use of the value framework stages.

8 Cost Benefit Analysis

8.1.1 Cost-Benefit Analysis (CBA) has been carried out on proposed options to support our decision making and to understand what service levels and benefits can be expected from an option's outcome. While CBA supports economic justification based on Net Present Value (NPV), external factors like deliverability and legislation may ultimately influence the final decision.

8.1.2 The CBA uses a 20-year assessment period from the end of RIIO-GT3, a WACC of [redacted], and a discount rate of [redacted] all based on a price base of 23/24 and central case carbon costs from the HMRC Green Book and supplementary guidance provided in the Ofgem CBA template.

8.1.3 The single-value framework allows for the monetisation of risks and benefits, enabling a comparison with delivery costs. This comprehensive approach considers various factors, including:

- NARMs Risk Benefit
- Investment cost
- OPEX
- Carbon Emissions
- Supply Demand Scenarios

8.1.4 CBAs have been conducted for all products where relevant and where the benefit can be described. The RIIO-GT3 plan includes diverse investments with varying drivers and outcomes. CBAs have been conducted for relevant products with quantifiable benefits, categorised into three types: Asset Health, Network Capability, and Decarbonisation.

8.1.5 Asset Health CBAs were conducted using Copperleaf, which incorporates NGT's approved NARMs methodology. Condition is a key metric, and interventions aim to improve asset condition, with benefits quantified using NARMs methodology. Different interventions have different intervention lifetimes and costs, and hence have different benefits.

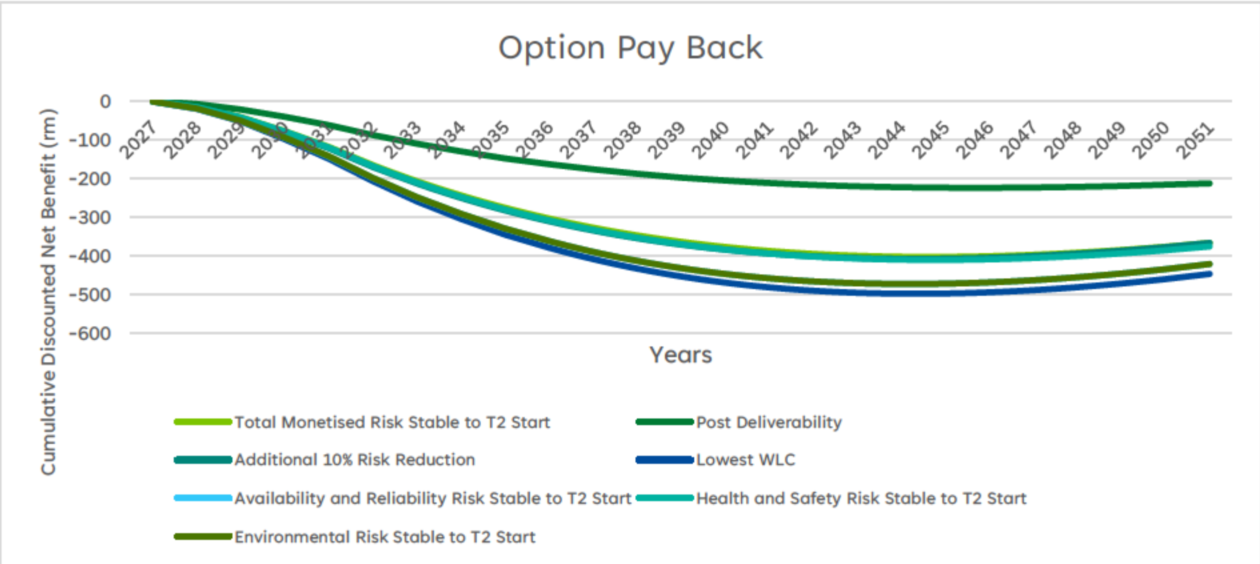

Figure 18: Example of an Asset Health payback graph. Option NPV varies based on both cost and benefit. Options which are above the x-axis are cost beneficial. CBAs support decisions, options will be chosen considering other factors and the most cost beneficial option won't always be taken forward.

8.1.6 Copperleaf's predictive analytics module allows us to analyse and compare various investment strategies, including alternative scenarios to our chosen deliverable. This top-down approach, combined with bottom-up analysis, identifies potential investments aligned with specific goals and constraints. The outcome of this is a set of known interventions with known cost and benefit that together will deliver a required target.

8.1.7 Due to the vast scale of the Asset Health plan, achieving network-level outcomes requires numerous individual interventions. These interventions, grouped together, represent tens, hundreds, or potentially thousands of benefit-producing actions, grouped together to show their effect.

8.1.8 Each asset within Copperleaf has a multitude of potential interventions, detailed within the EJPs. Copperleaf has pre-analysed potential interventions, calculating their expected costs and benefits. These interventions are then selected to achieve the desired strategy, they are then grouped to form the basis for our CBA options. As per the Ofgem NARM guidance, benefits modelled within the CBA for each option only begin from the end of RIIO-GT3. The cost associated with each option is spread evenly over the RIIO-GT3 period to allow a comparison between all options. However, the preferred option then underwent a deliverability assessment (covered in the next chapter) which included profiling the costs. These profiled costs for the preferred option post deliverability (Option 1A) are included in each EJP.

SUMMARY - BASE CASE

Central estimate

NPV of costs and benefits

[redacted]

8.1.9 Asset Health CBAs include a range of options. Our chosen strategy is to maintain monetised risk levels to the start of RIIO-2. Our chosen option is the investments that make up this strategy after the deliverability assessment.

8.1.10 For IDP03 – Network Capability, the CBA assess suitability of the current network to remain available and resilient to future supply demand patterns, analysed at a zonal level.

8.1.11 IDP03 – Network Capability options encompass a wider range of decisions, including improving existing assets, commercial options and building new assets. It can also assess the future need for assets and disconnection, or decommissioning is economically justified.

8.1.12 Using current network topology and anticipated compressor availability, capability lines are created along with expected run hours per berth. A Monte Carlo simulation then evaluates various scenarios, based on gas price references and zonal constraint resolution strategies.

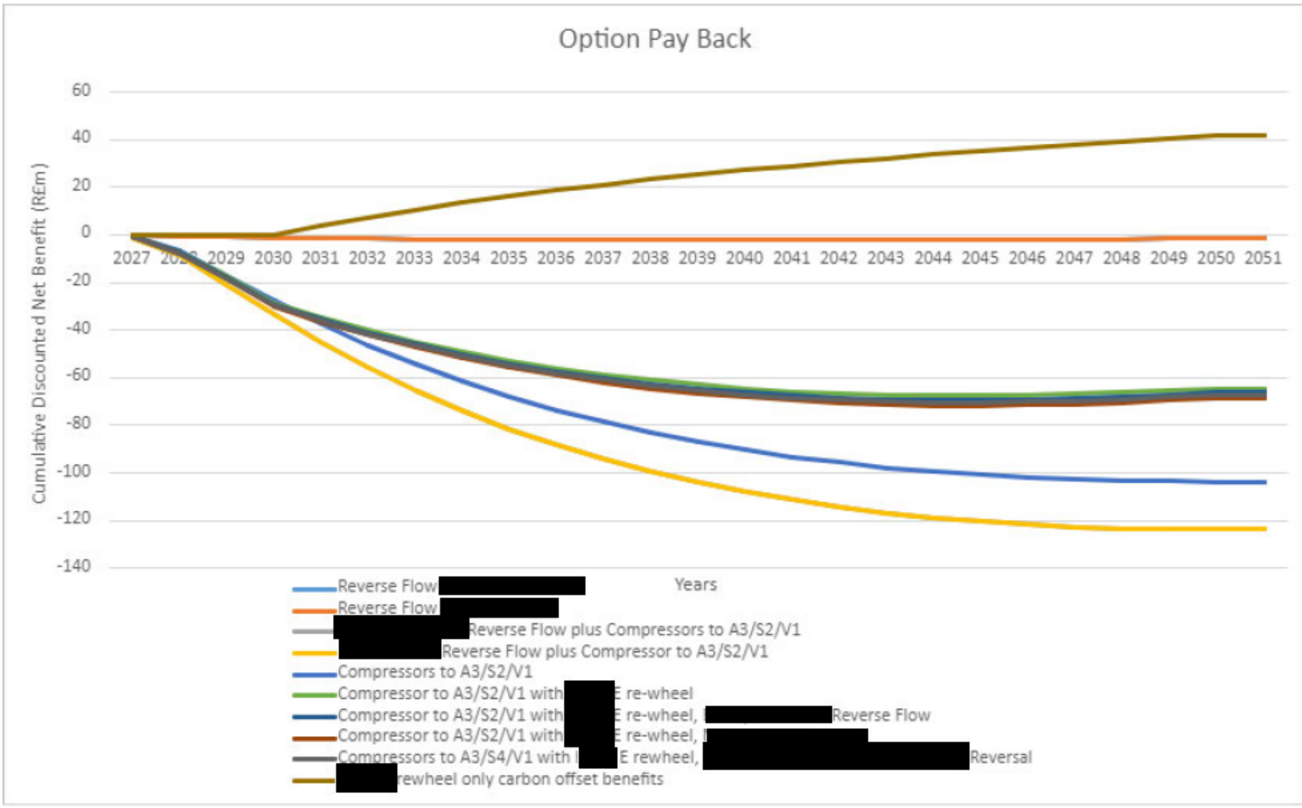

Figure 20: Example of a Network Capability CBA. The Option names are often a verbal description of the option components. In this example only Option 10, [redacted] *re-wheel only...", is cost beneficial.*

8.1.13 Each option is assessed for impact on constraints, carbon costs of run hours, and condition benefit changes (from the NARMs Model). The option with the highest NPV is selected.

8.1.14 Our Network Decarbonisation CBA[12] uses expected run hours from the chosen Network Capability options. It considers emission reductions based on intervention type, such as compressor combustion or gas venting.

8.1.15 Emissions have then all been calculated based on a Carbon Dioxide Equivalent and the outcome and benefit evaluated against the Central Carbon Cost Scenario from the Green book. Environmental is one of the 5 service risk measures considered in NARMs, and compressor emissions are considered in the IDP03 – Network Capability CBAs.

12 NGT_IDP09_V5_CBA_Network_Decarbonisation_RIIO-GT3

9 Deliverability Assessment

9.1.1 We have conducted deliverability assessments to ensure we deliver the optimal scope and volumes of work to meet our target outputs. In validating the deliverability of the plan, we have assessed our plans against the following categories: Outputs, Network Access, Organisational Capability and lastly financeability.

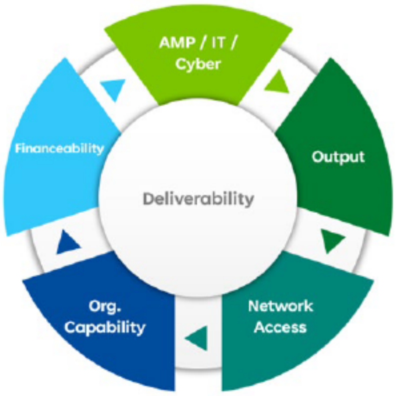

Figure 21:Deliverability assessment process

9.1.2 Physical network access is one of the main factors that restricts our ability to deliver capital works. The key principle is to maximise utilisation of available outages to deliver work and minimising disruption to customers and consumers. Plan deliverability becomes more challenging in RIIO-GT3 with increased work, hence why we propose to move towards a "shutdown" approach to maximise the volume of work delivered within proposed outages.

9.1.3 To enhance our ability to build a deliverable plan, we have made use of the investment optimisation capabilities of the Copperleaf tool, to configure constraints into the system, including network access constraints. We have also modelled organisational capability including known supply chain constraints.

9.1.4 We configured rules within Copperleaf to analyse our plan, allowing us to identify proposed work that would be undeliverable due to constraints. We challenged our rules and constraints, relaxing them when appropriate or employing alternative solutions to achieve access to the network. Following several such iterations we have been able to demonstrate using the Copperleaf software that our resultant plan can be delivered without violating the network access constraints.

9.1.5 Figure 22 shows our deliverability profile for the RIIO-GT3. The first years in RIIO-GT3 are broadly in line with RIIO-T2 Year 5 to maintain consistency and delivery capacity. Additional contingency is demonstrated in Year 4 and 5 to allow flexibility of plan changes.

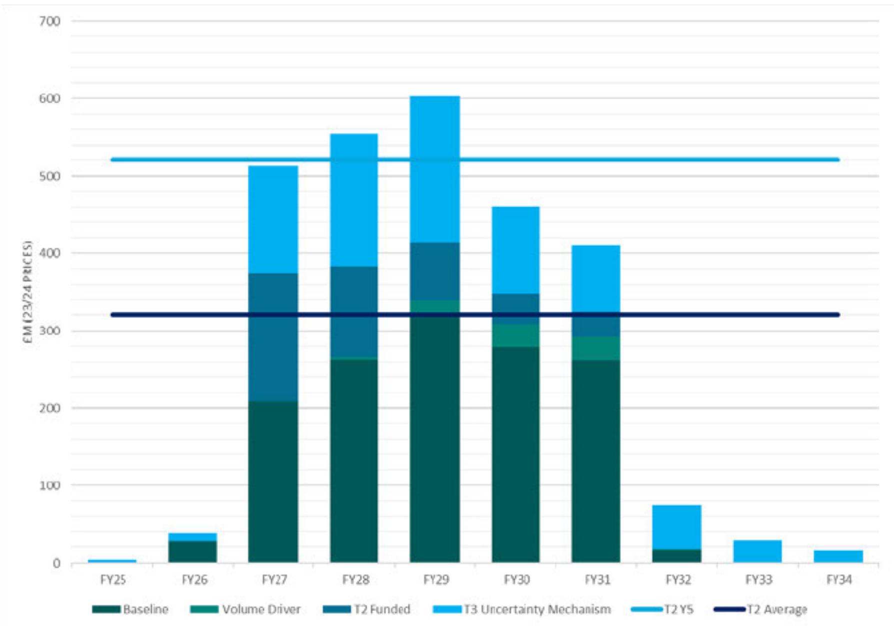

Figure 22: RIIO-GT3 delivery profile

9.1.6 Physical network access is constraining our asset management plan, i.e., we cannot deliver all of the work we have identified to manage network risk levels down to the levels seen at the start of RIIO-T2. Given this constraint, it is vital there are no delays to delivering our proposed RIIO-GT3 planned interventions to avoid future constraint and supply risk. If we do not invest at the levels set out in our plan, then the date we achieve stable network risk will move back.

9.1.7 Our deliverability process began with the development of an agreed set of constraint themes that would be applied. These included Network Access, Supply Chain, Delivery of our Obligations, Organisation Capability

Network Access

9.1.8 Our outage plan is based around legislative and safety-critical work which requires substantial outages. These include emissions-driven investment to build new or enhance our existing compressor units, investment to in-line inspect and, if required, remediate potential defects on our pipelines and replacement of control systems on our compressor stations. Other outage work or non-outage work has then been bundled with or scheduled around this.

9.1.9 Our deliverability assessment began with obtaining an agreed set of rules on network availability and operation between our Asset function and the System Operator. Constraints included defining the required availability of assets and the length of outages that could be achieved given the impact on wider network operations.

9.1.10 Crucial to this was an understanding of the intervention phasing and outage requirements. For each intervention, outage type and duration were defined. Delivery cost phasing profiles were applied to each intervention within the themes shown in Figure 23 based on our historical delivery information.

Delivery cost phasing profile						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Asset Health	15%	80%	5%			
Emissions	10%	25%	25%	25%	15%	
Decommissioning	20%	75%	5%			
Control Systems	4%	6%	29%	27%	39%	5%
Telemetry	23%	71%	6%			
Shared Telemetry	10%	84%	6%			
Metering	40%	50%	10%			
PSUP	11.5%	80.5%	8%			

Figure 23: Project cost standard phasing

9.1.11 Compressor planning assumptions, utilising existing compressor planning groups, were developed to ensure we maintained sufficient compressor availability to maintain security of supply and ensure no outage conflicts occurred between sites.

9.1.12 One of our key objectives was reviewing the investment bundling rules applied to our deliverability assessment. As previously stated, compressor outages have been built around Emissions and Control Systems projects, and we have bundled additional investment with this work, to maximise utilisation of outages. Additionally, our feeder outages have been built around ILI inspections and associated digs and we have bundled additional risk prioritised investment to maximise utilisation of these outages.

9.1.13 There are sections of the network which are typically more challenging to obtain an outage on. Those are mainly linked to power stations and off takes, where we do have obligations to maintain contracted flows. We will aim to utilise agreed maintenance days, if possible, however those are limited. Therefore, we have considered alternative isolation methods to ensure supply is maintained to customers, or in some cases there is the potential to reach a commercial agreement with our customers to enable an outage to be taken. We also propose to reduce overall number of isolations and recompressions by using alternative engineering and innovative solutions. To support that we have included stopple and bypass volumes in the plan to help mitigate this risk. We will carry out early feasibility studies to determine optimal solutions to mitigate above risk.

Supply Chain

9.1.14 Procurement constraints were critical to the plan in terms of frameworks and supply chain. Our procurement department conducted reviews of the plan volumes against the existing frameworks utilised in RIIO-T2, considering the current contractor performance, their capacity and capability. Constraints were assessed based on the requirement for the procurement of long lead items and concurrent volume of investment proposed within the same year to ensure our supply chain could support the proposed volumes both across the period and within each of the years of the RIIO-GT3 period. For example, we have profiled our cabs work in RIIO-3 in line with current cabs supply chain limitation and future ability to overcome existing constraint.

9.1.15 Valves work has been particularly challenging from a deliverability point of view due to number of constraints. To mitigate that challenge we must restrict total volumes in overall RIIO-GT3 plan to around 40 interventions per year, our current supply chain maximum. As a result, we do not reduce as much network risk as we would like to on our Valves theme. More details on this can be found in IDP10 – Valves.

Delivery of our Obligations

9.1.16 Our deliverability optimisation utilised Investment Tiers to ensure that all statutory and legislative investment was prioritised over the investment proposed for the management of risk over the RIIO-GT3 period.

9.1.17 Our investment tiers:

- **Tier 1** - Deliver our legal obligations with a clear volume and scope e.g., driven by legislation, evidenced defects on gas containing assets and our RIIO-T2 UM funded investment obligations (Bacton FOSR, Emissions Compliance, Cyber Compliance).
- **Tier 2** - Deliver policy aligned investment, NIS Compliance (Control), Redundant Assets, resolve evidenced defects on non-gas-containing assets (e.g., compressor cabs)
- **Tier 3** - Deliver investments which are required, but we have more potential to defer timings past RIIO-GT3, e.g., investments required to stabilise risk, address climate resilience and net zero

9.1.18 Figure 24 presents the prioritisation of constraints applied to our AMP to define the RIIO-GT3 capex investment plan.

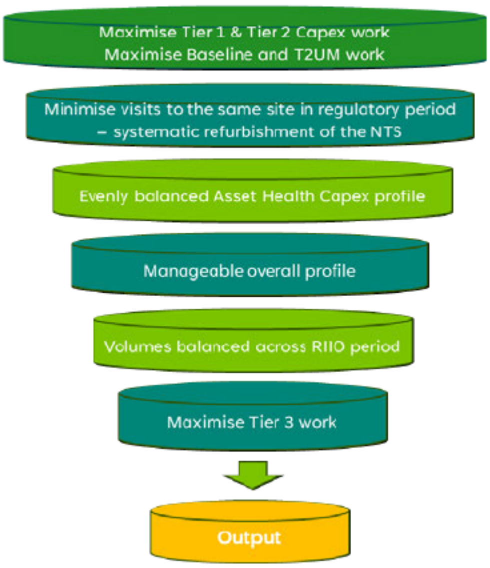

Figure 24: Prioritisation of deliverability principles

10 Assessing the quality of our AMP

10.1.1 We have assessed data confidence based on our Scope, Volume and Cost Data Confidence Standard. There are three primary data components against which we have assessed every investment proposal in the RIIO-GT3 plan:

- **Scope** – considers the justification and evidence supporting the investment rationale, e.g., is there a legislative requirement, or is it based upon known defects which have been triaged and validated.
- **Volume** – considers how intervention volumes have been derived, e.g., a physical count of known defects and/or quality of any extrapolation assumptions.
- **Cost** – considers how the cost of completing defined interventions has been derived, e.g., historical actuals (outturn), Estimated Cost at Completion (ECC) of inflight projects, tendered rates and/or statistically significant volume of data points used.

10.1.2 Our assessment criteria take into account Ofgem's expectations of best practice organisations. Ofgem defines its expectations by reference to the Infrastructure Planning Authority (IPA) Cost estimation guidance Cost Estimating Guidance - GOV.UK (www.gov.uk) and by reference to the treasury The Green Book (publishing.service.gov.uk).

10.1.3 To determine the appropriate funding mechanism, we apply the SVC assessment to all proposed investments. This protects consumers and the business from scope, volume or cost uncertainty which could present financial risk.

11 Delivery of the RIIO-GT3 Capex Plan

11.1.1 Our AMP is bundled into deliverable work packages which are baselined, and performance will be monitored against schedule, cost, and scope throughout the period.

11.1.2 We have identified 'Investment Sponsors' for each work package who are responsible for taking projects through their life cycle and ensuring delivery achieves the required outputs.

11.1.3 Our portfolio reporting team collate and report on project delivery on a weekly basis (through the 'Operational Capex War Room') and on portfolio theme level monthly (through 'Capex Programme Boards'). These forums review and challenge completion of key milestones, comparison of expected cost to sanctioned cost, adherence to scope and overall risks and opportunities with regular summary updates and escalations to the executive team and board.

11.1.4 Within our delivery units a further granularity of monitoring is performed, the methodology is dependent on the theme. Major Projects are tracked in Primavera which breakdown projects to detailed milestones and reports on several metrics including:

- Schedule Performance Index (SPI) - measure of conformance of actual progress to the planned progress
- Cost Performance Index (CPI) - measure of conformance of actual cost to the planned cost

Asset Health is broken down by delivery site, volumes and outages and tracked accordingly. These are reported in delivery-based review meetings with directors and escalated into the portfolio management team as required. Any expected breach of cost, scope and time as approved at sanctioning level is reviewed, challenged, and where needed re-approved at the Gas Transmission Investment Committee (GTIC) which is attended by delivery, asset and regulatory directors, Chief Financial Officer and Chief Executive Officer.