

Engineering Justification Paper

CPM6564 Newbury DPG (Newbury IP)

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2 Introduction

Reinforcement has been identified within Newbury IPMP Grid, specifically relating to anticipated Capacity failure at the IP feed to Newbury DPG. This project is part of a wider programme of reinforcement associated with the RIIO-GD2 Business Plan Appendix covering Capacity Management (2019).

2.1 General Background

Our distribution system is built to ensure security of supply for all our customers. Our networks operating at pressures below 7bar are designed to meet a peak six-minute demand level which could be experienced under 1:20 conditions, supporting a safe, secure and reliable service to those customers and meeting requirements outlined within the Licence Condition, including, but not limited to, Condition 16 contained therein.

Link: [Gas Transporters Licence – Standard Conditions](#)

Where capacity constraints are identified which are likely to impact on our ability to ensure security of supply to all customers, Network Planning will look to establish optimum cost-efficient reinforcement strategies to mitigate risk. Such constraints may arise as a result of a number of factors, but the most common is increased demand levels, often resulting from new connections.

We have initiated an extensive programme of stakeholder engagement, working closely with Local Authorities, both in Scotland and the South of England, to establish a fully informed and independently sourced picture of planned development.

This engagement has provided us with confidence the sites identified will progress to development, to support this level of growth, we have developed a programme of reinforcement across our network.

2.2 Site Specific Background

The primary driver for this reinforcement project is the Sandleford Strategic Site Allocation (SLA).

The West Berkshire Core Strategy (2006 – 2026) was adopted in 2012 and details proposals for 2,000 new houses at this site.

Planning applications are currently pending for two submissions to West Berkshire Council for this site.

Table 1: Development Summary

Development Name	Site Usage	Site Status	Confidence
Sandleford Park	2,000 houses	Outline Planning Permission Pending	Good prospects (>50% confidence)
Sandleford Park	1,580 houses	Planning Permission Granted	Probable (>75% confidence)

Please see Appendix A of this document which gives further details of the criteria applied when determining the attributable 'confidence' level of the above sites progressing to development.

Thames Valley Enterprise Berkshire LEP have since advised us approximately 1,150 properties will be constructed by 2026.

Through this determination we have deemed the requirement for this reinforcement within the RIIO-GD2 period as 'Low' and have therefore included the funding request in our Base Growth and High Growth scenarios.

3 Equipment Summary

Newbury IP system supplies the integrated Newbury Medium Pressure (MP) system via Sett Copse DPG (1.6bar) and Newbury DPG (1.4bar). Discreet MP systems exist at Thatcham DPG (1.4bar) and Cold Ash Hill DPG (0.8bar). All three systems are at least partially integrated across the Low Pressure (LP) system.

Security

Critical points on the IP system include the 8" ST supply to Newbury DPG, which is particularly sensitive to demand. The 12" ST supply to Sett Copse DPG is more robust, hence the pressure off-set to balance the downstream MP demand away from Newbury DPG.

4 Problem Statement

a) Why are we doing this work and what happens if we do nothing?

New connections to our networks reduce available capacity and when pressures are predicted to fall below minimum acceptable levels it is necessary to reinforce or increase pressures to facilitate increased capacity in the system.

b) What is the outcome that we want to achieve?

Maintain our licence conditions to ensure security of supply, avoid becoming a blocker to development and support the economic prosperity of this area.

c) How will we understand if the spend has been successful?

At a customer level, we will deliver a reinforcement ensuring a safe and secure network, meets stakeholder aspirations and allows developments to progress timeously.

On completion of the proposed reinforcement, we will monitor system performance to ensure expected system pressures are maintained. This will take the form of regular system performance checks and localised pressures surveys to ensure the successful outcome is delivered.

4.1 Narrative Real-Life Example of Problem

The 8" ST IP supply to Newbury DPG is very sensitive to additional demand which has been managed in recent years by manipulating the outlet settings of Newbury DPG and Sett Copse DPG to balance downstream demand away from the IP leg to Newbury DPG.

However, there is a limit to the demand this configuration can manage and planned major development at Sandleford Park will trigger a requirement for IP reinforcement.

Reinforcement of the Newbury IP system during RIIO-GD2 period (2021-26) will focus on development identified, mindful of long-term development beyond.

Security

A recent example of good planning to meet customer expectation, whilst also ensuring security of supply, occurred following the acceptance of a quotation to supply a new development at Milton Heights, Milton, Abingdon, Oxfordshire (P18143337).

Network analysis confirmed a requirement to reinforce SGN's system in advance of connecting the fully developed site load. However, network analysis also confirmed an interim load/connection of 72 new properties in advance of reinforcement, thereby meeting the GT/Developer's schedule of works.

Reinforcement to supply the full development was subsequently planned and completed in advance of connections beyond the interim load, ensuring security of supply to approximately 500 new/existing customers.

4.2 Spend Boundaries

The spend associated with these reinforcement works (CPM6564) provides capacity within the Newbury IP system to support projected development during RIIO-GD2.

Not included within this spend are the costs for subsequent phases of reinforcement required to support demand out-with the RIIO-GD2 period and/or any costs associated with reinforcement of the upstream Transmission system.

5 Probability of Failure

The existing South IPMP model predicts a failure to maintain minimum system pressures on the Newbury IP system in >97% of 1:20 demand conditions during 2025/26, within the RIIO-GD2 period (2021-26), in meeting the energy requirements of identified LDP development.

Table 2. Showing Failing Pressure on Newbury IP & MP Systems, as Development growth increases within RIIO-GD2.

Demand Year	Newbury DPG Inlet (Min. 3500mbar)	Newbury DPG Outlet (Max. 1600mbar)	Greenham Common GT (Min. 3600mbar)	Ash Rd / Bishops Gn. GT (Min. 350mbar)
2019/20 (GD1)	4336mbar	1400mbar	4414mbar	519mbar
2021/22 (GD2)	4084mbar	1400mbar	4172mbar	419mbar
2023/24 (GD2)	3617mbar	1400mbar	3550mbar	230mbar
2025/26 (GD2)	3908mbar	1510mbar	4077mbar	358mbar

5.1 Probability of Failure Data Assurance

Model Validation

To ensure the accuracy of Network Analysis models, validation is carried out in line with the published requirement under Section 17 of our Safety Case and is a fundament of our Licence to Operate.

Validation ensures the current models are an accurate representation of the actual gas transportation system and can be used to predict network behaviour under a variety of conditions, including the 1 in 20 design condition.

In addition to the Validation Programme, a robust model maintenance process and annual system performance checks ensures the models continue to be accurate and fit for purpose.

The existing modelled data within Newbury IPMP section of South IPMP model, was sense checked using 3 existing DG Inlet Loggers as well as charts taken from our DNCS (Distribution Network Control System), after the extreme weather seen at the end of February – early March 2018, known colloquially as “The Beast from the East”.

Table 3: System Performance Review – 1st March 2018 (95% peak demand).

System	Site	System Pressure (95%)		System Pressure (1 in 20)	
		PMAC Recorded Pressure	Modelled With Recorded Settings	System Min. Pressure Required	Modelled With Designed Settings
Newbury MP	NEW ROAD, START GATE	1016mbar	1149mbar	250mbar	1120mbar
Newbury MP	NEWTOWN ROAD	744mbar	971mbar	250mbar	921mbar
Newbury MP	ELIZABETH AVE	638mbar	806mbar	250mbar	734mbar

6 Consequence of Failure

Loss of Supply to Customers

The existing network will be unable to support projected growth requirements of identified LDP development, potentially impacting on local government housing/development targets and/or delaying construction and the economic well-being of the area.

Failure to reinforce will put at risk the security of supply to approximately 22,000 existing/new customers in Newbury, resulting in a failure to meet our Licence Conditions.

Affected customers will include West Berkshire Community Hospital, Donnington Hospital Trust, Strawberry Hill Medical Centre, 20 Schools including Newbury College, Fire Station and Thames Valley Police Station.

Financially, after the first 24 hours, affected householders will be compensated for time without gas. Domestic customers will receive £41 for each 24-hour period without gas, small businesses will receive £69 for each 24-hour period without gas.

Failure to invest in reinforcement would also prevent Gas from becoming a part of the energy mix at any growth areas identified within the Local Development Plans. We would be deemed to have blocked local development, effecting the growth of the local economy.

Table 4: Lowest Pressure Location

Lowest Pressure Location	Required Minimum Pressure	Minimum Failing Pressure
Greenham Business Park	345mbar	-165mbar

Security

Safety Impact of Failure

Reinforcement of the Newbury IPMP system is necessary to meet the requirements of our Licence Condition.

In this instance, a failure to reinforce will result in a system failure during peak winter conditions. The resulting loss of supply may have serious health and safety implications for vulnerable customers who rely on gas for essential heating and cooking facilities.

Environmental Impact

A system failure on this scale will result in a major recovery exercise. Environmental impacts will include increased travel to site by our employees, leading to an increase in greenhouse gas emissions and disruption to the public.

On site, the use of fossil fuels to power plant and equipment required in the restoration of supplies will further increase greenhouse gas emissions, as will subsequent travel/plant in use for the reinstatement of public highways following the conclusion of these works.

7 Options Considered

7.1 Options

In accordance with the guidelines set out in the Ofgem guidance document ‘Engineering Justification Paper Frameworks for RIIO-GD2 and RIIO-GT2’ – Appendix B (Section 7), the following options have been considered:

Replace on Failure

Wait until the network fails then replace the system. This option has been discounted as it is impracticable to replace Newbury IP system.

Repair on Failure

Mains reinforcement after the network has failed. This option has been discounted due to non-compliance with our Licence Condition.

Pre-emptively Replace

Replace the system prior to network failure. This option has been discounted as it is impracticable to replace Newbury IP system.

Pre-emptively Repair

Mains reinforcement based on model data prior to network failure, two options considered for further investigation:

Security

The proposed reinforcement involves the construction of 3.2km x 355mm HDPE IP / 12” ST IP. This solution follows a cross-country route which will require land easements. Route allows extension in future years should further development arise.

Security

This option involves the construction of approximately 2.4km x 355mm HDPE / 12" ST IP reinforcement, linking the Newbury and Sett Copse IP legs. This solution follows a combined cross-country/in-town route which will require land easements. Significant additional costs can be expected for the River Kennet and Kennet & Avon Canal crossings and for Traffic Management.

Do Nothing

Not considered practicable as potential development identified/programmed within the LDP/Core Strategy and associated documents will see the Newbury IP system approach capacity towards the latter half of RIIO-GD2.

7.2 First Option Summary- 3.2km x 355mm HDPE IP / 12" ST IP

The technical detail of the option i.e. capacity, system rating, availability etc.

Mains reinforcement of existing IP feed to Newbury DPG, removing capacity issue by significantly reducing pressure loss across the reinforcement route.

The basis for the cost estimate/unit cost

Cost estimate for the reinforcement is based on average contracted rates supplied by depot, validated against know cost for similar, completed projects.

The perceived benefits of the option

Reinforcement will accommodate known forecast growth within RIIO-GD2 (2021-2026), whilst being designed to provide for known growth up to a 10-year horizon (2022-2032).

Delivery timescales

Reinforcement is required to be delivered before winter 2023/24 to avoid anticipated capacity issues.

Key assumptions made

It is assumed known potential demand growth both within RIIO-GD2 and beyond will require the same level of gas supply currently experienced.

Any other items that differentiate the option from the others considered

The route of this reinforcement provides greater flexibility for future extension than considered in Option 2. The majority of the route is laid cross-country.

7.3 Second Option Summary – 2.4km x 355mm HDPE IP / 12” ST IP

The technical detail of the option i.e. capacity, system rating, availability etc.

Mains reinforcement linking the IP legs feeding the Newbury and Sett Copse DPGs.

The basis for the cost estimate/unit cost

Cost estimate for the reinforcement is based on average contracted rates supplied by depot, validated against know cost for similar, completed projects.

The perceived benefits of the option

Reinforcement will accommodate known forecast growth within RIIO-GD2 (2021-2026), whilst being designed to provide for known growth up to a 10-year horizon (2022-2032).

Delivery timescales

Reinforcement is required to be delivered before winter 2023/24 to avoid anticipated capacity issues.

Key assumptions made

It is assumed known potential demand growth both within RIIO-GD2 and beyond will require the same level of gas supply currently experienced.

Any other items that differentiate the option from the others considered

The route of this reinforcement does not provide the flexibility for future extension considered in Option 1. This solution follows a combined cross-country/in-town route which will require land easements. Significant additional costs can be experienced for the River Kennet and Kennet & Avon Canal crossings and for Traffic Management.

7.4 Third Option Summary - Interruption

In addition to the above, consideration was given to Interruption. As part of Interruption Reform, also known as the Mod 90 process, we have the option to offer a tender for interruptible contracts to customers to offset the need to invest for capacity.

Interruptible consumers receive discounted transportation charges for the flexibility they provide to the system for demand side management at times of high demand.

There are two sites within the Newbury IPMP Network which currently meet the criteria for an interruptible supply. Both sites are located within the Thatcham MP system and, under 1:20 conditions, interruption of these sites will have minimal impact on IP system pressures at Newbury. This option has been discounted.

7.5 Options Technical Summary Table

Table 5: Summary of Cost

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Equipment/ Investment Design Life	Total Cost (£m)
1/ 3.2km IP Reinforcement of Newbury DPG Inlet	2023/24	2023/24	3.2km x 355mm HDPE IP / 12" ST IP	10 Years	2.956
2/ 2.4km IP Reinforcement Connecting Newbury and Sett Copse DPG Inlets	2023/24	2023/24	2.4km x 355mm HDPE IP / 12" ST IP	10 Years	4.049

7.6 Options Cost Summary Table

Table 6: Options Cost Summary Table

Option	Cost Breakdown	Total Cost (£m)
1/ 3.2km IP Reinforcement of Newbury DPG Inlet	Materials = <input type="text"/> Labour = <input type="text"/> Design Costs = <input type="text"/> Commercial Confidentiality Site Management = <input type="text"/> Traffic / Easements = <input type="text"/>	2.956
2/ 2.4km IP Reinforcement Connecting Newbury and Sett Copse DPG Inlets	Materials = <input type="text"/> Labour = <input type="text"/> Design Costs = <input type="text"/> Site Management = <input type="text"/> Civils/Engineering/Easements/Traffic = <input type="text"/>	4.049

8 Business Case Outline and Discussion

Validation of the network analysis model, a robust model maintenance process and system performance checks have confirmed the accuracy of the Newbury IPMP model for use in network analysis.

A full review of the relevant Local Development Plans and associated documents, followed by close engagement with stakeholders, has provided confidence in the level of development expected during RIIO-GD2.

The development outputs have been applied to the validated network model which predicts a failure at 97% pk demand by winter 2023/24, putting at risk supplies to 22,000 customers.

To mitigate this risk and meet Licence Conditions it will be necessary to pre-emptively reinforce the network during the RIIO-GD2 period.

There have been no external costs incurred in assessing the options considered as these have been prepared by the in-house Network Planning and Design teams.

8.1 Key Business Case Drivers Description

Pre-emptively Repair: Option 1.

Option 1 Involves significant mains laying of 3.2km x 355mm HDPE IP / 12" ST IP following a cross-country route which will require land easements.

If required, this option can be extended in future years should further development arise.

Pre-emptively Repair: Option 2.

Option 2. Involves significant mains laying of 2.4km x 355mm HDPE IP / 12" ST IP reinforcement, linking the Newbury and Sett Copse IP legs.

This solution follows a combined cross-country/in-town route which will require land easements. Significant additional costs can be expected for the River Kennet and Kennet & Avon Canal crossings and for Traffic Management.

Table 7: Summary of Key Value Drivers

Option No.	Desc. of Option	Key Value Driver
1	3.2km IP Reinforcement of Newbury DPG Inlet	Provides available capacity for future growth within Newbury MP System, allowing for future phases of reinforcement and additional growth beyond GD2. Mostly cross-country route facilitates minimal disruption to the public
2	2.4km IP Reinforcement Connecting Newbury and Sett Copse DPG Inlets	Provides available capacity for future growth within Newbury MP system. Route incurs greater expense as mains laid into Newbury to create IP mains connection, involves a river crossing and major road works. No scope available for any future extension as route creates a closed loop with 12" leg still bearing majority of flow.

8.2 Business Case Summary

This project is driven by the requirement to maintain Security of Supply to our existing and proposed customers, throughout the RIIO-GD2 period 2021-2026.

Table 8: Business Case Matrix

	3.2km IP Reinforcement of Newbury DPG Inlet	2.4km IP Reinforcement Connecting Newbury and Sett Copse DPG Inlets
Capex (£m)	2.956	4.049
Design Life	10 Years	10 Years
Positive Benefit (Pros)	Maintains SGN license Obligations to maintain Security of Supply whilst accommodating notified growth up to 2031. Allows for future phases of reinforcement and additional growth beyond GD2. Mostly cross-country route facilitates minimal disruption to the public.	Maintains SGN license Obligations to maintain Security of Supply whilst accommodating notified growth up to 2031.
Negative Impact (Cons)	Incurs easement and traffic management costs, some disruption to the public.	Involves a river crossing and major road works. No scope available for any future extension as route creates a closed loop with 12" leg still bearing majority of flow. Route through town causes additional disruption.

Costs inclusive of overheads and efficiencies.

9 Preferred Option Scope and Project Plan

9.1 Preferred option

Pre-emptively Repair Option 1: Lay 3.2km x 355mm HDPE IP / 12" ST IP Mains Reinforcement during 2023/24.

9.2 Asset Health Spend Profile

The developments driving reinforcement of the Newbury IP system are included within the West Berkshire Council Local Development Plan and associated documents.

Construction at these sites is expected to reach a point during RIIO-GD2 where reinforcement will be required to ensure security of supply.

To support this development, reinforcement has been scheduled to commence in 2023/24 and is expected to be completed the same financial period as shown in Table 9. below.

Table 9: Summary of Schedule of Spend

Asset Health Spend Profile (£m)						
Pre GD2	2021/22	2022/23	2023/24	2024/25	2025/26	Post GD2
0.0	0.0	0.0	2.956	0.0	0.0	0.0

Costs inclusive of Overheads and Efficiencies.

9.3 Investment Risk Discussion

Gas demand growth has been based around current Local Plan projections for new housing within RIIO-GD2 period 2021-26, with new CGS design providing for future capacity needs beyond 2026 to the limit of the Local Plan in 2031.

Factors such as market driven demand linked to the economy, the UK's potential exit from the European Union, emerging decarbonisation strategies and industry innovation can potentially impact on the scope of works outlined in this paper. We have proposed a volume driver funding mechanism to de-risk underspend/overspend for these works. Further details of this proposal can be found in Section 6.2 in the RIIO-GD2 Business Plan Appendix for Capacity Management.

As stated in our Environmental Action Plan, and in line with current UK Governments targets, our long term target is to achieve Net Zero emissions by 2045. This means a decarbonisation of the energy network and supporting the transition to an environmentally sustainable low-carbon energy system. Indeed, we recognise there have been preliminary government targets set facilitating a move toward a renewable or low carbon heat solutions by the end of the RIIO-GD2 period. As such, throughout the RIIO-GD2 period we will continue to closely monitor this emerging heat strategy with a view to refining any potential impact on current growth forecasts.

Appendix A - List of Acronyms

Acronym	Backronym (spelled out acronym)	Definition / explanation
Pressure Tiers ○ HP ○ IP ○ MP ○ LP	○ High Pressure ○ Intermediate Pressure ○ Medium Pressure ○ Low Pressure	○ High Pressure i.e. above 7bar LTS (NTS) ○ Intermediate Pressure i.e. 2 – 7bar ○ Medium Pressure i.e. up to 2bar ○ Low Pressure i.e. up to 75mb
CSEP	Connected System Exit Point	Third party connection to Gas network from an iGT or UIP
DG	District Governor	Pressure regulator primarily used for reducing pressures from IP and MP tiers to LP.
DPG	Distribution Pressure Governor	Pressure regulator primarily used for reducing pressures from IP tier to MP.
HDPE	High Density Polyethylene	Material standard for plastic pipe – High density allows for use at > 2bar operation due to thicker pipe wall. Reduced internal diameter increases weight of pipe, is not suitable for use < 2bar. Cheaper material and jointing than Steel.
iGT (GT)	Independent Gas Transporter	Third party supplier of gas and infrastructure to closed developments, not generally adopted by SGN.
LTS	Local Transmission System	High Pressure system feeding from National Offtakes to P(T)RS Inlets
MDPE	Medium Density Polyethylene	Material standard for plastic pipe – Medium density allows for greater internal diameter for extra capacity required at lower tiers, but thinner pipe wall thickness is not considered safe for operation at >2bar. Cheap material and jointing due to electro fusion welding.
MOP	Maximum Operation Pressure	Highest design pressure for a mains system, however regulator may be set lower than this but not higher.
NTS	National Transmission System	High Pressure system feeding National Offtakes from Terminals
PMAC	Pressure Management and Control	Third Party monitoring system which communicates live data via BT Comms link, facilitates remote control of pressure settings and profiles on SGN Plant, used at all Plant levels.
P(T)RS	Pressure (Transmission) Regulator Station	Pressure regulator primarily used for reducing pressures from HP (LTS/NTS) tier to IP / MP or LP.
UIP	Universal Infrastructure Provider	Provides and connects infrastructure to gas network but does not supply gas. UIP infrastructure is generally adopted by SGN.
RIIO-GD1	Revenue=Incentives + Innovation + Outputs – Gas Distribution 1	8-Year price control period (2013-2021)
RIIO-GD2	Revenue=Incentives + Innovation + Outputs – Gas Distribution 2	Proposed 5-Year price control period (2021-2026)
SHP	SHP File Format	SHP is a file extension for a Shapefile shape format used in geographical information systems (GIS) software.
ST	STEEL	Steel pipe material is used where PE cannot i.e. protection from heavy traffic or bridge crossings, Regulator outlets where excessive gas cooling may be experienced at pressure reduction. Steel pipe laying can be expensive due to welded joints.
1:20	1:20 Demand Conditions	Designing a network to operate whilst experiencing demand conditions historically only seen every 20 years, during severe weather events.

Appendix B - Categorisation of Potential Load Growth

The following Table sets out the manner in which identified potential load growth has been categorised and applied, leading to customer driven reinforcement, when looking to establish the optimum investment strategy for our networks.

DEFINITION TABLE				
Confidence	Definition	Factors to be considered	Base Growth	High Growth
Highly probable (>90% confidence)	Connection expected in RIIO-GD2 for all sites	<ol style="list-style-type: none"> 1. Quotation accepted but not yet on stream 2. Building is in progress. 3. Detailed planning permission granted. 4. Economic conditions indicate that sites for consumers of a particular type are likely to be developed, e.g. <ol style="list-style-type: none"> a. Domestic sites where there is a high demand for housing and there is a shortage of land available. b. Interest has been shown in having a connection made to a non-domestic site and economic factors suggest development will go ahead. 	✓	✓
Probable (>75% confidence)	Connection Likely in RIIO-GD2 for majority of sites	<ol style="list-style-type: none"> 1. Outline planning consent has been granted. 2. Recent development has been carried out in the area. 3. The land is a prime site for development, but no connection enquires have yet been received. 4. Adopted Local Plan Site 	✓	✓
Good prospects (>50% confidence)	Connection expected for some sites in RIIO-GD2	<ol style="list-style-type: none"> 1. Proposed Local Plan Site 2. No indication of planning permission being granted for the site. 3. The site is outside existing gas supply areas. 4. The site would involve physical problems in delivering a gas supply. 5. The site would require substantial additional infrastructure, e.g. additional roads, schools. 6. Site marked “reserve” in Local Plan. 7. Site is known to be contaminated ground. 8. Site has “protection” orders served over it – e.g. SSSI. 		✓
Poor prospects (<50% confidence)	Significant time or investment required to progress	<ol style="list-style-type: none"> 1. Does not meet the above planning criteria. 2. Site has been deemed as ‘speculative’. 3. The site would require significant additional infrastructure, e.g. additional roads, schools. 		