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EXPECTED EQUITY RETURNS FOR CADENT UNDER THE RIIO-GD3 DDS

FINAL REPORT

Economic Insight Ltd

CONTENTS

1. EXECUTIVE SUMMARY

CADENT'S EXPECTED RORE IS SIGNIFICANTLY BELOW THE ALLOWED RETURN ON EQUITY FOR GD3 UNDER THE DDS

Ofgem published the draft determinations (DDs) for electricity transmission (ET), gas distribution (GD) and gas transmission (GT) on 1 July 2025 for RIIO-GD3 (GD3), which runs from 1 April 2026 to 31 March 2031.

As part of its statutory duties, Ofgem must ensure that the companies it regulates are able to finance their activities. For a firm to be financeable, it must be able to: (i) expect to generate (earn) an overall rate of return that is commensurate with the risks it faces, as typically measured by the WACC; and (ii) have cash flows that are consistent with it being able to make its debt payments and raise debt finance. On (i), for the expected return for debt and equity investors to be commensurate with the risks they face, it is necessary that:

- the regulatory set WACC (and within it, the cost of debt and equity) reflects those risks; and
- the overall price determinations reflect a symmetrical balance of risk for equity investors, such that they neither expect to outperform nor underperform (known as the 'fair bet' principle).

Ofgem considered whether the gas distribution networks (GDNs) were financeable in the GD3 DDs, concluding that the DDs did represent a 'fair bet'. However, Ofgem made several errors in its approach to assessing return on regulated equity (RoRE) risk, including (in several cases) presupposing equal upside and downside risks relative to the allowed return on equity. Cadent has therefore commissioned Economic Insight to rigorously assess (on an efficient notional company basis) the expected RoRE for Cadent's networks in GD3 and whether this meets the 'fair bet' principle.

OUR FINDINGS

We find that the expected RoRE for the efficient notional operator of Cadent's networks is below the allowed return on equity for GD3 under the DDs, and therefore the package as a whole is **not a 'fair bet'**, particularly for the North London network. Ofgem has made several errors in its approach in the DDs which understates the downside risk for the efficient notional company and overstates the upside risk, relative to the allowed return on equity for GD3.

We estimate the expected RoRE for the efficient notional operator of Cadent's networks to be 5.33% compared to the allowed return on equity of 6.04%

We identify baseline totex as the key driver of notional company performance risk relative to the GD3 DD allowed return on equity

We estimate the expected RoRE for the efficient notional operator of the North London network to be 4.15%, significantly below the allowed return on equity

Note: We use the expected RoRE to indicate the 'most likely' or P50 outcome.

1 We estimate the expected RoRE for the efficient notional operator of Cadent's networks to be 5.33% compared to the allowed return on equity of 6.04%

Ofgem finds for GD3 there is a *"reasonable balance between scope for outperformance for high performing companies and underperformance"*.[1] However, there are three key errors with Ofgem's approach, related to:

1. **Performance distributions.** Ofgem does not conduct robust analysis of the range of performance outcomes for GD3 and instead uses risk scenarios that (in several cases) presuppose equal upside and downside risk relative to the allowed return on equity.
2. **Risk aggregation.** Ofgem aggregates risk by summing it across risk areas, which implicitly assumes there is perfect correlation in performance between risk areas.
3. **Risk coverage.** Ofgem does not cover all risk areas. GDNs face many more sources of risk than Ofgem recognises.

To correct these errors, we assess the RoRE using a more sophisticated methodology, which has the following features:

1. **Plausible performance distributions**. We use historical data, supplemented with expert judgement, to inform expected GD3 performance and risk ranges for each risk component.
2. **Monte Carlo risk aggregation**. We aggregate risk by taking random draws from performance distributions, allowing for there to be outperformance in one risk area and underperformance in another, which is more representative of reality.
3. **Greater scope of risk areas**. We consider many more components of risk than Ofgem. In many instances, the notional company faces risk that is not recognised under Ofgem's approach.

We estimate the expected RoRE (P50) for the efficient notional operator of Cadent's networks to be 5.33% in GD3 under the DDs. This is less than the allowed return on equity of 6.04%. We estimate the RoRE risk range to be:

- 4.33% RoRE at the P10 level (the 10th percentile of performance).*
- 6.38% RoRE at the P90 level (the 90th percentile of performance).*

Therefore, we conclude that Ofgem's GD3 package under the DDs is not a 'fair bet' for the efficient notional operator of Cadent's networks.

Ofgem's DDs do not represent a 'fair bet' for the efficient notional company

We have primarily estimated the expected RoRE and associated risk using Cadent-specific data. We consider that Cadent's data provides a sound basis for estimating RoRE risk for the efficient notional company because Cadent is: (i) cost efficient, with two out of four of Cadent's networks either setting or being beyond the percentile of the GD3 cost efficiency adjustment; and (ii) delivering high service quality for its customers, for example, achieving outperformance (on average) against ODI and NARM targets in GD2, indicating the cost efficiency has not been achieved through lower service quality.

**Note: A higher percentile of performance indicates a higher RoRE.*

2 We identify baseline totex as the key driver of notional company performance risk relative to the GD3 DD allowed return on equity

We have analysed the impact of the following sources of risk in relation to baseline totex:

- **Modelling risk:** the risk that Ofgem's approach to setting allowances for a specific totex component does not accurately capture the ex-ante efficient costs of delivery.
- **Spending risk:** the risk that the company spends more or less than its allowances as a result of exogenous factors that the efficient company cannot control, which are not captured by mechanisms built into the price control (for example, volume drivers, re-openers).

We define baseline totex risk for the notional company as the risk that baseline totex allowances are not reflective of a notional company's expenditure, whether because: (i) they have been modelled incorrectly (modelling risk); or (ii) because spending changes due to exogenous factors (spending risk).

We model baseline totex risk across the following components: (i) modelled regressed costs; (ii) modelled non-regressed costs (excluding streetworks); (iii) streetworks costs; (iv) technically assessed costs; (v) ongoing efficiency (OE); (vi) regional factors; and (vii) real price effects (RPEs).

We estimate that baseline totex is responsible for around 60% of the difference between the allowed return on equity and the expected RoRE for the notional company. Therefore, baseline totex risk is the key driver of the efficient notional company's lower expected RoRE of 5.33% relative to the allowed rate of return at GD3 under the DDs of 6.04%.

There is a clear need for a robust ex-ante assessment of totex risk in Ofgem's RoRE modelling

We estimate a negative expected impact of baseline totex of -0.42pp on the RoRE for the notional company. The main source of this negative expected impact is ongoing efficiency, which has a negative expected impact of -0.34pp on the RoRE.

The negative expected impact on the RoRE due to baseline totex for the efficient notional operator of Cadent's networks for GD3 reinforces the need for Ofgem to consider ex-ante expected totex performance, rather than presupposing risk symmetry in its RoRE modelling.

3 We estimate the expected RoRE for the efficient notional operator of the North London network to be 4.15%, significantly below the allowed return on equity

The GD3 determinations should ensure that an efficient notional company faces a 'fair bet', with an expected RoRE in line with the allowed return on equity (6.04%). The need for a 'fair bet' also holds for the individual networks, in the cases where a GD company owns more than one network. For example, suppose a company owns two networks and earns the allowed rate of return in aggregate, but allowances are too low (relative to the efficient level) in one network and too high in the other. This implies cross-subsidisation between regions, meaning consumers in one network pay more than the efficient level (and others pay less). This would appear inconsistent with Ofgem's principal duty to "*protect the interests of existing and future consumers*".[2] The expected RoRE for the efficient notional operator of each of Cadent's networks should therefore be in line with the allowed return on equity.

However, we estimate the expected RoRE for the efficient notional operator of the North London network to be significantly below the allowed return on equity. For the North London network, we estimate a RoRE risk range of 3.19% (P10) to 5.18% (P90), with an expected RoRE of 4.15% (P50) for the efficient notional company. The expected RoRE (and indeed the RoRE implied across the risk range in our modelling) is significantly lower than the allowed return on equity in the GD3 DDs of 6.04%. Our estimate of the expected RoRE for the efficient notional operator for North London (4.15%) is also significantly below our estimate of RoRE for Cadent as a whole (5.33%) and the Cadent networks excluding North London (5.72%).

For the efficient notional operator of the North London network, most aspects of the price control are expected to have a negative impact on the RoRE:

- The most likely effect of baseline totex on the RoRE is -1.24pp compared to -0.42pp for Cadent overall.
- The most likely effect of GSOPs on the RoRE is -0.22pp compared to -0.16pp for Cadent overall.

The expected RoRE of the efficient notional operator of the North London network is significantly below the allowed return on equity

The lower expected RoRE for the North London network is a consequence of some of the network's unique operating circumstances that are not properly accounted for in the DDs:

- Ofgem disallowed significant costs in the DDs for the North London network that an efficient network would incur, such as those related to London-specific regional factors.
- The way mechanisms across the price control are designed often means that it is harder for the North London network to avoid significant penalties compared to other networks. For example, North London has a high proportion of multi-occupancy buildings (MOBs), which the design of GSOPs penalises.

THE DDS DO NOT REPRESENT A 'FAIR BET' FOR CADENT, PARTICULARLY FOR THE NORTH LONDON NETWORK

Figure 1: Risk under the GD3 DDs, Monte Carlo aggregation (% RoRE)

Notes: The corrected BPI value of +0.11pp RoRE is included in our risk range for Cadent and for the Ofgem DD analysis. We apply a corrected BPI of +0.02pp RoRE to North London and +0.14pp RoRE to Cadent (excl. North London).

Source: Economic Insight analysis.

We estimate the P50 RoRE outcome for the efficient notional operator of Cadent's networks for GD3 under the DDs to be 5.33%, which is significantly below the allowed return on equity of 6.04%. As such, we conclude that the package as a whole does not represent a 'fair bet' for equity investors.

The P50 RoRE for the efficient notional operator of the North London network (4.15%) is significantly lower than the allowed return on equity in the GD3 DDs (6.04%).

Cadent's P50 RoRE for the efficient notional operator of its networks excluding North London (5.72%) also remains below the allowed return on equity (6.04%). This indicates that the DD package still does not constitute a 'fair bet' for Cadent with North London excluded.

Our risk ranges all have lower upsides and downsides than Ofgem's DD risk range. We have adjusted Ofgem's DD risk range to be consistent with our Monte Carlo approach, which results in a narrower risk range compared to Ofgem's published DD analysis (which relied on simple aggregation). This is because Monte Carlo modelling allows for there to be both outperformance and underperformance across different risks, unlike simple aggregation which assumes perfect correlation of performance between risk areas. As a result, this method results in a more realistic view of risk than simple aggregation.

2. INTRODUCTION AND METHOD OVERVIEW

Introduction

Ofgem published the draft determinations for electricity transmission, gas distribution and gas transmission on 1 July 2025 for RIIO-3, which runs from 1 April 2026 to 31 March 2031.

As part of its statutory duties, Ofgem must ensure that the companies it regulates are able to finance their activities. Specifically, Ofgem has a statutory duty "*to have regard to the need to secure that licence holders are able to finance the activities which are the subject of obligations on them*".[3] For a firm to be financeable, it must: (i) expect to generate (earn) an overall rate of return that is commensurate with the risks they face, as typically measured by the WACC; and (ii) have cash flows that are consistent with it being able to make its debt payments and raise debt finance. On (i), for the expected return for debt and equity investors to be commensurate with the risks they face, it is necessary that:

- the regulatory set WACC (and within it, the cost of debt and equity) reflects those risks; and
- the overall price determinations reflect a symmetrical balance of risk for equity investors, such that they neither expect to out, nor underperform (known as the 'fair bet' principle).

Ofgem has assessed the risk-reward balance of its GD3 DDs based on RoRE modelling to assess whether its risk package represents a 'fair bet'. It starts from the allowed return on equity in the DDs and considers potential risk around this. It concludes "*our RIIO-3 price control package offers a reasonable balance between scope for outperformance for high performing companies and underperformance for those companies that fall short*".[4] There are several errors in Ofgem's approach to assessing the GD3 package, such as presupposing symmetrical totex risk without considering the plausible range of company performance in GD3. Given these errors, Cadent has commissioned Economic Insight to rigorously assess (on an efficient notional company basis) the expected RoRE, and associated RoRE risk, for Cadent's networks to inform whether the DDs meet the 'fair bet' principle.

The rest of this report sets out our findings of RoRE risk for Cadent at GD3 based on Ofgem's DDs position. In the remainder of this section, we detail our method at a high-level (with more details in the annex in section 11). In section 3, we summarise our aggregated risk results for Cadent based on both a Monte Carlo and simple aggregation approach to risk. In section 4-10 we detail our findings on RoRE risk for each of the key areas of the price control.

Our method to estimate RoRE risk corrects the three main errors with Ofgem's approach in the GD3 DDs

Ofgem's estimate of RoRE risk suffers from three main errors

1. **Performance distribution.** Ofgem does not conduct robust analysis of the range of plausible performance outcomes for GD3 and instead uses risk scenarios that (in several cases) presuppose equal upside and downside risks relative to the allowed return on equity.

2. **Risk aggregation.** Ofgem aggregates risk by summing it across risk areas (simple aggregation), which has the implicit – and strong – assumption of perfect correlation of risk.

3. **Risk coverage.** Ofgem does not have full coverage of all the risk areas facing the efficient notional network operator.

We correct these errors in our assessment of RoRE risk

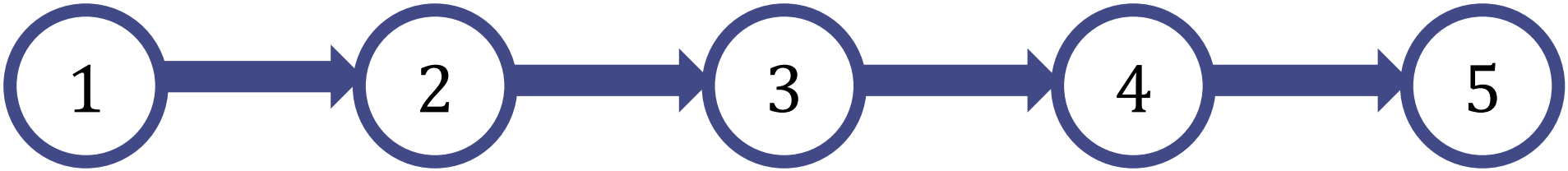
✓ **Plausible performance distributions.** We use historical data for Cadent (discussed later in this section), supplemented with expert judgement, to inform expected GD3 performance.

✓ **Monte Carlo risk aggregation.** We aggregate risk by drawing from performance distributions, allowing for there to be outperformance in one risk area and underperformance in another, which is more representative of reality.

✓ **Greater scope of risk areas.** We consider seven broad risk areas, which is four more than Ofgem. Within these risk areas we conduct our analysis at a much deeper level of granularity than Ofgem do, e.g., we consider risk for specific components of totex whilst Ofgem considers risk for aggregated totex only.

We have a five-step approach to estimating the RoRE risk range at GD3 under the DDs at the network level

Five-step approach to estimating the RoRE risk range at GD3 under the DDs



1	2	3	4	5
Identify parameters to assess	Identify risks associated with parameters	Estimate parameter distribution	Convert to financial implication	Run Monte Carlo simulations
Identify the risk areas and parameters to assess RoRE risk	Identify the plausible equity risks for each parameter based on economic theory and sector knowledge	Determine the distribution of parameter outcomes based on historical and forecast data	Estimate the £ implication across the distribution for each parameter for GD3 and convert to % RoRE based on notional gearing	Estimate overall RoRE risk range based on 10,000 simulated draws of each of the financial distributions for each parameter

We provide a more detailed explanation of each of these steps in the pages that follow.

Step 1. We consider more risk areas and components compared to Ofgem's approach to RoRE modelling in the GD3 DDs

Risk area covered in Ofgem RoRE modelling for GD3 DDs — Yes / No

Baseline totex

- Modelled regressed costs
- Modelled non-regressed costs (excl. streetworks)
- Streetworks costs
- Technically assessed costs
- Ongoing efficiency
- Regional factors
- Real price effects

ODIs

- Customer Satisfaction
- Complaints Metric
- Unplanned Interruptions
- 7 and 28 Day Repair Standards
- Collaborative Streetworks

GSOPs

- GSOP 1
- All other GSOPs

PCDs

- Tier 1 Mains Decommissioned
- Tier 1 Services
- Tier 1 Iron Stubs
- Operational Transport Emissions Reduction (OTER)
- London Medium Pressure
- Grays Medium Pressure
- Tinsley Viaduct Diversion
- FWACV Compliance

Uncertainty mechanisms (UMs)

- Tier 2A Mains and Services volume driver
- Safety Disconnections volume driver
- 12 re-openers

- Network Asset Risk Metric (NARM)

- Business Plan Incentive (BPI)

Step 2. We consider a range of risks that Cadent faces across the price control

Risk area	Identified risks
Baseline totex	• Modelling risk: Ofgem's approach to setting allowances does not accurately capture efficient costs of delivery • Spending risk: the company spends more or less than its allowances due to exogenous factors
ODIs	• Design risk: Ofgem miscalibrates the ODI mechanisms for a notional company • Performance risk: the notional company does not perform in line with targets due to exogenous factors
PCDs	• Modelling and spending risk: as per baseline totex for baseline PCD allowances • Volume risk: the company completes more or less workloads relative to target, leading to allowance changes • Late delivery risk: the company partially delivers or delivers late, losing allowances or incurring penalties
GSOPs	• Design risk: Ofgem miscalibrates the price control so the notional company cannot meet its GSOP obligations • Performance risk: the notional company must make GSOPs payments due to exogenous factors
UMs	• Modelling and spending risk: as per baseline totex for baseline volume driver allowances • Volume risk: the company completes more or less workloads relative to target for volume drivers, changing allowances • Re-opener assessment risk: the company spends more or less than its re-opener allowances due to exogenous factors
BPI	• The company BPI shifts the expected RoRE upwards or downwards depending on whether it is a reward or penalty
NARM	• Modelling and spending risk: as per baseline totex for baseline NARM allowances • Volume risk: the company delivers more or less risk output than the target, leading to allowance changes • Justification risk: the company does not justify its over/underdelivery, leading to penalties or unfunded expenditure

Step 3. We build a triangular distribution of performance for each risk component based on the P10, most likely and P90 values for each Cadent network

A. Estimate most likely performance

A

First, we estimate the most likely performance for each risk area based on historical data and expert judgement (see page 18 for more detail).

When using historical data, we use GD2 data only. The RIIO price control has evolved significantly between GD1 and GD3 (e.g., the price control duration has changed from 8 years to 5 years) and therefore GDN performance in GD2 is more relevant when assessing the expected performance range over GD3 (see page 17 for more details).

In the round, we consider Cadent's data provides a good basis for assessing RoRE risk for the notionally efficient company, which we explain in more detail on the next page.

B. Estimate P10 and P90 performance

B

Second, we estimate the P10 and P90 performance for each risk component. The P10 and P90 outcomes represent the 10th and 90th percentile of the performance distribution respectively, corresponding to 'low' and 'high' performance in the distribution.

Where we used historical data to inform the most likely value, we estimate the P10 and P90 by modelling the variation in performance of all networks in the industry (including non-Cadent) relative to each network's mean performance. We then apply the P10 and P90 value for the % variation in performance in the industry to each of the Cadent network's most likely values.

Where we used expert judgement to inform the most likely value, in most cases we also use it for the P10 and P90 values (see the method annex for further details).

C. Convert to triangular distribution of performance

C

Third, we use the P10, most likely and P90 values for each risk component to form a continuous distribution of performance. We approximate the underlying population performance distribution using a triangular distribution.

The triangular distribution has several benefits:

- It requires a small number of data points (a minimum of three, though in most instances we have many more than this).
- It is analytically tractable and easy to implement.
- It allows for constant decreasing probability of performance occurring as values move further away from the most likely value (similar to a normal distribution).

Step 3a. In the round, Cadent's data provides a sound basis for assessing equity risk for the efficient notional company

Cadent's networks are cost efficient

The available evidence shows that Cadent's networks are cost efficient:

- Cadent's networks are key determinants of the catch-up efficiency challenge. Two out of four of Cadent's networks either set or are beyond the percentile at which the benchmarking efficiency adjustment is set for GD3, with the West Midlands network having the lowest efficiency score and the East of England network having the 3rd lowest efficiency score in the GD3 cost modelling. These efficiency scores are taken from Ofgem's GD3 totex model, with any identified errors corrected.
- The North London network is significantly closer to the catch-up efficiency benchmark once Cadent's position on regional factors is accounted for.

Cadent's networks have high service quality

Cadent has performed strongly on service quality historically, and expects to continue to do so at GD3:

- **ODIs**. In the available GD2 outturn data, Cadent has outperformed its targets on average, receiving net rewards for its performance.
- **PCDs.** Cadent expects to fully deliver against all of its evaluative PCDs in GD2 with 100% completion of projects.
- **NARM.** Cadent is on track to fully meet its NARM targets for GD2 across all four of its networks.
- **BPI.** Cadent received a reward for its business plan submission as part of the GD3 DDs, and expects this reward to increase in the FDs once Ofgem corrects errors in its calculation of the BPI for Cadent.

Conclusion: The available evidence shows that, in the round, Cadent's networks are cost efficient, and this has not been achieved through lower service quality. As such, we consider Cadent network-specific data to provide an appropriate basis for assessing notional company performance. *Throughout the remainder of the report, references to Cadent's RoRE mean the RoRE for the efficient notional operator of Cadent's networks.*

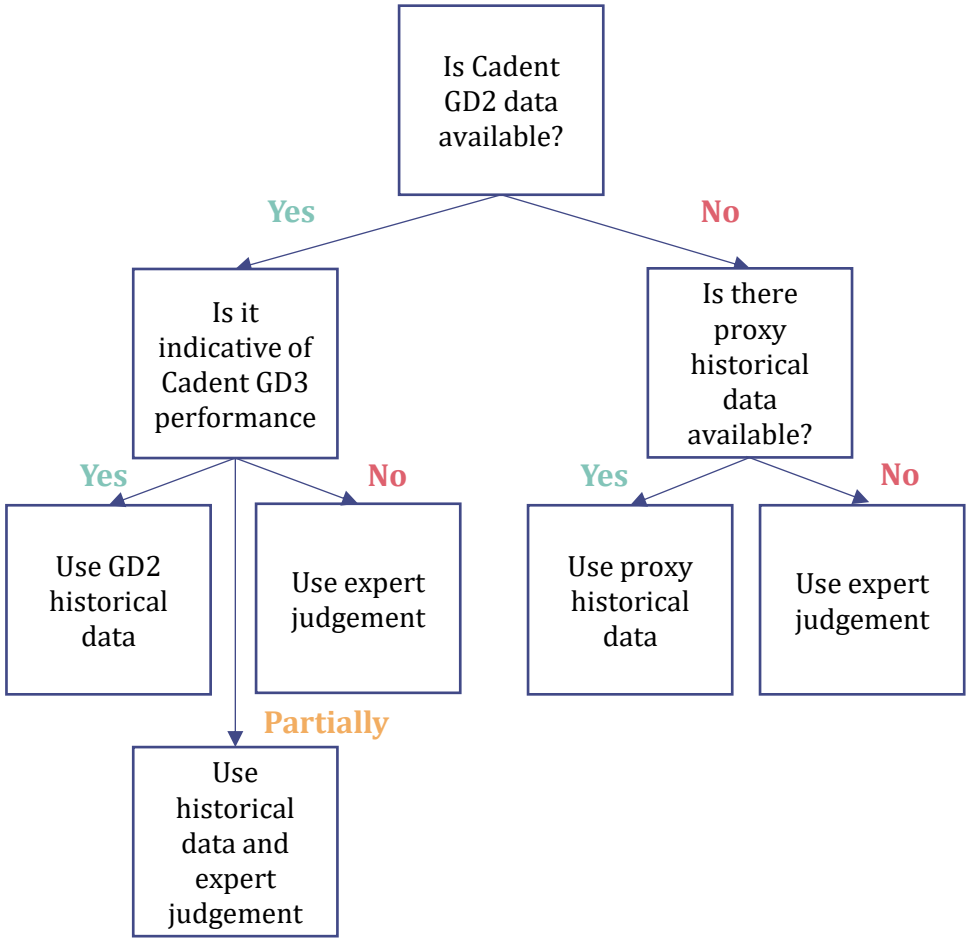
Step 3a. The GD3 DDs have limited changes in the overall price control framework compared to GD2, but substantial changes compared to GD1

Change in RIIO framework — Low — Medium — High

	GD1	GD2	GD3 (DDs)	Change, GD1-GD3 DDs	Change, GD2-GD3 DDs
Duration	8 years[5]	5 years[11]	5 years[17]		
Ongoing efficiency	1% per year for opex and 0.7% per year for capex and repex[6]	1.15% per year for capex (and repex), and 1.25% for opex[12]	1% OE target for RIIO-3[18]		
Real price effects	Fixed ex-ante allowances[7]	Indexation[13]	Indexation[19]		
Econometric approach	Top-down and bottom-up[8]	Top-down[14]	Top-down[20]		
Catch-up efficiency challenge	75th percentile[9]	85th percentile, with 3 year glide path from the 75th percentile[15]	85th percentile, with 3 year glide path from the 75th percentile[21]		
Outputs and incentives	Six output categories[10]	ODIs; and PCDs[16]	ODIs; and PCDs[22]		

Steps 3a and 3b. We primarily rely on GD2 historical data in our analysis, but supplement this with expert judgement when appropriate

Our decision rule for performance data



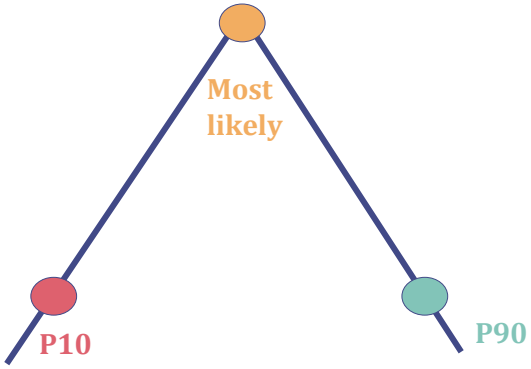
The notional performance distribution

A **Most likely.** Given we consider Cadent's data to represent a good basis for notional company performance (see page 16), we use Cadent network-specific data to inform the 'most likely' value of performance across risk components for the efficient notional operator of Cadent's networks. As shown in our decision rule opposite, we rely on Cadent GD2 performance data when historical data is indicative of GD3 performance. We do not use GD1 data as it is unlikely to be reflective of GD3 performance, as discussed on the previous page. We supplement historical data with expert judgement when historical data is either not available or not appropriate to use.

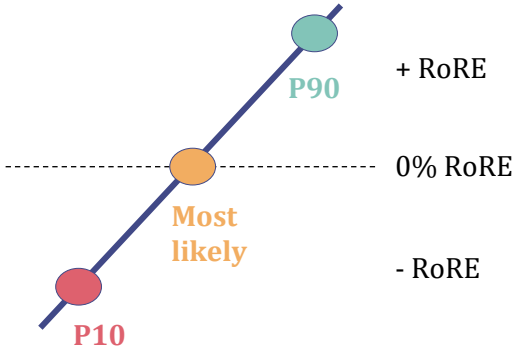
B **Variation around most likely value.** Once we have identified the most likely value of performance based on Cadent data, we select suitable P10 and P90 values such that we can form a triangular distribution of performance for each Cadent network for GD3 across each risk component. We use industry-wide variation in performance relative to mean performance when this data is available and apply this to each Cadent network's most likely performance to determine its P10 and P90 values. This approach allows us to use far more data points to assess variation in performance compared to using Cadent network-specific data only.

Step 4. We convert the performance distribution to a financial distribution for all risk components to ensure distributions are on the same basis for the Monte Carlo modelling

Example performance distribution



Example financial impact distribution



Once we have estimated the performance distributions for each component of risk, we must convert it into a financial distribution of % RoRE outcomes, to identify the distribution of impacts of each component on the RoRE. The method to convert from a performance distribution to a financial distribution depends on the specific risk being considered (full details for each area are in the method annex).

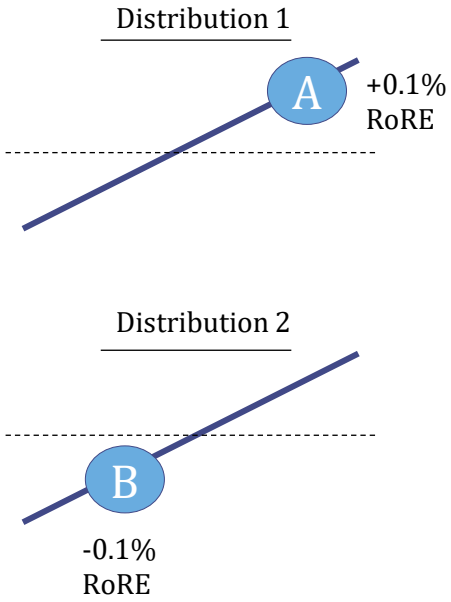
In the simplest case, the performance distribution will already be in monetary units, and therefore all that is required is to divide by the regulated equity (on a notional company basis) to identify the financial distribution in % RoRE terms.

In other cases, the conversion to a financial distribution has several steps. For example, in the case of an ODI, the financial impact for an efficient notional operator of a Cadent network, given its performance distribution on an ODI, depends on several factors that all must be taken into account. These factors include the targets of the ODI, the incentive rate, along with any deadbands, caps, collars and other parameter-specific factors that affect financial outcomes.

Step 5. To estimate a Monte Carlo RoRE risk range for the notional company, we take independent draws across all financial distributions in a simulation and repeat 10k times

Firstly, we take independent draws from financial distributions (in % RoRE) terms. In the example graphic below, there are two financial distributions (1 and 2, with random draws from each: A and B). Each of these random draws reflects a % RoRE impact on the efficient notional operator of Cadent's networks.

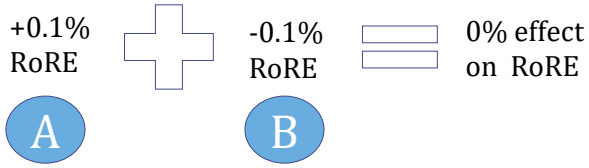
Example random draws



Secondly, we aggregate the % RoRE impact for an individual simulation (see example graphic below). This requires summing the random draws across all the financial distributions to estimate an overall impact on the RoRE in a single simulation. The % RoRE effect can be either positive or negative.

In the example below, draw A from the 1st distribution has a 0.1pp increase on the RoRE, whilst draw B from the 2nd distribution has a 0.1pp decrease on the RoRE. In this example simulation, these RoRE effects fully counteract, and therefore there is an overall 0pp effect on the RoRE due to these distributions.

Example aggregation for one simulation

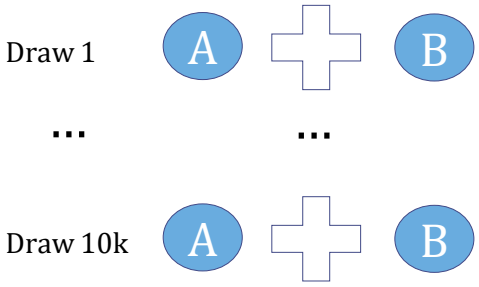


Thirdly, we repeat the simulations 10,000 times to produce a % RoRE range of outcomes.

Each simulation will produce an estimate for the effect on the efficient notional operator of Cadent's networks' RoRE for that 'state of the world' and therefore the expected RoRE relative to the allowed return on equity.

We aggregate these equity returns to produce a % RoRE distribution to derive our Monte Carlo risk range.

Example 10k simulation



3. MONTE CARLO RESULTS

We aggregate risk using Monte Carlo modelling to provide a more plausible range of RoRE outcomes for Cadent compared to a simple aggregation of risk

Introduction to Monte Carlo

Monte Carlo modelling is a technique that relies on repeated random sampling across several distributions to generate an aggregated distribution.

In the case of RoRE risk analysis, Monte Carlo methods involve taking random samples from distributions of financial outcomes across the different risk areas and components in the price control, and then summing them. This process is repeated many times (10,000 in the case of our analysis) to produce an aggregated distribution of RoRE outcomes.

The key benefit of Monte Carlo analysis is that it is a better representation of reality than the simple aggregation approach used by Ofgem in the GD3 DDs. Given the random sampling in the Monte Carlo methods, it allows for differing effects on the RoRE across risk areas concurrently e.g., one risk area could have a negative impact on the RoRE, whilst another risk area could have a positive impact on the RoRE. Conversely, the simple aggregation approach used by Ofgem implicitly assumes perfect correlation between risk areas, that is, if one risk area has a negative expected effect on the RoRE, then all other risk areas have a proportionally equally negative effect on the RoRE in that 'state of the world'. This is not plausible because it implies that networks would do equally well or equally poorly across all price control areas at the same time. Historically, this has not been the case. Networks often perform well in some areas relative to allowances and targets, and fall short in others.

Overview of our method

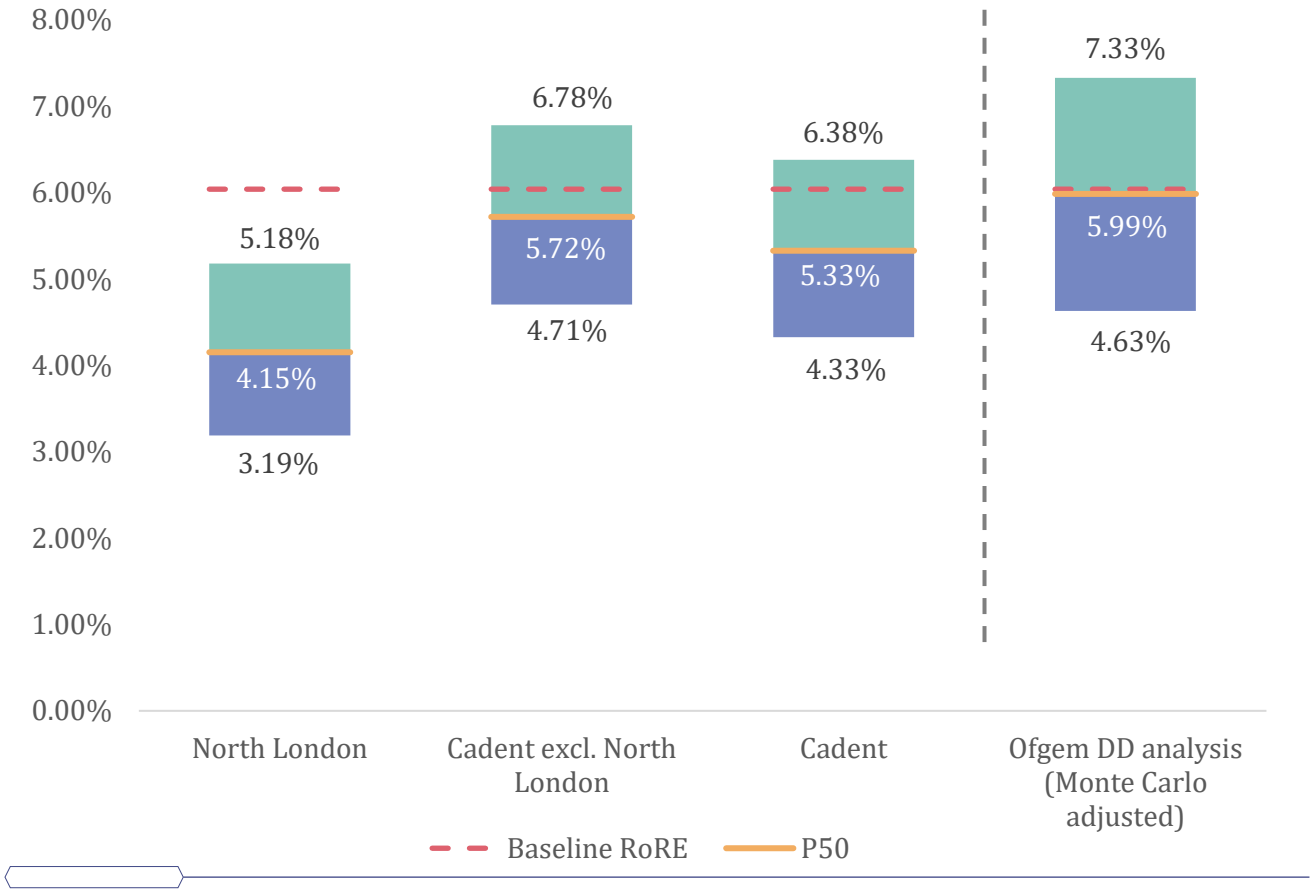
The starting point for the Monte Carlo modelling is the financial distributions across all risk components. To aggregate risk based on Monte Carlo modelling, we take the following approach:

- Convert financial distributions to a five-year (price control) basis. This is required because some of the risk areas have financial distributions on an annual basis, for example ODIs, and there is a need for all inputs to the Monte Carlo model to be on the same basis. We convert annual financial distributions for a risk component to a price control (five-year) basis through a separate Monte Carlo model.
- Simulate a plausible RoRE outcome by taking draws across all financial distributions, and then summing their individual impacts on the RoRE.
- Repeat simulations a large number of times to approximate the 'true' population distribution of RoRE outcomes. In our analysis, we repeat the simulation 10,000 times.
- From this distribution of RoRE outcomes, take the P10, P50 and P90 values to inform the RoRE risk range for each Cadent network in GD3 under the DDs.

We have taken a conservative approach throughout our modelling. For example, we have not estimated any risk associated with the revenue forecasting penalty mechanism for GD3. Cadent would not have expected to receive any penalties under this mechanism in GD2, and therefore we assume this will continue for GD3. This is a conservative assumption, because the mechanism is penalty-only and so can only add to downside risk.

Under the Monte Carlo aggregation of risk, we conclude that the GD3 DDs do not represent a 'fair bet' for Cadent, particularly for the North London network

Figure 2: Risk under the GD3 DDs, Monte Carlo aggregation (% RoRE)



Notes: It is not possible to break down the overall risk range by area as can be done with the simple aggregation approach, as a result of the nature of Monte Carlo modelling. The corrected BPI value of +0.11pp RoRE is included in our risk range for Cadent and for the Ofgem DD analysis. We apply a corrected BPI of +0.02pp RoRE to North London and +0.14pp RoRE to Cadent (excl. North London).

Source: Economic Insight analysis.

We estimate that the expected RoRE for the efficient notional operator for Cadent (hereafter 'Cadent's expected RoRE') to be 5.33% under the Monte Carlo risk aggregation. As such, it remains well below the allowed return on equity (6.04%) for GD3, with the package not representing a 'fair bet'.

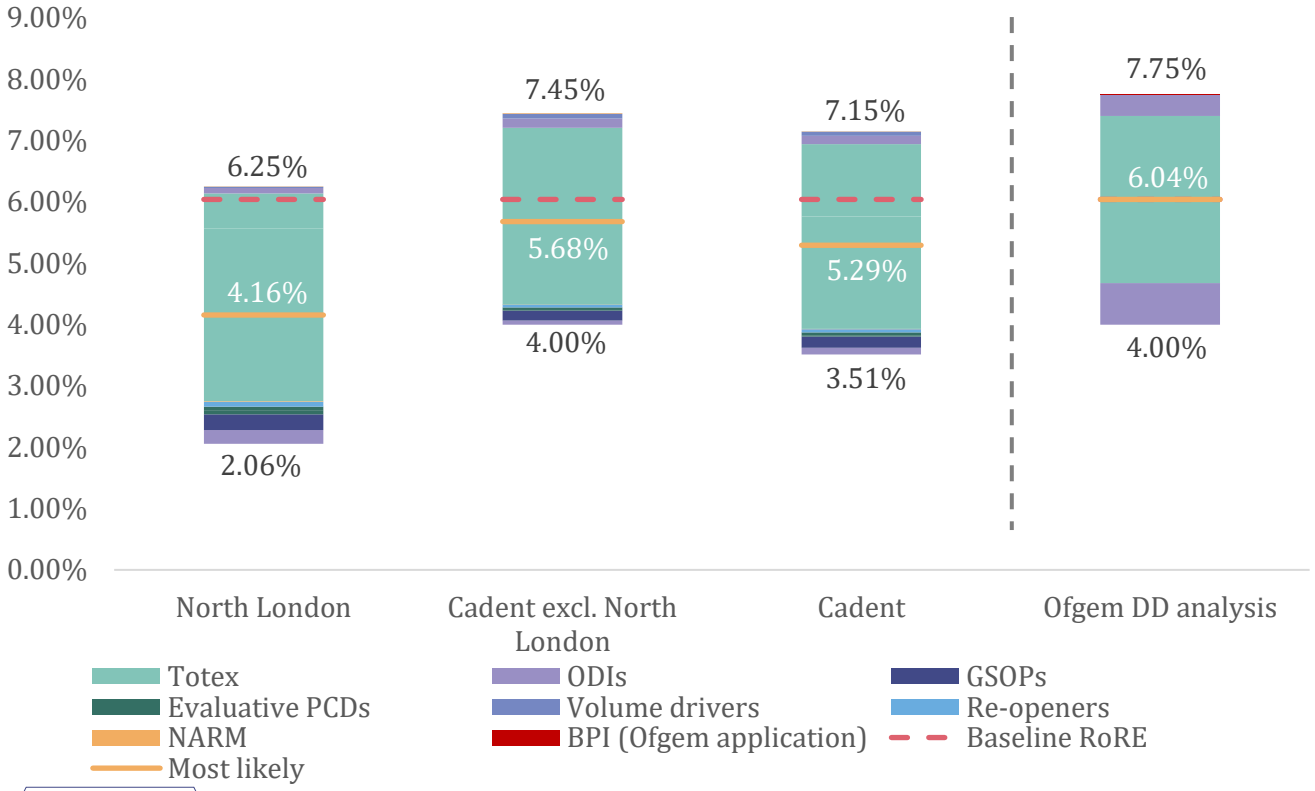
We estimate that the North London network has a significantly lower expected RoRE (4.15%) relative to the allowed return on equity (6.04%). Notably, the P10-P90 range for the North London network for RoRE (3.19%-5.18%) is entirely below the allowed return on equity for GD3.

Our analysis of the magnitude of the risk range that Cadent faces under the DDs is shifted downwards compared to Ofgem's analysis for two key reasons:

1. Ofgem does not consider several risks that have a clear expected negative effect on the RoRE e.g., GSOPs.
2. Ofgem does not consider plausible performance distributions and instead assumes upside and downside risks around the allowed return on equity are equal.

Under the simple aggregation of risk, we conclude that the GD3 DDs do not represent a 'fair bet' for Cadent, particularly for the North London network

Figure 3: Risk under the GD3 DDs, simple aggregation (% RoRE)



Notes: Ofgem only includes totex, ODIs and BPI risk in its RoRE analysis. The RoRE risk ranges in our analysis reflect the range between the P10 and P90 outcomes. We note it is unclear whether Ofgem's DD analysis reflects the P10 and P90 values. All figures are pre the application of the Return Adjustment Mechanism (RAM). We do not apply the RAM to the North London network here, despite reaching the primary RAM threshold because the simple aggregation of risk is not representative of the actual risk that Cadent faces. We apply corrected BPI values aligned to the Monte Carlo analysis to our estimates, but leave Ofgem's BPI value unchanged from the DDs to fully reflect the range it presented in the GD3 DDs.

Source: Economic Insight analysis.

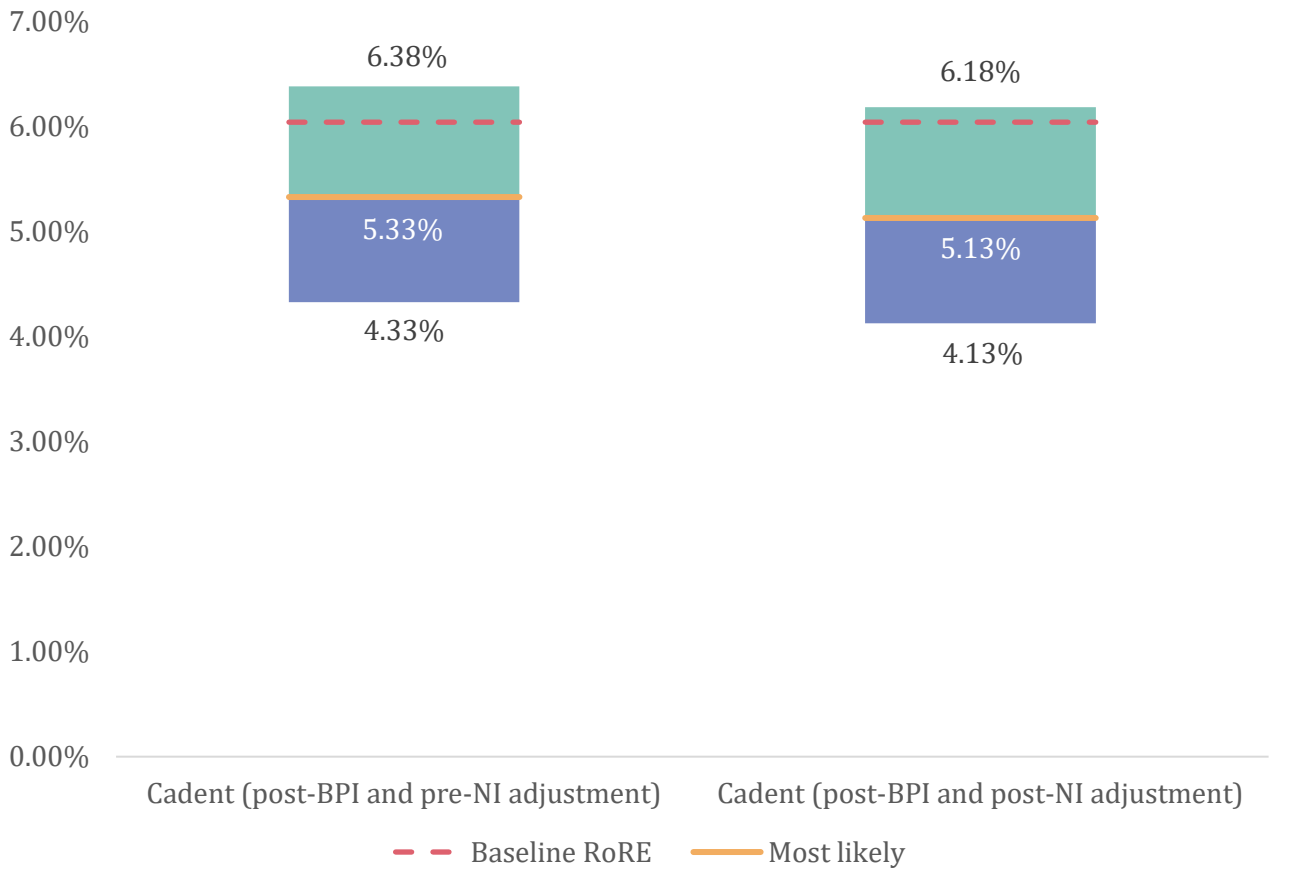
Under the simple aggregation approach, we estimate the expected RoRE for Cadent to be 5.29%, which is below the allowed return on equity in GD3 under the DDs (6.04%). For the North London network, we estimate the expected RoRE to be even lower than Cadent overall at 4.16%. Consequently, based on the simple aggregation of risk approach, we clearly conclude the DDs package for Cadent is not a 'fair bet'.

The simple aggregation risk range is wider than our Monte Carlo results, which we consider to represent a more plausible distribution of performance. Therefore, it is critical that Ofgem moves away from simple aggregation of risk. For Cadent the risk range widens as follows:

- The P10 outcome RoRE is 4.33% under the Monte Carlo aggregation versus 3.51% under simple aggregation.
- The P90 outcome RoRE is 6.38% under the Monte Carlo aggregation versus 7.15% under simple aggregation.

It is critical that Ofgem allows GDNs to recover costs associated with recent changes in National Insurance contributions

Figure 4: Risk under the GD3 DDs, Monte Carlo aggregation, pre- and post-NI adjustment for Cadent (% RoRE)



Notes:. A BPI effect of +0.11pp RoRE applies, shifting the RoRE risk range upwards by this amount.

Source: Economic Insight analysis.

The UK Government announced increases to National Insurance (NI) contributions in the Autum Budget 2024 (which came into effect in April 2025). These NI changes which will affect Cadent's efficient costs at GD3.

Cadent estimates the effect of the increases in the NI contributions to be ~£96m across its four networks for GD3.

We estimate that the effect of these NI increases on Cadent's expected RoRE for GD3 is -0.20pp, reducing the expected RoRE from 5.33% (post-BPI adjustment and pre-NI adjustment) to 5.13% (post-BPI adjustment and post-NI adjustment). This NI change shifts the whole RoRE risk range downwards because it is a known effect on Cadent's expected returns.

Currently, Ofgem does not allow GDNs to recover the costs associated with the changes to NI contributions under the GD3 DDs. As stated above, this has a material negative impact on Cadent's expected RoRE and reinforces the view that the DD package does not represent a 'fair bet' for Cadent.

4. ESTIMATE OF BASELINE TOTEX RISK

Baseline totex is a key source of risk for the notional company, which Ofgem fails to appropriately quantify in the DDs

Introduction to baseline totex risk

The RIIO framework is designed to incentivise GDNs to efficiently spend their allowed revenues in delivering their business plan, since any under or overspend relative to baseline totex allowances is borne (in part) by the company. However, this also exposes companies to significant risk, since over or underspend relative to allowances can be driven by a number of factors, several of which are outside management's control.

In the DDs Ofgem attempts to quantify this risk by assuming a ±10% over/underspend relative to allowances for GDNs in its risk analysis.[23] This is a clear error in approach, as: (i) Ofgem assumes the risk is symmetrical around the allowed rate of return by definition, rather than providing any evidence in support of the fact; and (ii) Ofgem fails to use any industry performance data in its analysis, relying on broad assumptions instead. Therefore, Ofgem fails to accurately capture the true risk faced by the Cadent at GD3. Our analysis seeks to improve upon Ofgem's range and more precisely measure the baseline totex risk that Cadent faces.

Key sources of risk

For the components of baseline totex, there are two main sources of risk that Cadent faces:

- **Modelling risk:** the risk that Ofgem's approach to setting allowances for a specific (baseline) totex area does not accurately capture the ex-ante efficient costs of delivery.
- **Spending risk:** the risk that the company spends more or less than its allowances as a result of exogenous factors that the efficient company cannot control, which are not covered by mechanisms built into the price control (e.g., volume drivers, re-openers).

Our methods for assessing baseline totex risk are designed to capture both these sources of risk.

Coverage of our analysis for baseline totex

Modelled regressed costs	Technically assessed costs
Modelled non-regressed costs (excl. streetworks)	Ongoing efficiency
Streetworks costs	Regional factors
	Real price effects

We consider baseline totex risk at a granular level, using bespoke methods to assess risk for seven components of baseline totex

	Risk category	Approach
A	Modelled regressed costs	Estimate risk based on Ofgem's regressed cost efficiency scores
B	Modelled non-regressed costs (excl. streetworks)	Assume risk is proportionate to modelled regressed cost risk
C	Streetworks costs	Compare Ofgem's GD3 modelled streetworks allowances to outturn/forecast streetworks spend
D	Technically assessed costs	Assume risk is proportionate to modelled regressed cost risk
E	Ongoing efficiency	Estimate risk by comparing the Economic Insight 'plausible range' of OE at GD3 to Ofgem's OE assumption
F	Regional factors	Combine risks from modelled regressed costs and risks from an inaccurate labour regional factor index
G	Real price effects	Estimate risk by analysing the variation between Ofgem's RPE index and Cadent's proposed index

A more detailed breakdown of each approach can be founded in the method annex

A Method in focus: modelled regressed costs

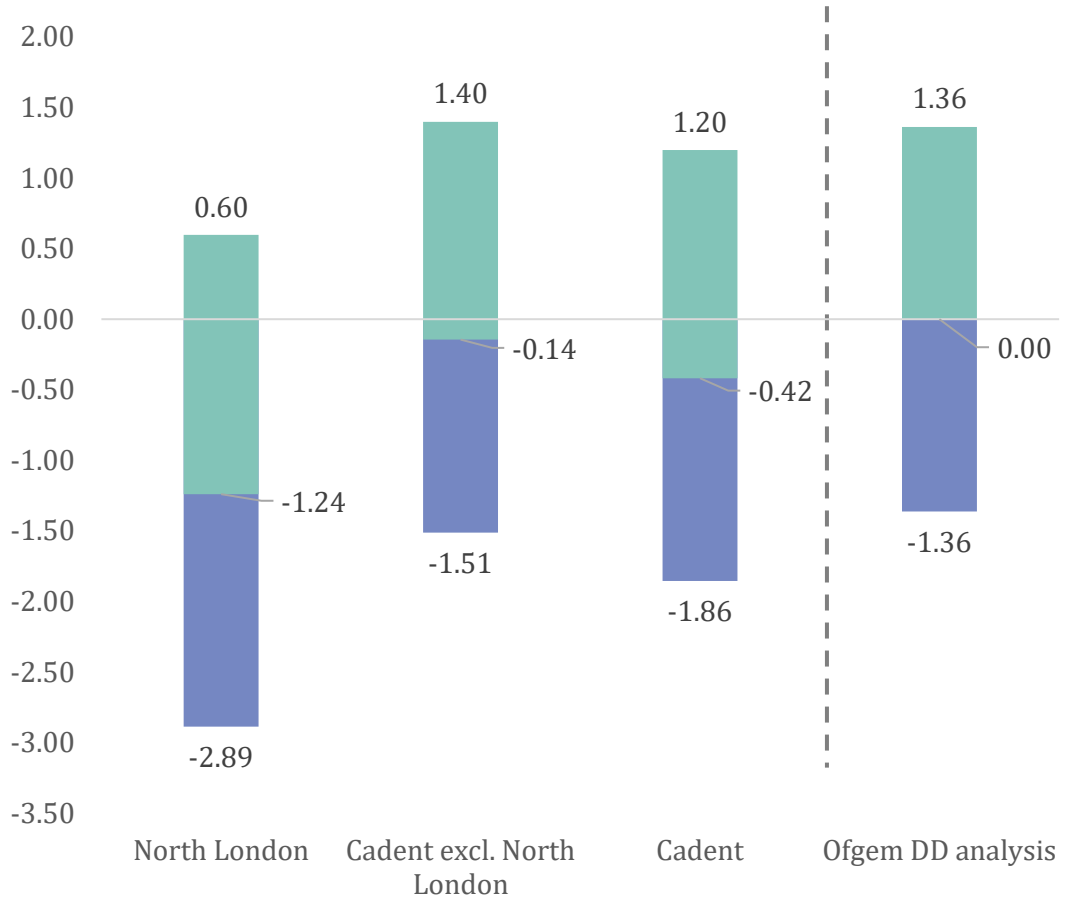
Efficiency scores capture both modelling risk and spending risk:

- **Modelling risk.** Efficiency scores are essentially a measure of how well the regression model fits a particular data point. Therefore, risk associated with a mis-specified regression model, e.g., risk from with variables that determine spend not being included in the model, is captured here.
- **Spending risk. E**fficiency scores also capture spending risk, as they are calculated based on company historical/forecast spend relative to (implicit) allowances. Therefore, the risk associated with higher or lower than allowed spending, such as spending that results from exogenous factors, will be measured here.

We primarily rely on historical and forecast cost data from 2022-2031 for our baseline totex analysis. This is a more conservative choice than the alternatives considered (e.g., using GD2 or GD2 outturn data only), since Cadent is, in general, forecasting performance improvements over GD3. Therefore, alternative methods would imply a greater negative expected impact on Cadent's RoRE, which would be less conservative than the approach we take.

The impact of baseline totex on Cadent's expected RoRE is negative overall, with the negative impact most pronounced for the North London network

Figure 5: Baseline totex risk under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

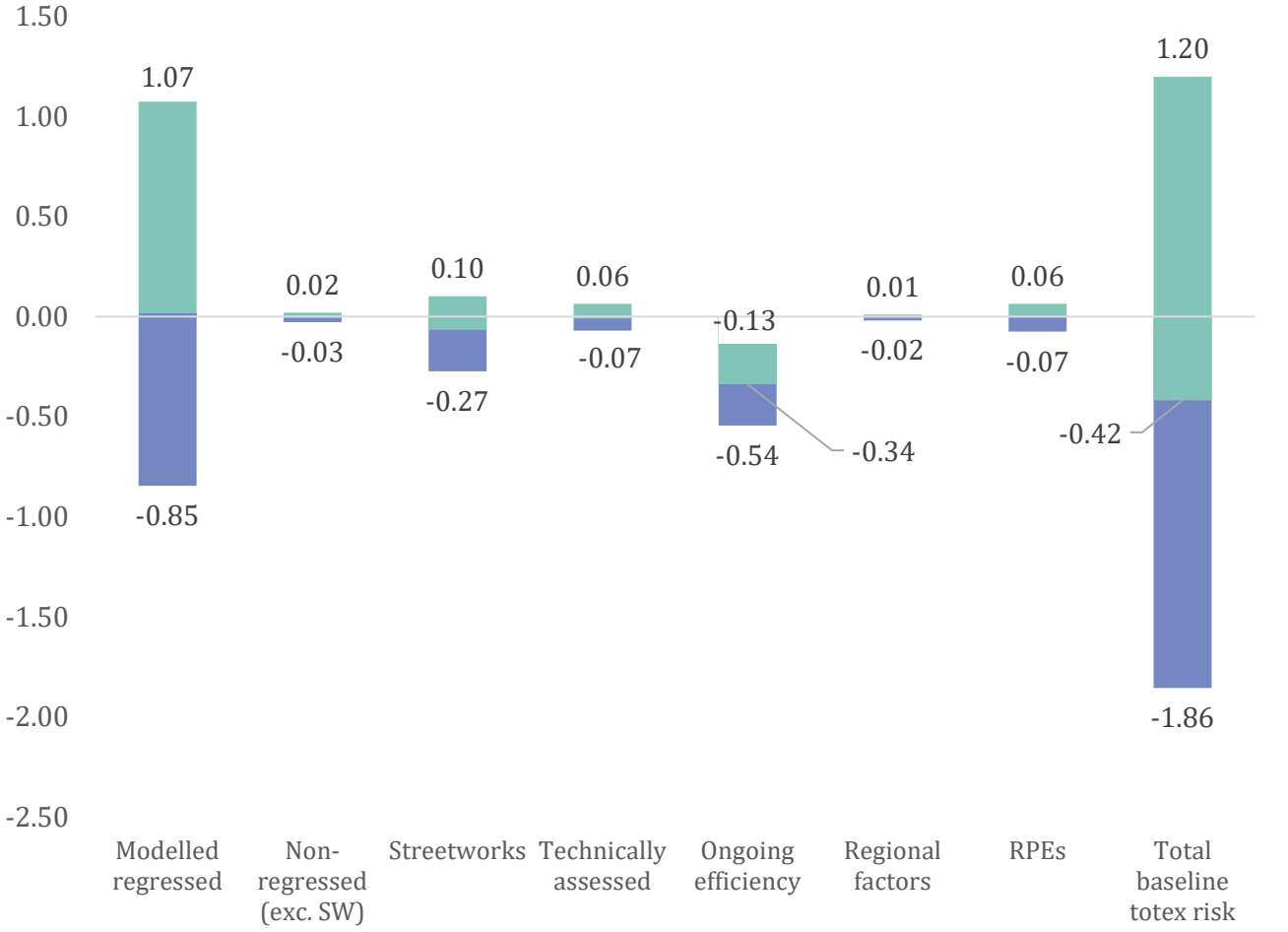
Our results show an expected impact on the RoRE of -0.42pp for Cadent from baseline totex. In the P10 outcome, this decreases to -1.86pp, whereas in the P90 outcome, this increases to 1.20pp, suggesting that there is some chance of totex outperformance and a positive impact on the RoRE for Cadent at GD3. However, the scope for outperformance is significantly less than the scope for underperformance.

Considering the North London network alone, the expected impact of baseline totex on its RoRE is -1.24pp, which is far more negative than for Cadent overall. This reflects the particular operational circumstances the North London network faces, notably the risks in relation to London-specific regional factors and streetworks costs. Excluding the North London network, the expected impact of baseline totex on the RoRE for Cadent is still negative (-0.14pp), albeit this is less pronounced. This shows that whilst North London is a key driver of the negative expected impact of baseline totex, it is not the sole determinant.

Our estimated risk range has a more negative impact on the RoRE than that presumed by Ofgem, in all outcomes considered (P10, most likely, P90). This reflects the asymmetric nature of the risks (with respect to baseline allowances) associated with several components of baseline totex. Ofgem fails to consider this asymmetry in its presupposed symmetrical totex risk range (for which it assumes a ±10% over/underspend).

The key driver of the negative impact of baseline totex on Cadent's expected RoRE is ongoing efficiency

Figure 6: Decomposition of baseline totex risk for Cadent under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

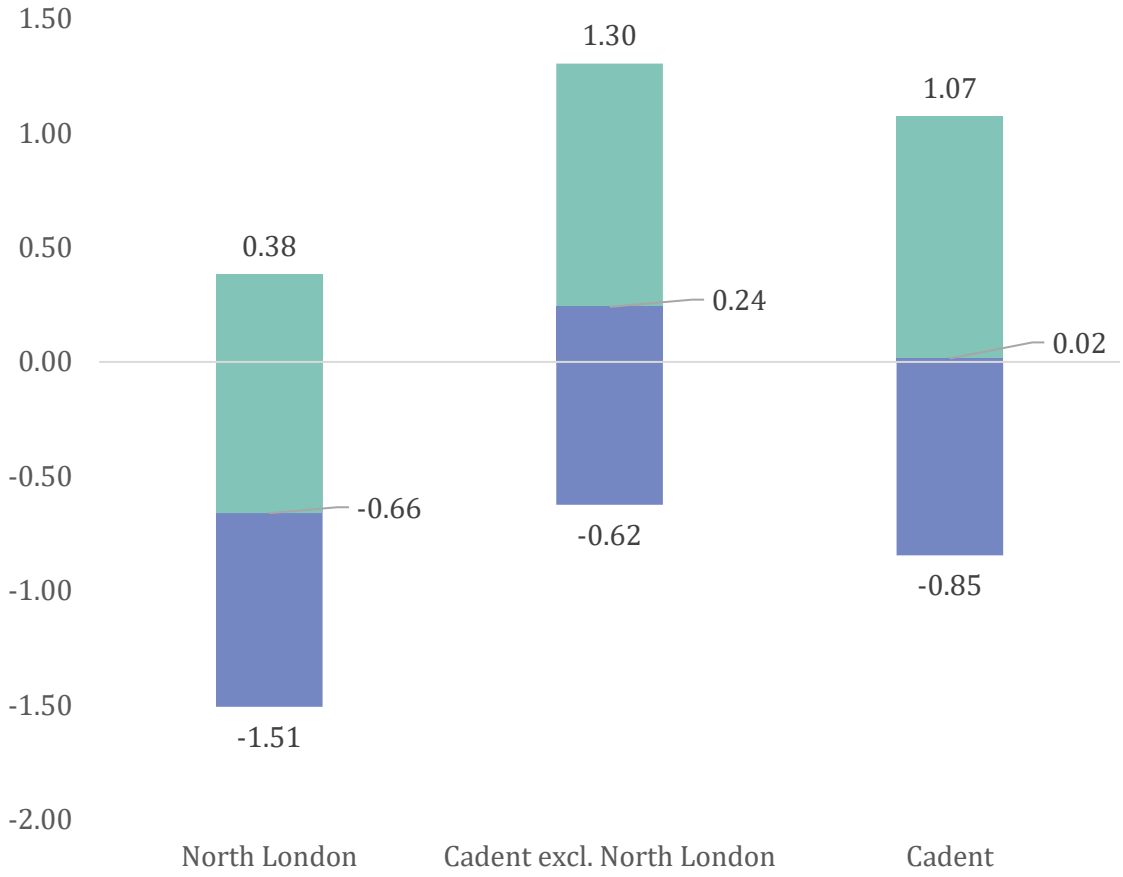
Ongoing efficiency is the single largest contributor to the expected negative impact on the RoRE from baseline totex, contributing -0.34pp compared to a total -0.42pp RoRE impact. This is driven by the large difference between Cadent's expected level of OE at GD3 (0.5%, based on Economic Insight's analysis[24]) and Ofgem's 1% OE assumption. By applying an OE assumption above the level that is supported by the available evidence, Ofgem effectively bakes in significant overspend, with a consequent impact on the expected RoRE.

Other key sources of baseline totex risk for Cadent include: (i) modelled regressed costs; and (ii) streetworks. These are addressed in more detail in the rest of this section.

Whilst the risk associated with Ofgem's regional factor adjustments appears small for Cadent as a whole, this is because regional factor risk – specifically, the risk that Ofgem's adjustment is set at the 'wrong' level – is already partially captured by the efficiency scores used for the modelled regressed risk range (as explained on the following page). Therefore, the regional factor risk range only quantifies additional sources of risk not captured in modelled regressed costs. See the method annex for more details.

The impact of modelled regressed costs on Cadent's expected RoRE is slightly positive, despite a large negative impact for the North London network

Figure 7: Modelled regressed costs risk under the GD3 DD (impact on the RoRE, pp)



Source: Economic Insight analysis.

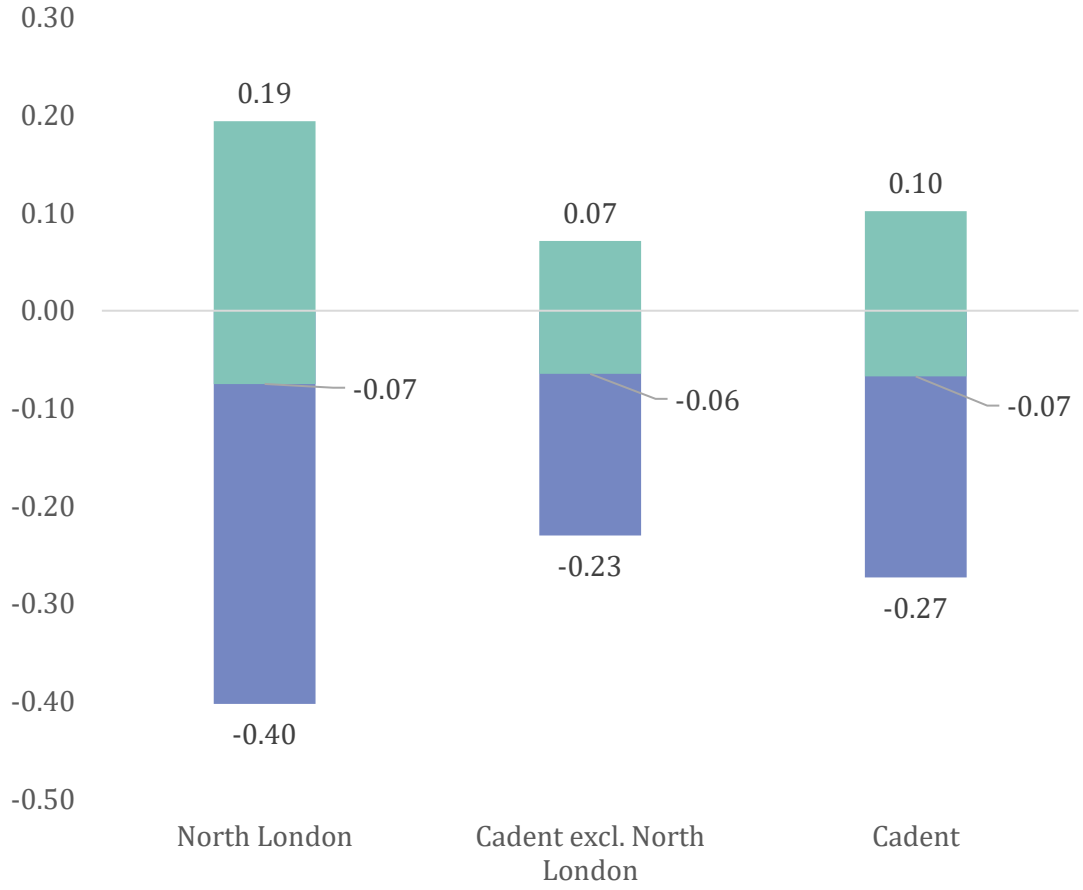
Our results show the most likely impact on Cadent's RoRE from modelled regressed costs is 0.02pp, for Cadent overall. Excluding the North London network, this increases to 0.24pp. The North London network, in comparison, shows a most likely impact of -0.66pp on its RoRE.

North London's modelled regressed costs have a large negative impact on Cadent's RoRE, because the efficiency scores for the North London network are the highest out of Cadent's networks. Given that (as explained on page 28) efficiency scores capture the modelling risk in Ofgem's regression, high efficiency scores for North London may be because Ofgem's models are less able to accurately capture factors that drive costs in North London. In support of this, we note that North London had a much higher £s amount of the proposed regional factor adjustments disallowed at DDs than other Cadent networks[25] and that this network is deemed significantly less efficient in Ofgem's totex model than other Cadent networks, despite operating under the same management and ownership.

Risk associated with modelled regressed costs is the main driver of overall baseline totex risk (i.e., the magnitude of the RoRE risk range for baseline totex). This is because modelled regressed costs make up around 85% of Cadent's baseline totex allowance.[26] As such, it is reasonable that these costs make up the single largest component of Cadent's baseline totex RoRE risk.

Streetworks are a material component of Cadent's baseline totex RoRE risk, which is driven largely by the high volume of streetworks required in the North London network

Figure 8: Streetworks risk under the GD3 DDs (impact on the RoRE, pp)



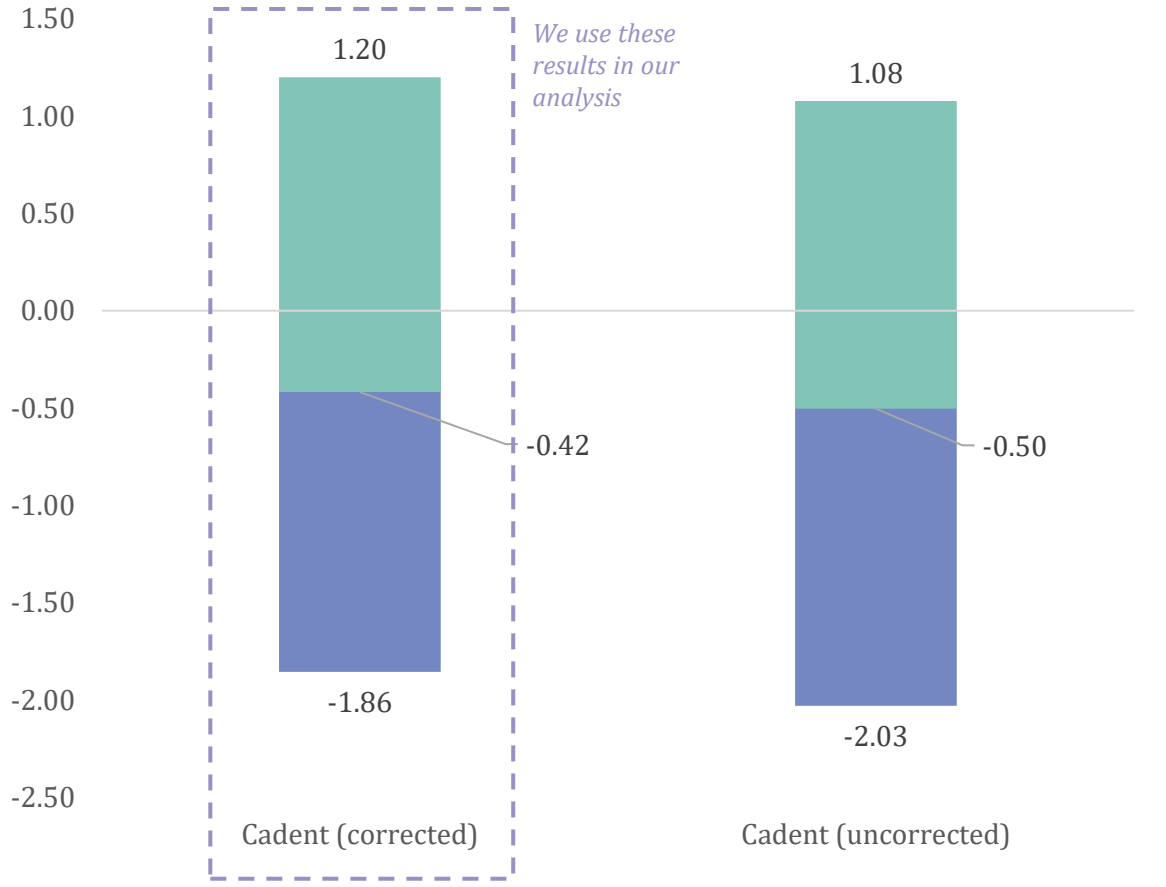
Source: Economic Insight analysis.

Our results show a most likely impact of -0.07pp on Cadent's RoRE from streetworks at GD3. This negative impact is driven by the exclusion of penalties and charges associated with streetworks from Ofgem's streetworks allowance calculations. Given a non-zero expected level of penalties and charges (based on past performance), this results in a negative impact on Cadent's expected return in the most likely outcome. These penalties and charges are also not subject to the Totex Incentive Mechanism (TIM), further increasing the magnitude of this negative impact.

The impact on Cadent's RoRE ranges from -0.27pp in the P10 outcome to 0.10pp in the P90 outcome. The key driver of this range is the streetworks risk associated with the North London network. As shown in the chart opposite, the risk range for North London is much wider than the risk range for both Cadent excluding North London, and Cadent as a whole. Intuitively, this is expected because streetworks costs and allowances are significantly higher in North London compared to other networks, given the urban nature of the London operating environment. As a result, the corresponding risk – both upside and downside – is also greater for this network as any % over/underspend against allowances is large in £s terms (and large relative to North London's regulated equity).

Ofgem's DDs cost model contains several errors, leaving these errors in our analysis results in a more negative impact on Cadent's expected RoRE

Figure 9: Totex risk under the GD3 DDs with and without Ofgem's modelling errors corrected, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

In Ofgem's analysis, material errors related to: (i) the calculation of efficiency scores and subsequent catch-up efficiency adjustment; and (ii) the ongoing efficiency adjustment, have been identified. We have sought to accurately capture the true risk to Cadent over GD3, therefore, we use the outputs of Cadent's 'error corrected model' in our RoRE risk analysis – which does not suffer from these errors – rather than Ofgem's DDs cost model. We assume that Ofgem will also correct these errors at the FDs.

To demonstrate the impact of these errors on our results, we also estimate totex risk using Ofgem's cost model 'as published' in the DDs, inclusive of any errors. These results show an (uncorrected) impact on Cadent's expected RoRE of -0.50pp, and an impact of -2.03pp and 1.08pp in the P10 and P90 outcomes, respectively. In each of these outcomes, the impact on Cadent's expected RoRE is more negative than in the risk range suggested by Cadent's error corrected model.

5. ESTIMATE OF ODI RISK

ODIs are a key component of the RIIO framework and so warrant a detailed analysis of the associated risks

Introduction to ODI risk

The RIIO framework is designed to incentivise GDNs to efficiently provide a high-quality customer-focused service through Output Delivery Incentives (ODIs). This is because ODIs reward/penalise GDNs based on their performance on key measures of service quality e.g., the complaints metric. However, this also exposes companies to significant risk, since over/underperformance relative to targets can be driven by a number of factors, several of which are outside of management control.

In the DDs, Ofgem acknowledges and quantifies ODI-related risk. It estimates ODI risk for GDNs by assuming performance is such that the maximum available reward/penalty is received in the high and low performance outcomes, respectively.[27] This approach is not grounded in industry performance data and so does not reflect the risk the notional company faces due to ODIs. Our analysis seeks to improve upon Ofgem's range and more accurately measure the ODI risk that Cadent faces.

Key sources of risk

For each ODI performance metric there are two main sources of risk that Cadent faces:

- **Design risk:** the risk that Ofgem miscalibrates its approach to setting how performance on each ODI metric translates to financial rewards/penalties resulting in the notional company receiving rewards/penalties.
- **Performance risk:** the risk that factors outside of company control affect performance on ODI metrics resulting in the notional company receiving rewards/penalties.

Our method for assessing ODI risk is designed to capture both these sources of risk.

Coverage of our analysis for ODIs

- Customer Satisfaction
- 7 & 28 Day Repair Standards
- Complaints Metric
- Collaborative Streetworks
- Unplanned Interruptions

We consider ODI risk at a granular level, assessing risk for each individual performance metric

	ODI	Performance metrics assessed
A	Customer Satisfaction	(i) Connections survey average score (ii) Planned work survey average score (iii) Unplanned work survey average score
B	Complaints Metric	The complaints metric
C	Unplanned Interruptions	Average duration of unplanned (i) MOB and (ii) non-MOB interruptions
D	7 & 28 Day Repair Standards	Percentage of gas escape repairs completed in (i) 7, and (ii) 28 days
E	Collaborative Streetworks	Number of (i) 'strategic' and (ii) 'minimum' criteria projects completed

A detailed breakdown of the approach used for each ODI can be found in the method annex

Method Overview

For each individual performance metric, we:

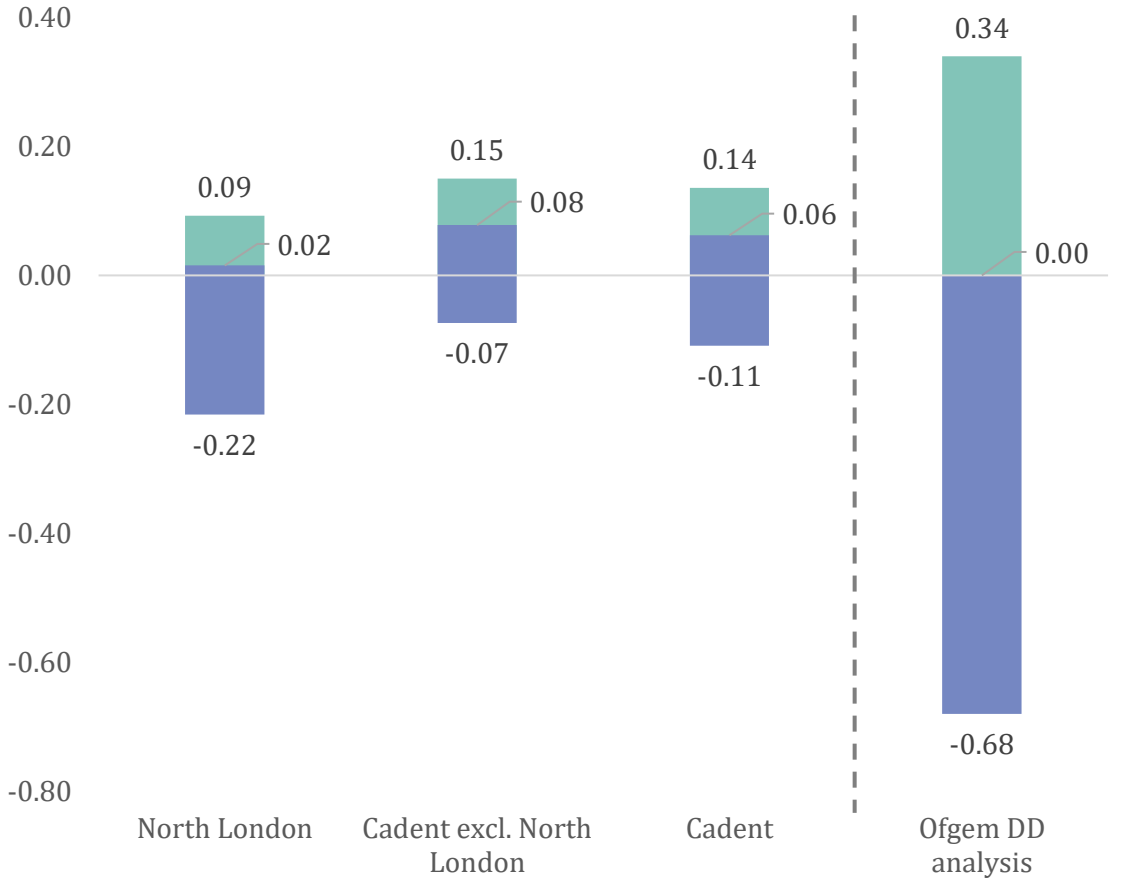
1. **Estimate the performance distribution.** We estimate the distribution of each individual performance metric (e.g., the connections survey average score) for each network in GD3 using historical GD2 performance data.
2. **Calculate the financial implication.** We apply the relevant targets, deadbands etc., to the estimated performance distribution to estimate the associated distribution of rewards and penalties.

This approach captures both design risk and performance risk:

- **Design risk.** The impact of Ofgem's design for each ODI (incl. targets, deadbands etc.) is captured in how the estimated distribution of each performance metric translates into rewards and penalties.
- **Performance Risk.** This is captured through the variability of each network's performance metrics, in the estimated distributions, and the consequent effect on the distribution of financial rewards and penalties.

The ODI risk range is narrower than Ofgem's DDs analysis indicates, and has a positive impact on the expected RoRE for both Cadent overall and the North London network

Figure 10: ODI risk under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

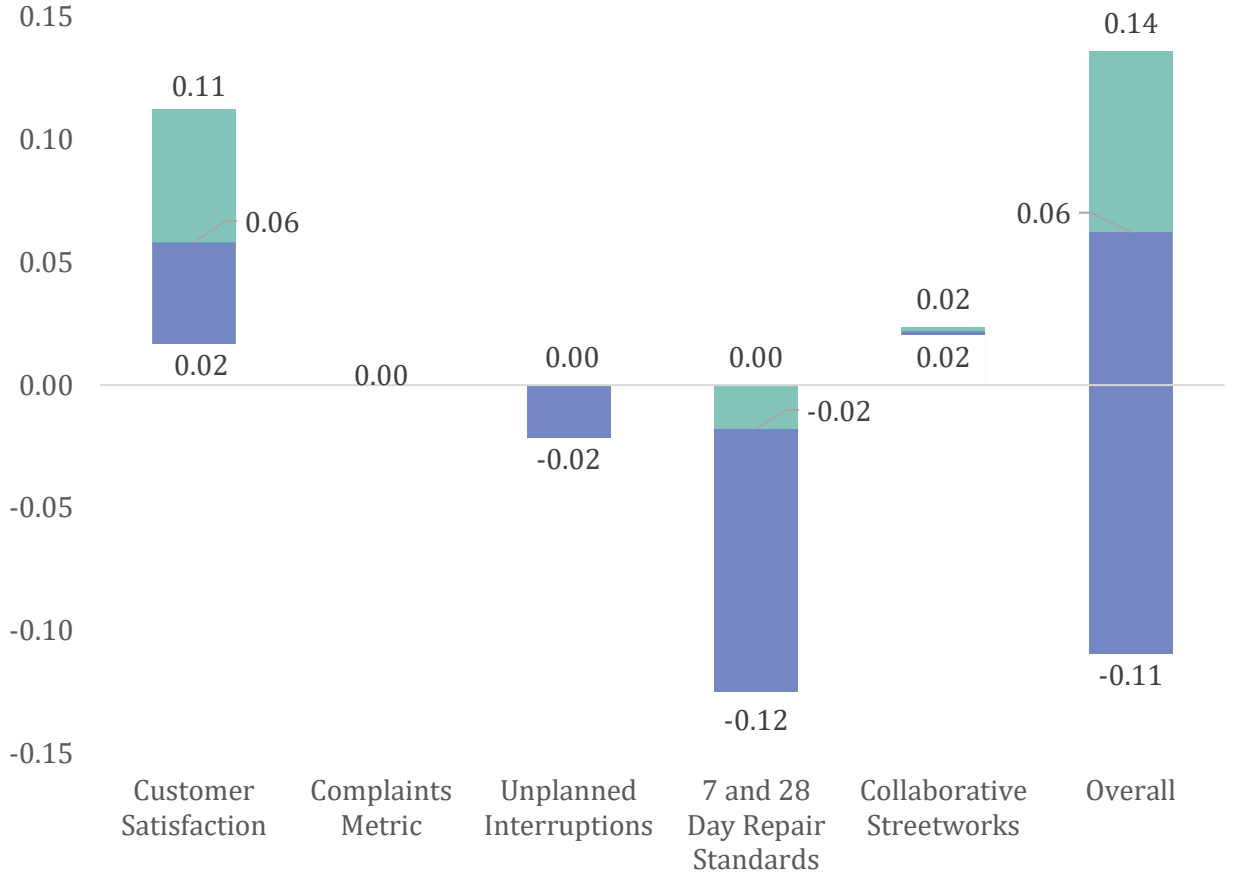
Our analysis shows that ODIs have a positive impact on Cadent's expected RoRE of 0.06pp. Similarly, for the North London network, the impact of ODIs on the expected RoRE is also positive; however, the magnitude is far smaller, at 0.02pp, compared to the effect on the expected RoRE of other Cadent networks: 0.08pp.

Further, our analysis shows the risk range associated with ODIs is far narrower than that indicated by Ofgem. That is, we find the impact on Cadent's RoRE is -0.11pp in the P10 outcome and 0.14pp in the P90 outcome. By contrast, Ofgem's DDs analysis indicates an impact on the RoRE of -0.68pp in the low performance outcome and 0.34pp in the high-performance outcome.[28] Some of this difference comes from Ofgem producing its range based on the maximum rewards and penalties possible. It is unclear if this reflects Ofgem's view of the P10 and P90, or the minimum and maximum outcomes.

The narrower risk range in our analysis reflects that Ofgem's high and low performance outcomes, where each network receives the maximum possible reward or penalty across all ODIs,[29] are very low in likelihood. This is evident from GD2, where no network achieved the maximum reward or penalty across all ODIs. In contrast, our approach uses outturn GD2 performance data to inform the distribution of each performance metric.

The key drivers of ODI risk for Cadent overall are the Customer Satisfaction and the 7 and 28 Day Repair Standards ODIs

Figure 11: Decomposition of ODI risk for Cadent under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

The primary drivers of ODI risk for Cadent are:

- **Customer Satisfaction.** This ODI has positive impact on Cadent's expected RoRE of 0.06pp. The impact on the RoRE ranges from 0.02pp to 0.11pp in the P10 and P90 outcomes, respectively. This positive impact on the RoRE is driven by Cadent's strong GD2 performance on this ODI.

- **7 and 28 Day Repair Standards.** This ODI has a negative impact on Cadent's expected RoRE of -0.02pp. The impact to the RoRE ranges from -0.12pp to 0.00pp in the P10 and P90 outcomes, respectively. For this ODI, we applied an additional uplift to Cadent's historical performance based on Cadent's expert judgement. This approach is conservative, as relying solely upon historical performance would further amplify the negative impact on the expected RoRE.

Cadent has limited upside risk on Collaborative Streetworks, a reward only ODI, with a P90 impact on the RoRE of only 0.02pp. This is because the minimum annual threshold for a network to obtain rewards – 5 projects [30] – is stretching and so we anticipate some Cadent networks will not reach this level and so will obtain no rewards.

6. ESTIMATE OF PCD RISK

PCDs have risks associated with modelling and spending, late delivery of projects, and deviations from target workloads

Introduction to PCD risk

The RIIO framework for PCDs links price control funding to the delivery of outputs. This is intended to incentivise GDNs to deliver outputs efficiently.

There are two types of PCDs: evaluative and mechanistic. We have assessed risk for these two types of PCDs differently, as the underlying mechanisms for evaluative and mechanistic PCDs differ.

- Evaluative PCDs will either be: (a) fully delivered; (b) fully delivered with an alternative specification; (c) partially delivered; (d) partially delivered with an alternative specification; (e) delayed or (f) not delivered. In GD2, Cadent expects to fully deliver all evaluative PCDs. We therefore do not model risks associated with (c), (d) and (f) above, but instead focus on scenarios in which there is full delivery, but that delivery is delayed.
- Mechanistic PCD outcomes are different. For these PCDs, a target outcome is set, and any underdelivery relative to the target (or overdelivery in some cases) will cause a decrease (or increase) in the totex allowance. For mechanistic PCDs, we apply the same over/underspend risk as for modelled regressed totex.

Key sources of risk

- **Late delivery risk:** if Cadent delivers a project late, a late delivery penalty will be incurred (this applies to **evaluative PCDs**).
- **Volume risk:** if Cadent deviates from the target workload set, this will lead to an increase or decrease in the PCD allowance (this applies to **mechanistic PCDs**). This change in allowance means that our estimated baseline totex risk is either an overestimate (if the PCD allowance decreases) or an underestimate (if the PCD allowance increases), as totex risk is proportional to the magnitude of totex allowances.
- **Spending/modelling risk:** modelling and spending risk for baseline PCD allowances is already included in our estimate of baseline totex risk.

Coverage of our analysis for PCDs

London Medium Pressure	Tier 1 Mains Decommissioned
Grays Medium Pressure	Tier 1 Services
Tinsley Viaduct Diversion	Tier 1 Iron Stubs
FWACV Compliance	OTER

We apply a range of approaches to estimate risk for evaluative and mechanistic PCDs

	Risk category	Approach
A	London Medium Pressure, Grays Medium Pressure and Tinsley Viaduct Diversion	Estimate risk using construction delay data, and the GD3 baseline allowances given in the DDs
B	FWACV Compliance	Calculate a forecast of the GD3 allowance and estimate risk using construction delay data
C	Tier 1 Mains and Tier 1 Services	Estimate risk based on GD2 performance (outturn versus targets) and calculate forecast GD3 allowances
D	Tier 1 Iron Stubs	Estimate risk using GD2 Tier 1 Mains and Tier 1 Services performance, and estimate GD3 allowances
E	Operational Transport Emissions Reduction	Estimate risk using expert judgement and GD2 Commercial Fleet EV PCD performance, and calculate forecast GD3 allowances

A more detailed breakdown of each approach can be found in the method annex

General method overview

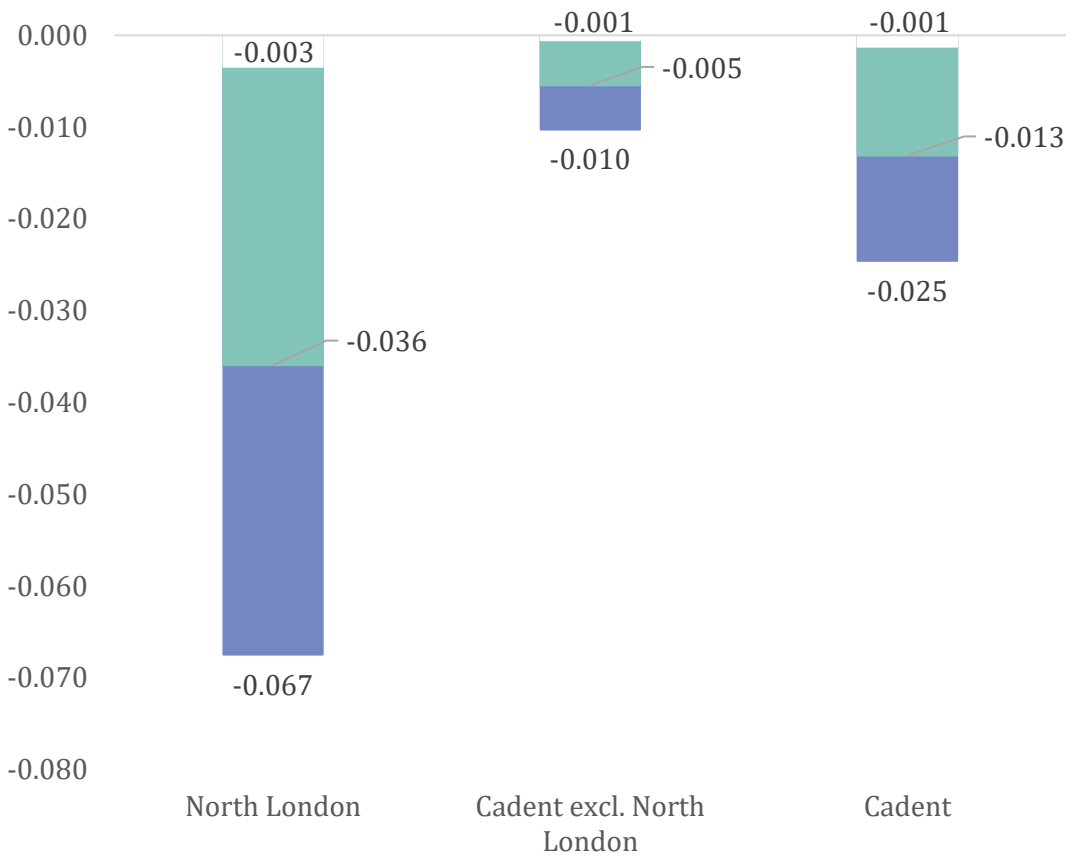
Evaluative PCDs:
For evaluative PCDs, we focus on delivery risk by estimating the penalties associated with late delivery. We do so by estimating the delay time in the P10, most likely and P90 outcomes, as well as the average % of projects delayed. Based on this, we calculate a forecast penalty for each network.

Mechanistic PCDs:
The risk for mechanistic PCDs stems from over/underdelivery. This is because any deviation from target workloads will change PCD allowances, which in turn impacts the magnitude of over/underspend risk.

To model risk for mechanistic PCDs, we use GD2 outturn data to forecast GD3 deviation from target workloads, which allows us to estimate a change in allowance for GD3. We then assess the over/underspend risk associated with this change in allowance, and account for the impact on overall totex risk.

Evaluative PCDs add downside risk for Cadent, due to penalties incurred from late delivery

Figure 12: Evaluative PCD risk under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

Our results show that for evaluative PCDs, the impact on the RoRE for Cadent is -0.013pp in the most likely outcome, whilst for North London this is -0.036pp. North London's larger negative impact on the expected RoRE reflects the fact that there are two London-specific evaluative PCDs – London Medium Pressure and Grays Medium Pressure.

Evaluative PCDs only have downside risk for Cadent as we model the spending/modelling risks associated with baseline evaluative PCD allowances in our baseline totex risk estimates.* Therefore, to avoid double counting with the baseline totex risk range, modelling and spending risk for baseline evaluative PCDs is not reflected in our risk ranges in this section.

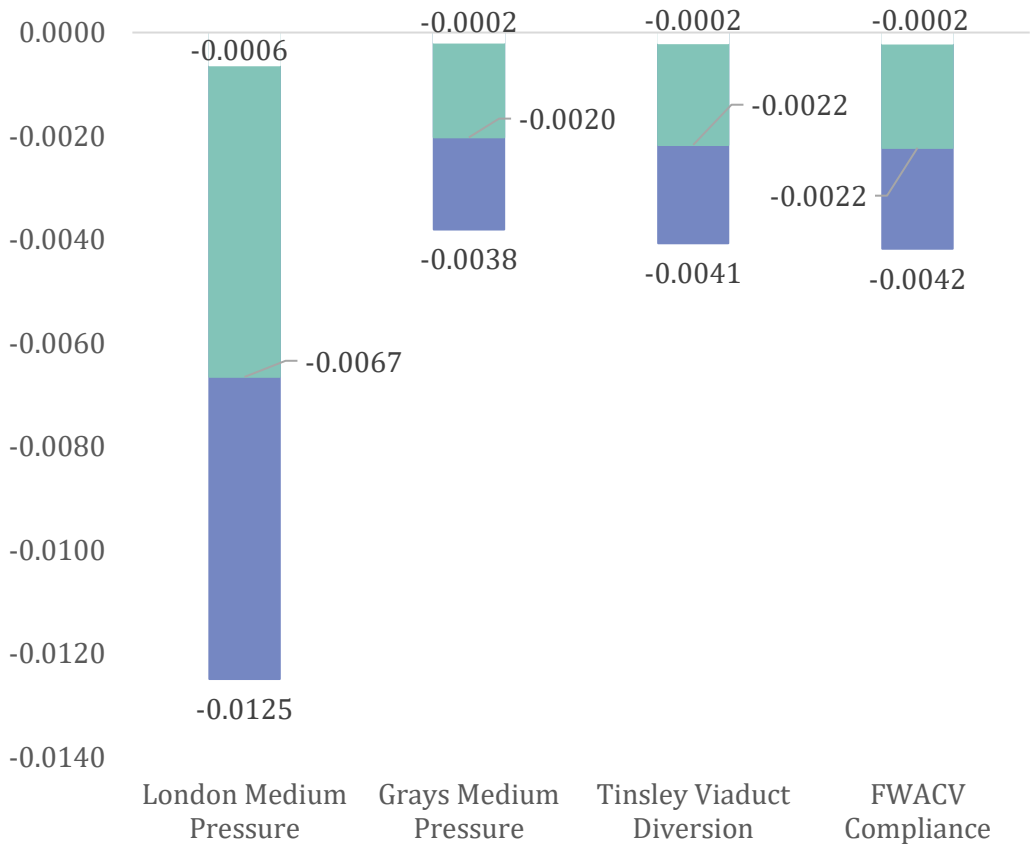
While risk associated with evaluative PCDs is small relative to other areas, it remains the case that it is one of several risks that Ofgem did not account for in the DDs.[31]

We have made some simplifying assumptions regarding the size of penalties in the absence of clear direction from Ofgem. More detail can be found on page 75.

**We note though that Ofgem models baseline totex risk as a whole and does not explicitly reference spending and modelling risk associated with baseline PCD allowances.*

London Medium Pressure has the largest negative impact on Cadent's RoRE out of all evaluative PCDs

Figure 13: Decomposition of evaluative PCD risk for Cadent under the GD3 DDs (impact on the RoRE, pp)



Source: Economic Insight analysis.

The figure to the left breaks down evaluative PCD RoRE risk for Cadent, by PCD. There are four evaluative PCDs at GD3:

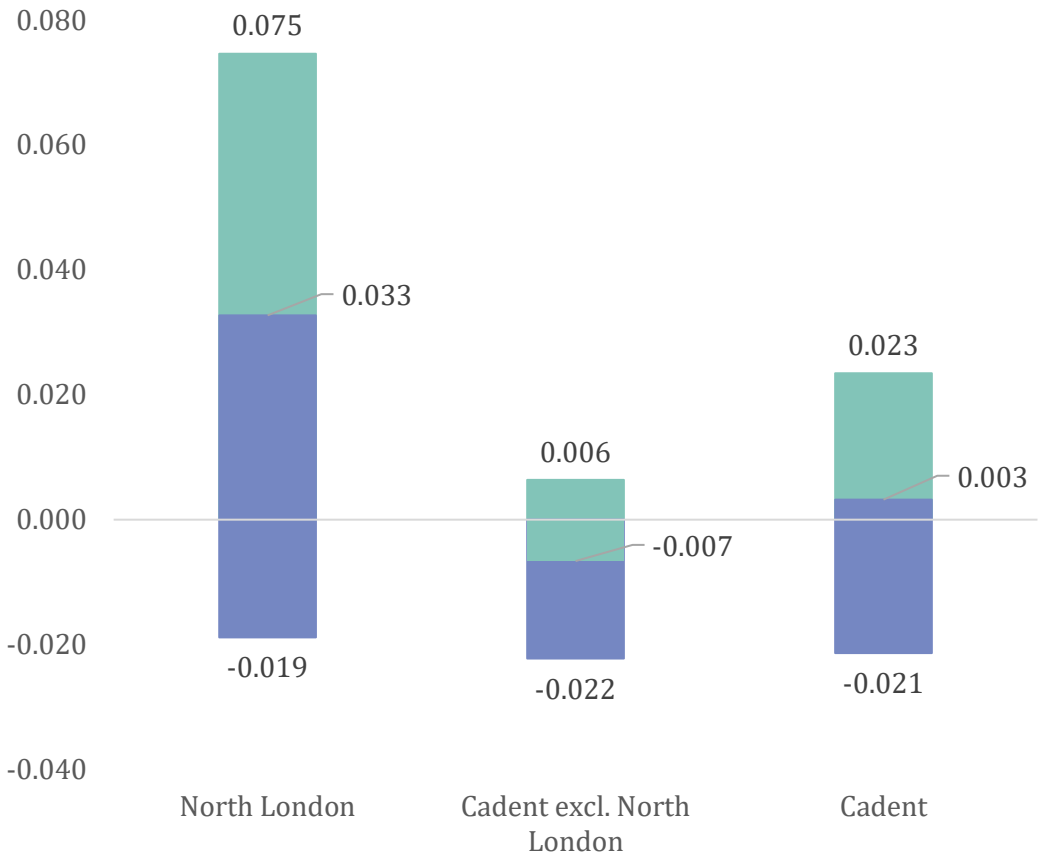
1. London Medium Pressure (LMP);
2. Grays Medium Pressure (GMP);
3. Tinsley Viaduct Diversion (TVD); and
4. Flow Weighted Average Calorific Value (FWACV) Compliance.

LMP has the largest impact on the RoRE amongst the four, with a P10 of -0.0125pp, a most likely value of -0.0067pp and a P90 of -0.0006pp. This reflects the fact that LMP has the largest baseline allowance (our method assumes that penalties are proportional to the magnitude of the PCD baseline allowance, which is covered in more detail in the method annex).

The risk associated with GMP, TVD and FWACV Compliance is smaller compared to the risk attributable to LMP.

Unlike the delivery risk for evaluative PCDs, mechanistic PCDs can have a positive or negative impact on the expected RoRE

Figure 14: Mechanistic PCD risk under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

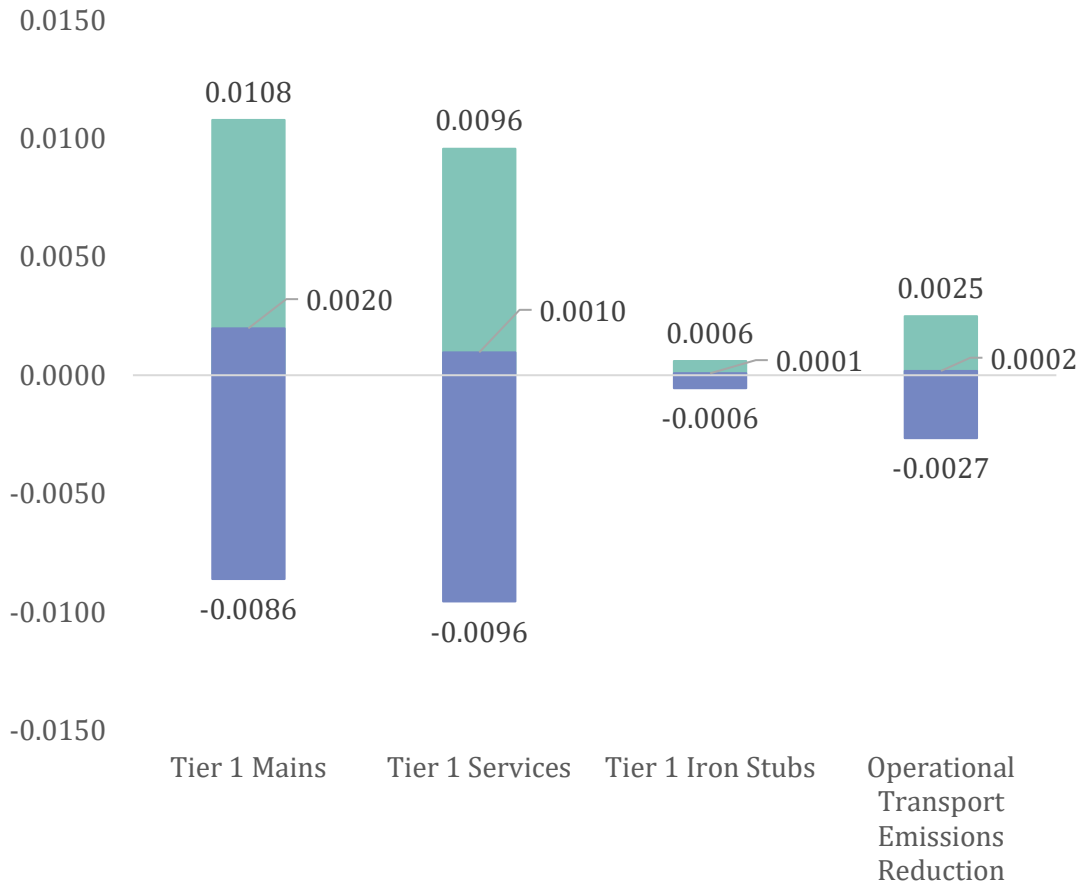
Mechanistic PCDs affect totex risk, as PCD allowance changes alter the overall totex allowance. Our analysis shows that mechanistic PCDs slightly reduce totex risk. This is discussed in more detail on page 46.

Our results show that for mechanistic PCDs, the most likely impact on the RoRE for Cadent (beyond that which is captured through baseline totex risk) is 0.003pp, whilst for North London alone this is 0.033pp.

The more positive expected impact on North London's RoRE is due to two factors: (i) North London is expected to have the largest underdelivery for most mechanistic PCDs in GD3; and (ii) North London is expected to have the largest % overspend relative to allowances. This is based on GD2 performance, and our assumption that PCDs and baseline totex share the same spending/modelling risk range.

Tier 1 Mains and Tier 1 Services account for most of the risk associated with mechanistic PCDs

Figure 15: Decomposition of mechanistic PCD risk for Cadent under the GD3 DDs (impact on the RoRE, pp)



Source: Economic Insight analysis.

The figure to the left breaks down the mechanistic PCD risk for Cadent by PCD. As before, this is the risk beyond that which is captured through baseline totex. We model risk for the four mechanistic PCDs at GD3: (a) Tier 1 Mains Decommissioned; (b) Tier 1 Services; (c) Tier 1 Iron Stubs and (d) Operational Transport Emissions Reduction (OTER).

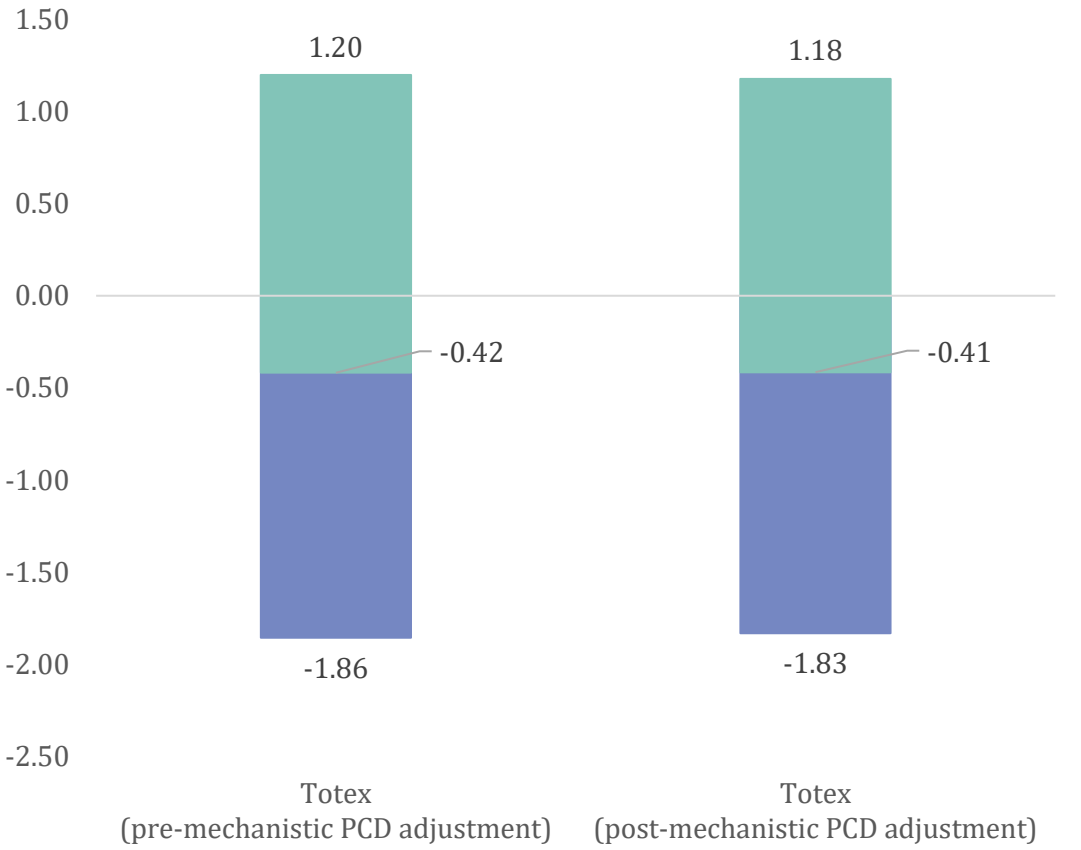
Tier 1 Mains and Tier 1 Services have the largest impact on the RoRE for Cadent, with P10s of -0.0086pp and -0.0096pp, most likely values of 0.0020pp and 0.0010pp, and P90s of 0.0108pp and 0.0096pp respectively.

The risk associated with OTER is significantly smaller, and for Tier 1 Iron Stubs smaller still, as they both account for a very small proportion of baseline totex.

Overall, the range of impacts on the RoRE from mechanistic PCDs is almost symmetrical, which implies a roughly equal probability of financial upside or downside in their impacts on Cadent's expected RoRE.

Mechanistic PCDs reduce the overall totex risk range marginally for both the P10 and P90 values, with the expected impact on the RoRE becoming less negative

Figure 16: Totex risk adjusted for mechanistic PCDs for Cadent under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

Mechanistic PCDs can change the totex allowance (due to over/underdelivery of mechanistic PCDs), and therefore the totex risk range (in % RoRE terms).

If there is an increase in PCD allowance due to overdelivery, the over/underspend risk associated with this change in allowance is added to the totex risk range. If there is a decrease in PCD allowance due to underdelivery, the PCD risk is subtracted from the overall totex risk range.

Our results show that mechanistic PCDs reduce totex risk marginally (as there is a net reduction in allowance from these PCDs in aggregate across the risk range), as shown on the figure to the left.

Taking mechanistic PCDs into account, the most likely impact of totex risk on Cadent's RoRE changes slightly from -0.42pp to -0.41pp. The negative totex impact on the RoRE decreases by 0.03pp in the P10 outcome, whilst the positive totex impact on the RoRE decreases by 0.02pp in the P90 outcome.

7. ESTIMATE OF GSOP RISK

GSOP expenditure is not funded through RIIO-3 at the DDs and so Cadent is fully exposed to any payments made, hence it is important to understand the risks GSOPs introduce

Introduction to GSOP risk

Guaranteed standards of performance (GSOPs) are license obligations that GDNs are required to follow. If a GDN violates a GSOP, it must make a payment to customers directly. Despite being a component of operating expenditure, with all GDNs incurring costs due to GSOP payments, they are not funded in the RIIO framework. Consequently, all GSOP expenditure is ultimately borne by the company's equity holders.

In the GD3 DDs, Ofgem does not acknowledge or quantify GSOP-related risk.[32] This is particularly concerning as GSOP risk can only reduce expected returns and so, if material, risks reducing the extent to which GDNs are a 'fair bet' for investors. By not including GSOP-related risk, Ofgem's GD3 DD risk analysis fails to accurately capture the true downside risks faced by the notional company at GD3. Our analysis seeks to improve upon Ofgem's RoRE risk range by capturing the risk posed to Cadent at GD3 due to GSOP expenditure.

Key sources of risk

There are two main sources of GSOP risk that Cadent faces:

- **Design risk:** the risk that Ofgem miscalibrates the price control such that the notional company cannot meet its GSOP obligations and so incurs costs due to GSOP payments.
- **Performance risk:** the risk that factors outside of company control cause it to not meet GSOPs, leading the notionally efficient company to incur GSOP payments.

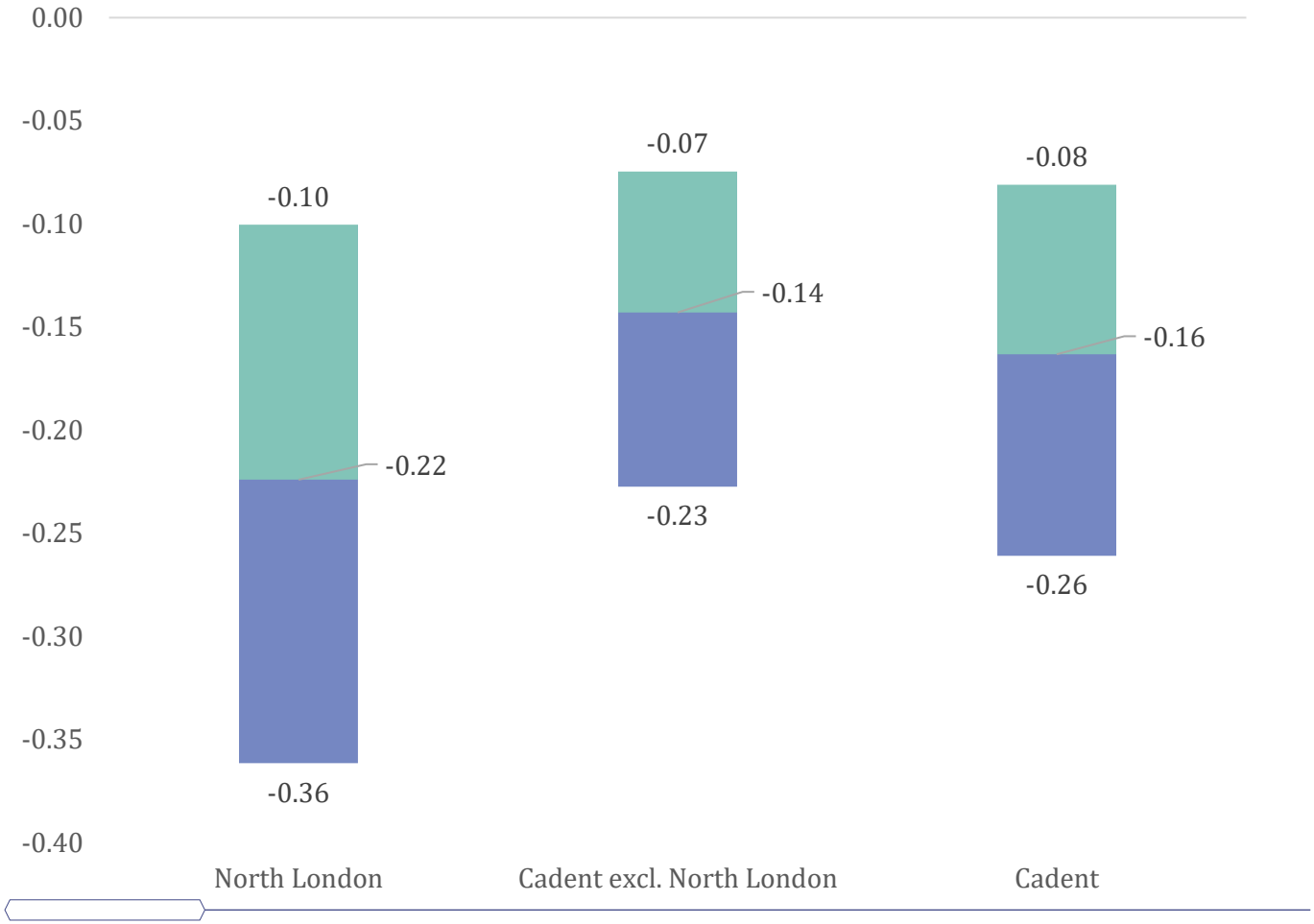
Our method for assessing GSOP risk is designed to capture both these sources of risk. We use historical GD2 GSOP expenditure data, which embodies both risks, to inform our assessment of GSOP risk for each Cadent network. See the method annex for a detailed breakdown of our approach. Note, we have separately assessed risks associated with GSOP 1 (Gas supply restoration following an unplanned interruption) due to Cadent's concern that the North London network is particularly exposed to GSOP 1 risk.

Coverage of our analysis for GSOPs

GSOP 1	All other GSOPS (2 to 14)

GSOP risk is material and has a negative impact on the expected RoRE for both the North London network and Cadent overall

Figure 17: GSOP risk under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

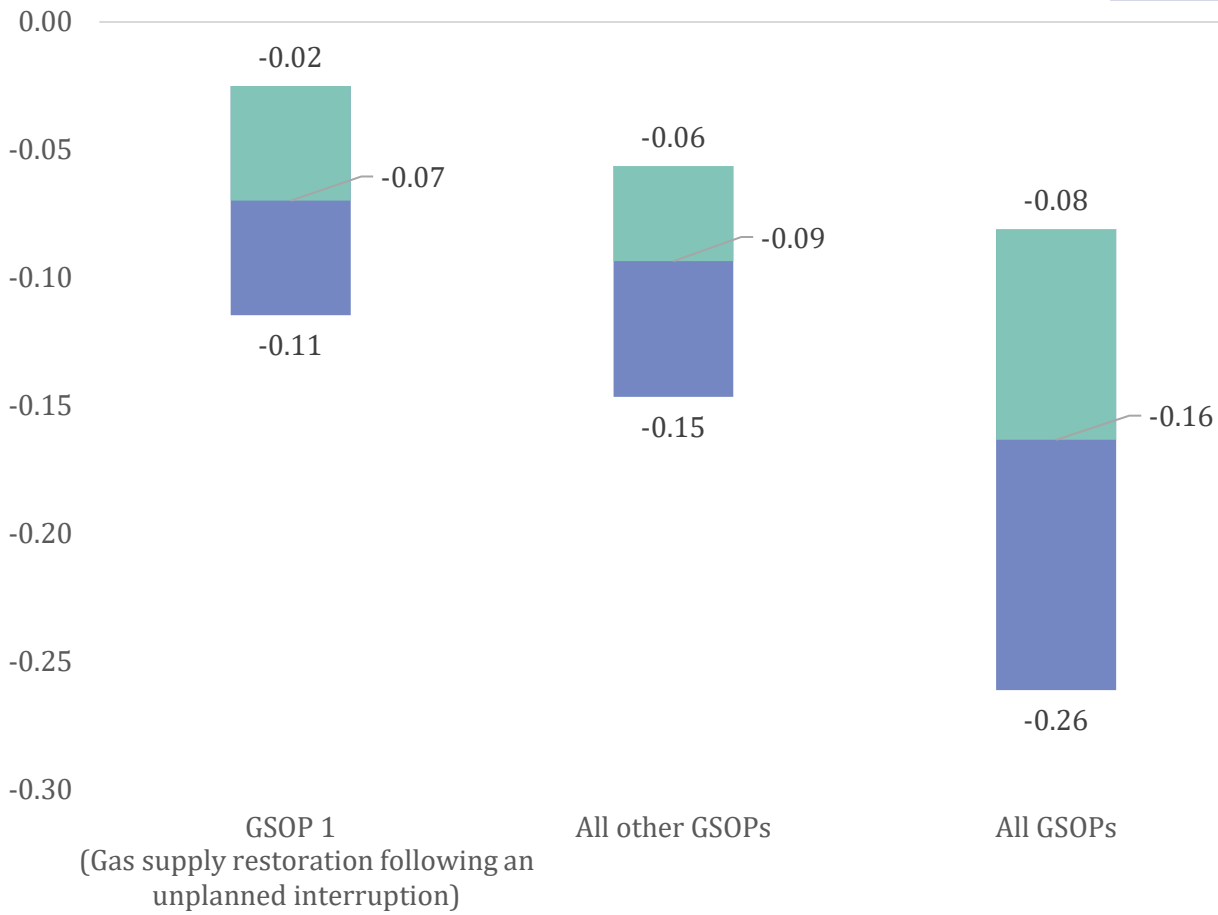
Our analysis shows that GSOPs have a negative impact on the expected RoRE for Cadent overall, of -0.16pp. Similarly, for the North London network, the impact on the expected RoRE from GSOPs is also negative, however the magnitude is greater, at -0.22pp, compared to the impact on the expected RoRE of all other Cadent networks, at -0.14pp.

Further to this, Cadent still faces a substantial negative impact on the RoRE even in optimistic outcomes, with GSOPs reducing the RoRE by 0.08pp in the P90 outcome.

The large difference in the expected impact of GSOPs on the RoRE between the North London network and other Cadent networks is largely driven by GSOP 1 (Gas supply restoration following an unplanned interruption), as shown on page 51.

GSOP 1 drives a significant proportion of all GSOP risk

Figure 18: Decomposition of GSOP risk for Cadent under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



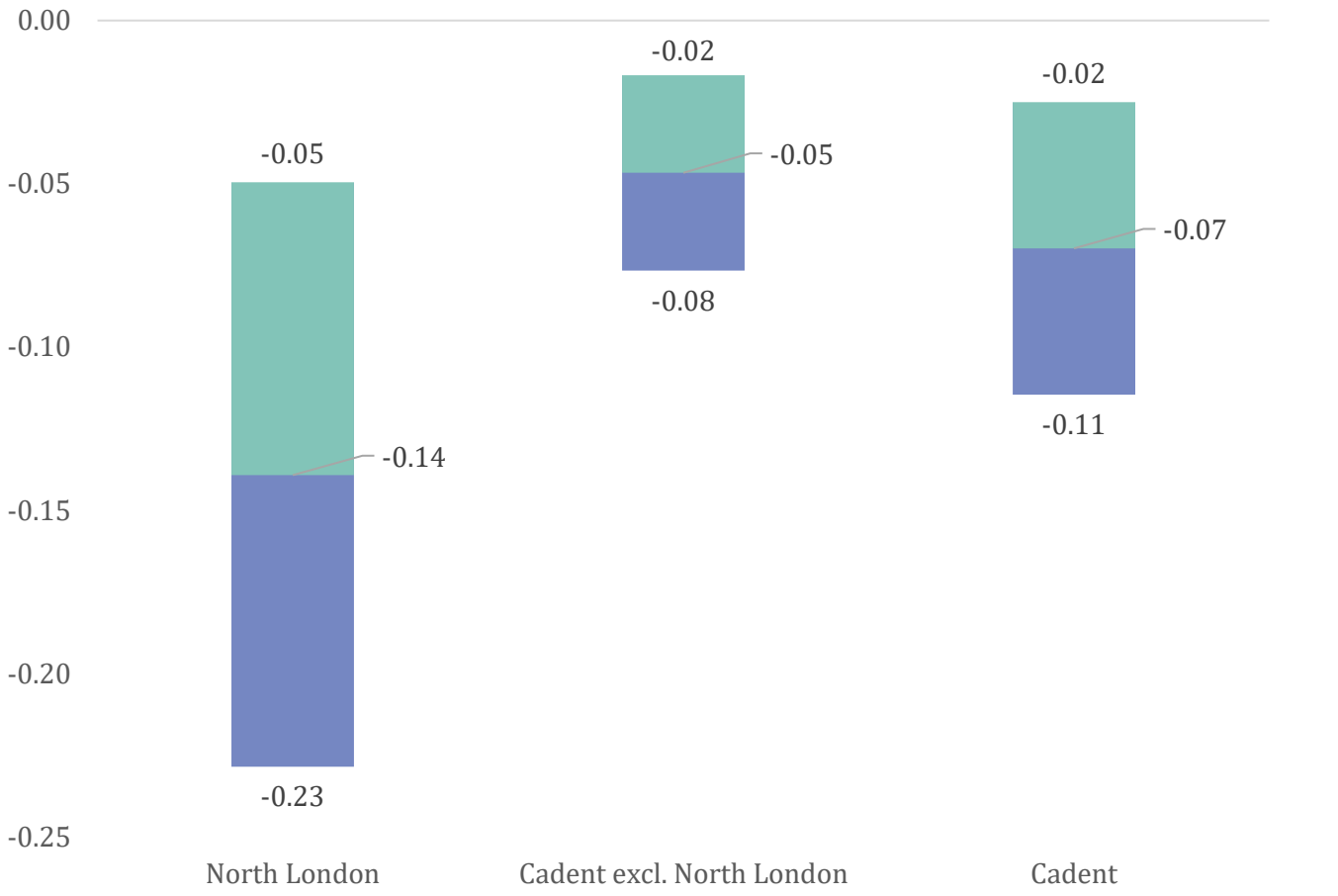
Approximately half of the negative impact on Cadent's expected RoRE due to GSOPs is driven by GSOP 1 (Gas supply restoration following an unplanned interruption), which alone reduces Cadent's expected RoRE by -0.07pp. In total, all GSOPs (including GSOP 1) reduce Cadent's expected RoRE by -0.16pp.

The remaining 13 GSOPs (covered under 'all other GSOPs' in the chart), have an expected impact on Cadent's RoRE of -0.09pp.

Source: Economic Insight analysis.

The magnitude of GSOP 1's negative impact on the expected RoRE is far greater for Cadent's North London network than all other Cadent networks

Figure 19: GSOP 1 risk under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

The negative impact on the expected RoRE due to GSOP 1 (Gas supply restoration following an unplanned interruption) is almost three times greater in magnitude (in pp RoRE terms) for Cadent's North London network, -0.14pp, than the impact on the expected RoRE of other Cadent networks, -0.05pp.

This is likely to be driven by the higher proportion of MOBs served by Cadent's North London network relative to other Cadent networks. This results in Cadent's North London network incurring greater GSOP 1 expenditure as the average duration of MOB unplanned interruptions is substantially longer than that of non-MOBs. Hence, as unplanned MOB interruptions are more likely to exceed the 24-hour GSOP 1 payment threshold, networks serving a greater number of MOBs, for instance Cadent's North London network, face greater downside risk from GSOP 1.

8. ESTIMATE OF UNCERTAINTY MECHANISM RISK

Uncertainty mechanisms have risks associated with modelling and spending, volumes and re-opener assessments

Introduction to UM risk

The RIIO framework includes uncertainty mechanisms (UMs), which adjust allowances during the price control period to deal with workloads and costs that are uncertain, ex-ante.

In the DDs, Ofgem omits many of the risks associated with UMs across: (a) volume drivers; and (b) re-openers.

a) **Volume drivers.** Ofgem attempts to assess modelling and spending risk associated with any expected volume driver allowances in baseline totex. However, as discussed in the baseline totex section, there are clear errors in Ofgem's modelling approach. Further, Ofgem does not consider the risks of potential in-period differences between volume driver outturns and targets, and the effect this has on totex allowances and risk.

b) **Re-openers.** Ofgem does not assess risk associated with re-openers at all in its analysis, which is a clear error. Re-opener allowances have totalled more than £100m in GD2 for Cadent, and therefore the RoRE risk due to this could be material.

Key sources of risk

- **Modelling/spending risk:** this is similar to the risk for baseline totex, and applies to volume driver and re-opener allowances. Specifically, it is the risk that Cadent over/underspends relative to allowances associated with volume drivers or re-openers (on a per unit basis).

- **Volume risk**: if Cadent deviates from the target workload set, this leads to an increase or decrease in the volume driver allowance (in a similar manner to mechanistic PCDs). This risk changes the magnitude of the modelling/spending risk above. If outturn volumes are higher than target, this increases totex allowances, thereby increasing the totex risk compared to the baseline totex risk range. Conversely, if outturn volumes are lower than target, this decreases totex allowances, thereby reducing totex risk compared to the baseline totex risk range.

- **Re-opener assessment risk:** the additional risks associated with re-opener assessment are that: (i) Cadent might require re-opener allowances due to unforeseen circumstances; and (ii) there are likely to be differences between the amount spent on a re-opener, and the allowances given by Ofgem. For example, this difference could occur if Ofgem deems the work carried out by Cadent to be cost inefficient, or not meeting the re-opener scope.

Coverage of our analysis for uncertainty mechanisms

Tier 2A Mains and Services Replacement volume driver	12 re-openers
Safety Disconnections volume driver	

We apply a range of approaches to estimate risk for uncertainty mechanisms

	Risk category	Approach
A	Tier 2A Mains and Servies Replacement volume driver	Estimate risk based on GD2 performance (outturn versus targets) and calculate forecast GD3 allowances
B	Safety Disconnections volume driver	Use expert judgement and data provided by Cadent for our estimate of forecast change in allowance at GD3
C	Re-openers	Calculate GD2 difference between re-opener allowances and spend, and use this to estimate GD3 overspend. We supplement this with Cadent expert judgement

A more detailed breakdown of each approach can be found in the method annex

General method overview

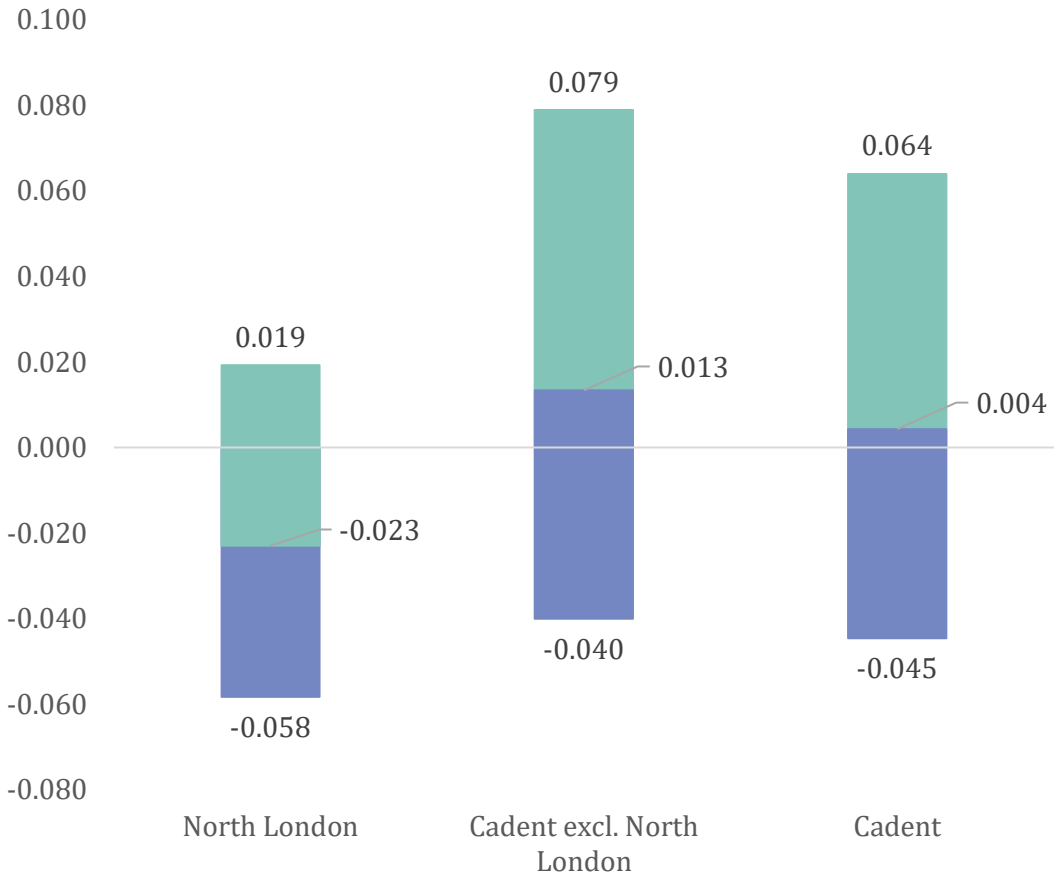
Volume drivers:
The risk for volume drivers stems from over/underdelivery. This is because any deviation from target workloads will change totex allowances from baseline, which in turn impacts the magnitude of over/underspend risk.

To model risk for volume drivers, we use a mix of GD2 outturn data and expert judgement to inform our forecast GD3 change in allowance. We then assess the over/underspend risk associated with this change in allowance, and account for the impact on overall totex risk.

Re-openers:
We model re-opener risk by estimating, for GD3, the forecast spend and the forecast allowance for re-openers at the network level. Based on this, we calculate the overspend in the P10, most likely and P90 outcomes using the modelled regressed cost % over/underspend risk range. In some cases, the forecast spend will not be eligible for re-openers under the DDs, and therefore the allowances are zero. This captures both the modelling/spending risk associated with re-opener allowances, and the re-opener assessment risk.

Volume drivers primarily add to downside risk for the North London network, with the expected impact on the RoRE positive for Cadent as a whole

Figure 20: Volume driver risk under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

Volume drivers affect totex risk, as volume driver allowance changes alter the overall totex allowance. Any modelling and spending risk associated with baseline volume driver allowances is covered in the baseline totex section. Any modelling and spending risk associated with changes to allowances, due to expected volume driver outturns being different to target, is covered in this section.

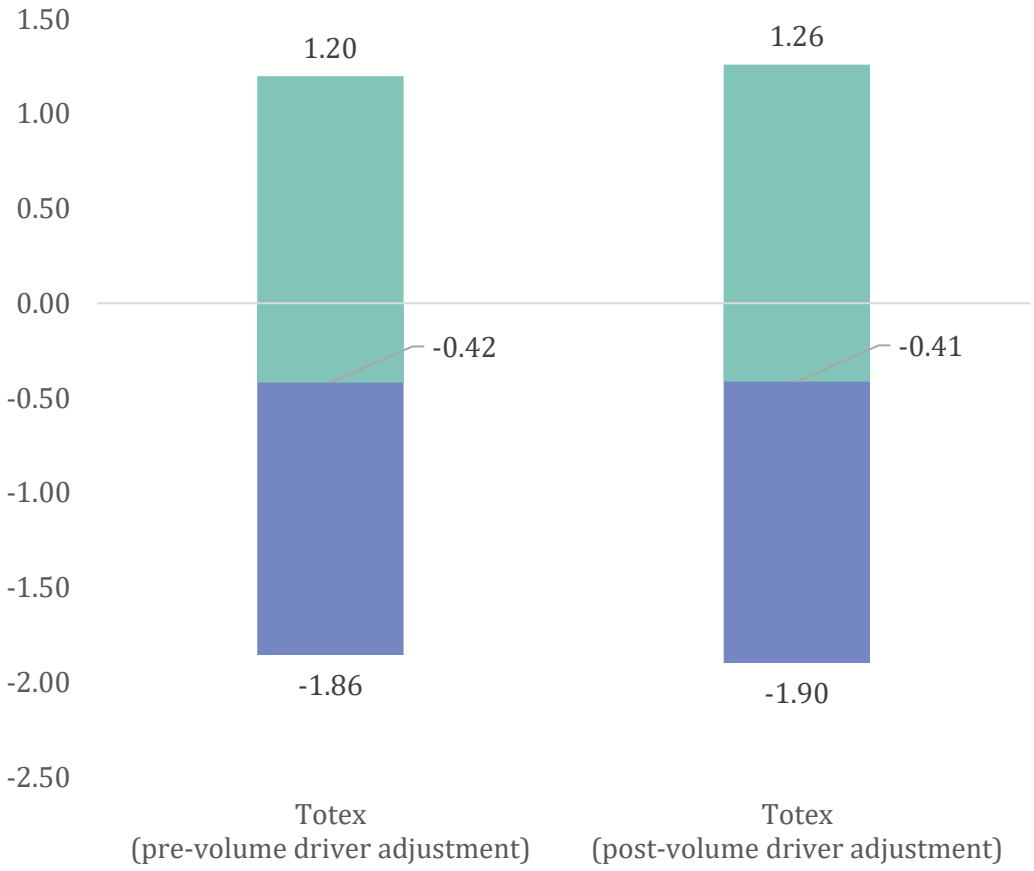
Our results show that for volume drivers, the most likely impact on the RoRE for Cadent is 0.004pp, whilst for North London it is -0.023pp. North London's negative expected impact on the RoRE is due to the North London network having the greatest expected totex overspend and an expected net increase in volume driver allowances.

The risk attributable to Tier 2A Mains and Services Replacement is low compared to other UMs as the forecast allowances associated with this volume driver is relatively small. Therefore, the risk ranges shown on the left are primarily being driven by the Safety Disconnections volume driver.

While risk associated with volume drivers is small relative to other areas, it remains the case that it is one of several risks that Ofgem did not account for in the DDs.[33]

Volume drivers are expected to widen the totex risk range, with the expected impact on the RoRE becoming less negative

Figure 21: Baseline totex risk adjusted for volume drivers for Cadent under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

Volume drivers can change the totex allowance (due to over/underdelivery of volume drivers), and therefore the totex risk range (in % RoRE terms).

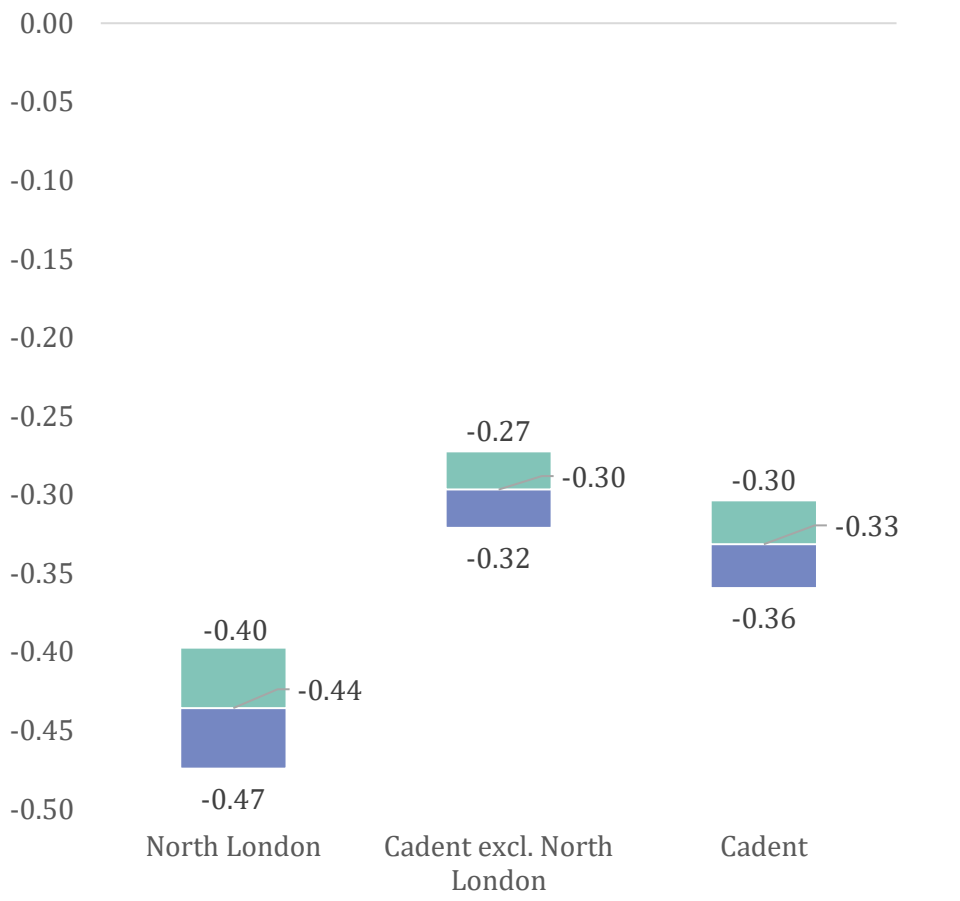
- If there is an increase in volume driver allowance due to overdelivery, the over/underspend risk associated with this change in allowance is added to the totex risk range, causing the totex risk range to become wider.
- If there is a decrease in allowance due to underdelivery, the volume driver risk is subtracted from the overall totex risk range, causing the totex risk range to become narrower.

During GD3, we have estimated that, across the two volume drivers, there will be a net increase in allowances in all outcomes (driven by the large expected increase in allowances for Safety Disconnections).

As shown in the figure to the left, this expected increase in allowance does indeed widen the totex risk range. The most likely impact of totex on the RoRE changes slightly from -0.42pp to -0.41pp. The negative RoRE impact at the P10 outcome increases by 0.04pp, whilst the positive RoRE impact at the P90 outcome increases by 0.06pp.

Re-openers account for a large proportion of RoRE risk, and only add to the downside for Cadent

Figure 22: Re-opener risk under the GD3 DDs, simple aggregation (impact on the RoRE, pp)



Source: Economic Insight analysis.

Our analysis shows that re-openers are a significant source of downside risk for Cadent. The expected impact on Cadent's RoRE is -0.33pp, with a P10 impact of -0.36pp, and a P90 impact of -0.30pp. Ofgem does not consider re-opener risk in the GD3 DDs,[34] and so has made an error, given it is a material source of risk that Cadent faces.

Whilst re-openers can mitigate downside risk by providing allowances for unforeseen spending in the GD3 period, they do not mitigate downside risk entirely, in the expected outcome. This is due to expected spend being higher than expected allowances, which can occur for two reasons:

a) **Re-openers are not funded in full.** Ofgem may not provide allowances for the full re-opener application, for example if it considers the spend to be inefficient. In GD2, increased allowances due to re-openers was only ~75% of the additional spend requested by Cadent We assume in our analysis this continues for GD3.

b) **Required spending is not eligible for re-openers.** This is spending that is required for the efficient company but cannot be recovered anywhere else in the price control, and so is entirely overspend.

Thus, it is unlikely that there is any scope for underspend, as the difference between the required spend for an efficient company and Ofgem's allowance, will typically be greater than the magnitude of underspend, even in the best-case scenario.

The RoRE impacts shown on the left are the combined impacts (simple aggregation) of 12 re-openers. North London has the largest expected overspend across these 12 re-openers, causing the impact on North London's RoRE to be more negative than for Cadent as a whole.

9. ESTIMATE OF BPI RISK

Whilst not a source of risk, the Business Plan Incentive does influence the expected RoRE for Cadent

Introduction to BPI 'risk'

The BPI is intended, in theory: (i) to overcome information asymmetries between Ofgem and the companies; and (ii) to motivate companies to develop high-quality and ambitious business plans. As such, each company receives a reward or penalty depending on Ofgem's assessment of the quality of its business plan. Whilst this is not a risk per-se, as the BPI payment is a fixed quantity at the final determinations (FDs), the BPI payment can increase or decrease a network's expected equity return.

In the DDs, Ofgem included the BPI in its assessment of RoRE risk at GD3.[35] However, Ofgem makes an error in its implementation of the BPI adjustment to the RoRE risk range. Ofgem applies the BPI in its 'max' scenario only, which suggests that the BPI reward is available in this scenario only, for Cadent. However, given the BPI for Cadent is a fixed quantity that does not vary across different outcomes, it should be applied consistently to all outcomes in the RoRE risk range. Therefore, Ofgem's most likely value and risk ranges are wrong, because the BPI is omitted from all scenarios except the 'max'.

Key sources of risk

There is no risk per-se from the BPI, as the BPI payment is a fixed quantity that a company receives. Each company knows the BPI payment it receives and there is no uncertainty over this value post-FDs. Whilst there may be a risk that the BPI payment changes between the DDs and the FDs, we have not sought to consider this risk as the aim of our risk modelling is to estimate the risk for the notional company if Ofgem's final position for GD3 remains the same as at DDs.

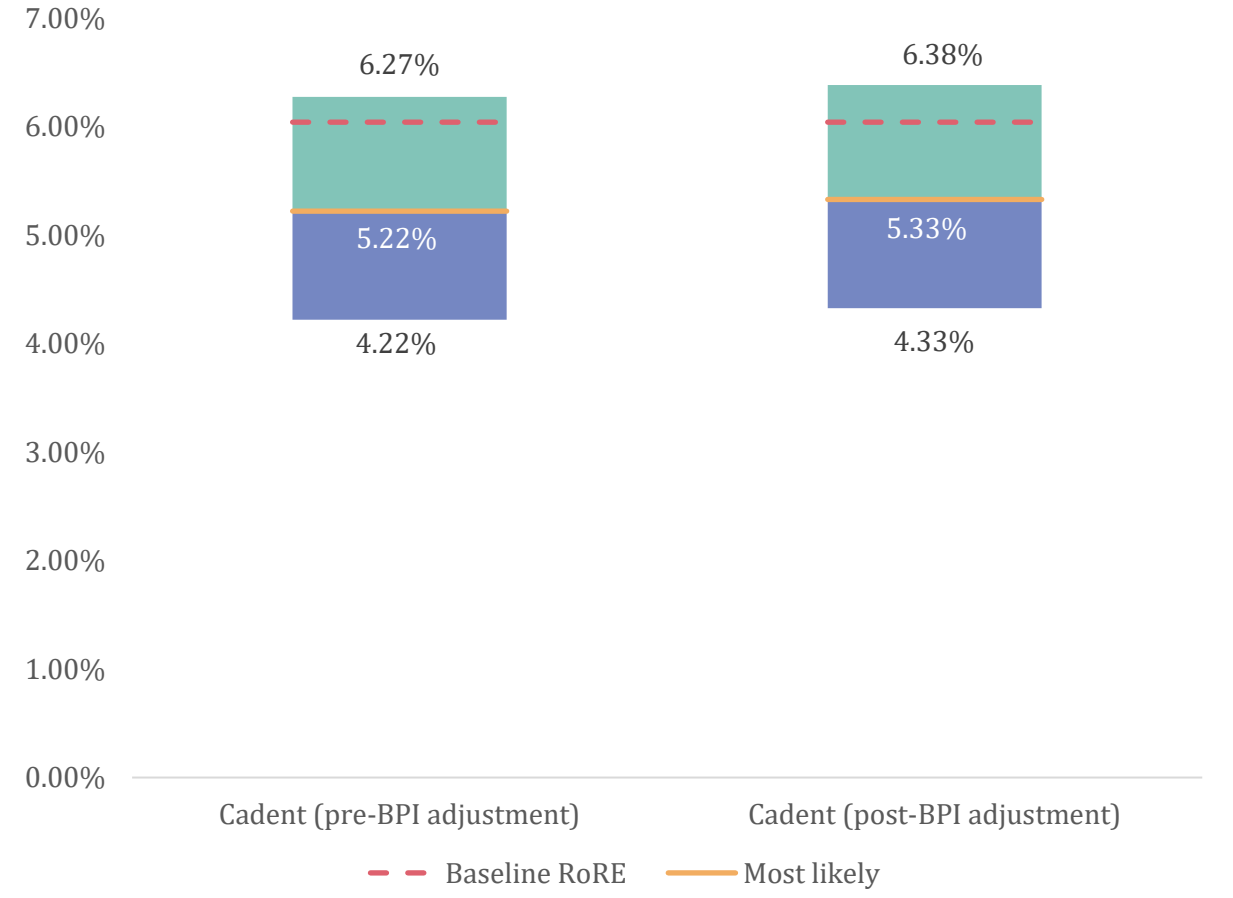
Overview of our method

Despite there being effectively no risk from the BPI, we still consider it necessary to include the BPI in our overarching method for this analysis, as it has a material impact on expected RoRE. Therefore, it is relevant in the consideration of whether the price control represents a 'fair bet' for the notional company.

The BPI impacts Cadent's RoRE in all outcomes (P10, most likely, P90) by the same amount, as it is a fixed quantity. Therefore, to quantify the impact of the BPI on Cadent, we shift the overall RoRE risk range by the value of the BPI payment. In this case, since the BPI payment for Cadent at the DDs is positive, the RoRE risk range is shifted upwards.

The addition of the BPI shifts Cadent's RoRE risk range upwards in all potential outcomes

Figure 23: Cadent risk relative to the cost of equity pre- and post-BPI under the GD3 DDs, Monte Carlo aggregation (% RoRE)



Source: Economic Insight analysis.

Based on the BPI methodology and the DDs, we understand Cadent will receive a BPI payment of 0.11pp of RoRE. This causes the RoRE risk range for Cadent to shift upwards relative to the baseline allowed return on equity by this amount. This applies for all potential outcomes, including the P10, most likely, and P90 outcomes.

It is our understanding that there were errors in Ofgem's calculation of the BPI for Cadent as published at the DDs. Cadent has provided a corrected BPI figure. Therefore, we use the corrected figure for our analysis, rather than the figure published in the DDs.

10. ESTIMATE OF NARM RISK

The Network Asset Risk Metric and its associated incentive mechanism can increase or decrease Cadent's expected RoRE at GD3

Introduction to NARM risk

The NARM Funding Adjustment and Penalty Mechanism is designed to incentivise companies to keep network asset risk within reasonable bounds, by: (i) adjusting NARM allowances up or down in line with outturn (justified) NARM risk output delivery and (ii) penalising unjustified underdelivery relative to NARM risk output targets. This exposes companies to risk at GD3.

Ofgem does not quantify risk related to the NARM in its DD analysis.[36] However, the NARM Funding Adjustment and Penalty Mechanism does have the potential to increase or decrease the RoRE for the notional company, as a result of factors outside of management's control. Therefore, it is important to consider the NARM Funding Adjustment and Penalty Mechanism in quantifying the extent of risk that Cadent faces at GD3.

Key sources of risk

- **Modelling and spending risk:** as per baseline totex-related risk, for baseline NARM delivery volumes.
- **Volume risk:** the risk that outturn NARM volumes are more or less than expected, with associated over/underspends on these volumes.
- **Justification risk:** Ofgem does not deem the NARM delivery that is greater or less than the baseline NARM delivery volumes to be 'justified'. This results in expenditure on NARM overdelivery not being funded, and financial penalties for unjustified underdelivery.

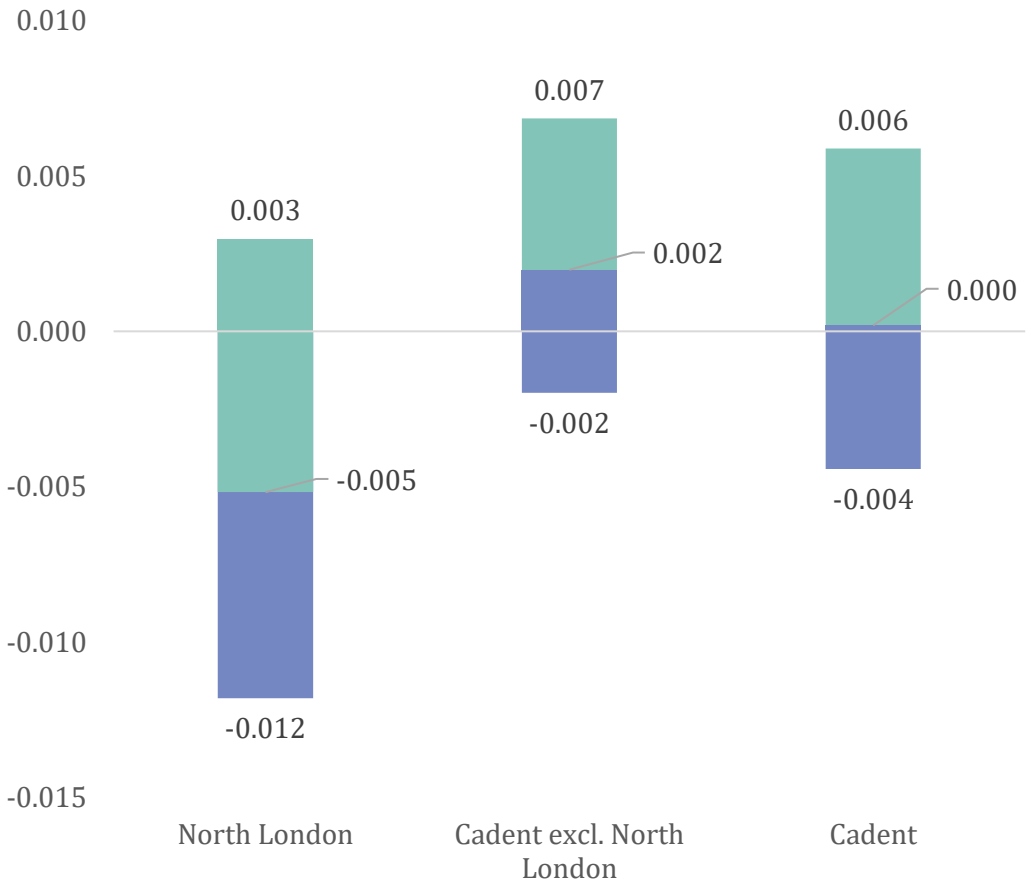
Overview of our method

Our method for assessing NARM risk is designed to capture the volume risk associated with the NARM Funding Adjustment and Penalty Mechanism. Modelling and spending risk related to NARM is already captured in baseline totex risk, and justification risk is not estimated since each Cadent network's NARM delivery is expected to fall within the 5% delivery deadband across the performance distribution. Given that justification risk is downside only, this ensures that our analysis is conservative.

We quantify NARM risk by applying Ofgem's NARM Funding Adjustment and Penalty Mechanism to the expected level of over/underdelivery on NARM risk outputs. We use this to inform the expected change in NARM allowances at GD3. The risk associated with additional NARM allowances is then assumed to be proportional to the risk associated with modelled regressed costs, so we subsequently apply the over/underspend % implied by the modelled regressed risk range to these additional allowances.

NARM-related risk at GD3 is limited, since Cadent is likely to perform within the NARM delivery deadband

Figure 24: NARM risk under the GD3 DDs (impact on the RoRE, pp)



Source: Economic Insight analysis.

Our estimated NARM-related impact on Cadent's RoRE is -0.004pp in the P10 outcome and 0.006pp in the P90 outcome. This is very narrow in comparison to Cadent's overall RoRE risk range, suggesting the NARM has a limited impact on Cadent's overall RoRE risk position. This is because each Cadent network is forecast to perform within the 5% NARM delivery deadband at GD2, whereby any over or underdelivery is presumed to be justified, with allowances adjusted accordingly. We assume that performance will remain within this deadband at GD3 for each Cadent network in all potential outcomes, including the P10, most likely, and P90 outcomes. As a result, we do not consider there to be material justification risk at GD3 for Cadent.

For Cadent as a whole, the NARM risk range is broadly symmetrical around an impact on the RoRE of 0pp. However, for the North London network, the impact on the RoRE in the most likely outcome is negative. This is because the efficiency scores – used to estimate risk on any extra NARM allowances received via the NARM Funding Adjustment mechanism – imply a higher expected overspend in GD3 for North London than Cadent's other networks.

As Ofgem finalises the implementation of its Clearly Identifiable Over/Underdelivery (CIO/UD) mechanism, it may be the case that additional RoRE risks associated with the NARM could materialise. Given the uncertainty surrounding Ofgem's methodology at the DD stage, we have not reflected this in our analysis.

ANNEX

ANNEX CONTENTS

ANNEX A: METHOD DETAILS

Method for assessing modelled regressed cost risk

A. Estimate most likely performance

A

The efficiency scores from Ofgem's regression model are used to inform the most likely over/underspend relative to cost allowances at GD3, for each Cadent network. Specifically, for each network we take an average of the annual efficiency scores over GD2 and GD3. Scores from both GD2 and GD3 are used as this is the data period used by Ofgem to estimate efficient costs at GD3.

Since efficiency scores are the ratio of actual costs (historical or forecast) against modelled costs, this is directly comparable to overspend, i.e., an efficiency score of 1.10 corresponds to an effective overspend of 10% against modelled allowances.

We understand that there are several errors in Ofgem's totex model that could influence the efficiency scores. Therefore, we perform our analysis using the efficiency scores from a corrected version of the totex model (provided by Cadent).

B. Estimate P10 and P90 performance

B

To inform the P10 and P90 % overspends, the variation in efficiency scores for all 8 networks is used.

In doing so, we calculate the percentage difference between annual efficiency scores and the average efficiency score for each network. We then take the 10th and 90th percentile of these differences to get the P10 and P90 difference from the mean efficiency score, for the industry. These are then added to the most likely efficiency score for each Cadent network, giving the P10 and P90 efficiency scores.

This method assumes that whilst the actual efficiency scores of different networks are not representative of Cadent's performance (e.g., because some companies are more efficient than others), the variability in other networks' performance is representative of the variability in Cadent's performance.

C. Convert to distribution of % RoRE

C

The P10, most likely, and P90 % over/underspend implied by the GD3 efficiency scores are then converted to a distribution of % RoRE, for each Cadent network.

This involves the following:

- Multiplying the GD3 modelled regressed cost allowances by this percentage, which gives the expected level of £s over/underspend in the P10, most likely, and P90 outcomes.
- Converting these outcomes to a triangular distribution of over/underspend.
- Applying the TIM to convert this distribution to the financial impact on each network.
- Dividing by each network's regulated equity, to convert the distribution from £s to % RoRE.

Method for assessing non-regressed modelled and technically assessed cost risk

A. Estimate most likely performance

A

We assume that risk associated with non-regressed modelled costs (excluding streetworks) and technically assessed costs is proportional to the risk associated with modelled regressed totex.

Therefore, we assume that the most likely percentage over/underspend relative to allowances implied by the modelled regressed efficiency scores for a network is applicable to these cost areas as well.

B. Estimate P10 and P90 performance

B

As with the most likely value, the P10 and P90 values of percentage over/underspend relative to cost allowances for modelled regressed costs are applicable to these cost areas.

C. Convert to distribution of % RoRE

C

The P10, most likely, and P90 % over/underspend estimated in the previous steps are then converted to a distribution of % RoRE, for each Cadent network.

For non-regressed modelled costs (excl. streetworks.), we adjust the GD3 non-regressed modelled cost allowances to exclude streetworks.

We then multiply the allowances for non-regressed modelled costs (excl. streetworks) and technically assessed costs by the P10, most likely and P90 % over/underspend.

To convert this to a % RoRE distribution, we then:

- Convert these outcomes to a triangular distribution of over/underspend.
- Apply the TIM to convert this distribution to the financial impact on each network.
- Divide by each network's regulated equity, to convert the distribution from £s to % RoRE.

Method for assessing streetworks cost risk

A. Estimate most likely performance

A

The most likely level of performance for each network is estimated using Ofgem's streetworks cost model. Performance in this case is measured as the % over/underspend relative to streetworks modelled allowances.

To implement this method, we take the modelled streetworks costs for the years 2022-2031 from Ofgem's GD3 streetworks model and take the percentage difference between annual actual/forecast streetworks expenditure (which include penalties and charges) and modelled costs (which exclude penalties and charges), for each network. The most likely value for each network is the average percentage difference between modelled costs and actual/forecast costs.

We use the GD3 streetworks model instead of other methods (e.g., comparing past performance to past allowances) as this: (i) captures the GD3 modelling risk and (ii) ensures costs and allowances can be compared directly, without adjustments, e.g., for gross/net costs or OE.

B. Estimate P10 and P90 performance

B

To inform the P10 and P90 % overspends on streetworks, the industry variation in streetworks performance is used, again based on the GD3 streetworks model.

We calculate the percentage difference between annual outturn/forecast and average streetworks spending from 2022-2031, for each network. Taking the 10^{th} and 90^{th} percentiles of these differences gives the P10 and P90 difference from the mean in terms of streetworks spend across the industry. We then apply these to the most likely % over/underspend for each Cadent network, giving the P10 and P90 % over/underspend for each Cadent network.

As with the method for modelled regressed costs, this assumes that industry variation in performance is representative of the variation in Cadent's streetworks expenditure.

C. Convert to distribution of % RoRE

C

The P10, most likely, and P90 % over/underspends estimated from Ofgem's streetworks cost model are then converted to a distribution of % RoRE, for each Cadent network.

This involves the following:

- Multiplying the GD3 streetworks allowances by this percentage, which gives the expected level of £s over/underspend in the P10, most likely, and P90 outcomes.
- Converting these outcomes to a triangular distribution of over/underspend.
- Applying the TIM to streetworks spend convert this distribution to the financial impact on each network. This is not applied to the proportion of streetworks costs estimated to be incurred from penalties and charges at GD3, since penalties and charges are not subject to the TIM.
- Dividing by each network's regulated equity, to convert the distribution from £s to % RoRE.

Method for assessing ongoing efficiency risk

A. Estimate most likely performance

A

Cadent's most likely level of ongoing efficiency is assumed as 0.5% per year. This is because: (a) this is the efficiency assumption proposed in Cadent's business plan;[37] and (b) this is also the midpoint of the Economic Insight 'plausible range' of OE for GDNs over GD3.[38]

To estimate the impact of this efficiency assumption, we re-estimate Ofgem's reduction in allowance from OE in its cost model, for each network, using 0.5% OE in place of Ofgem's 1% OE assumption. We calculate the difference between the OE disallowance under Ofgem's assumption and our assumption, which is effectively the overspend each Cadent network faces from Ofgem setting an overly stretching OE target.

We understand that there are errors in Ofgem's application of its OE assumption in the DDs cost model. Therefore, we perform our analysis using a corrected version of Ofgem's model (provided by Cadent).

B. Estimate P10 and P90 performance

B

The P10 and P90 OE outcomes are estimated using the high and low case from Economic Insight's 'plausible range' of ongoing efficiency for GDNs over GD3: 0.2% and 0.8% per year.

As with the most likely value, we re-estimate the OE disallowances in Ofgem's cost model for each Cadent network using these different assumptions and compute the difference between these disallowances and Ofgem's estimated disallowance. This provides the effective overspend in the P10 and P90 outcomes Cadent faces from Ofgem setting the OE target at a different level to the OE Cadent actually experiences in the P10 and P90 OE outcomes.

C. Convert to distribution of % RoRE

C

The P10, most likely, and P90 £s impact from the difference between Cadent and Ofgem's OE assumptions are then converted to a distribution of % RoRE, for each Cadent network. This involves the following:

- Converting these outcomes to a triangular distribution of performance.
- Applying the TIM to convert this distribution to the financial impact on each network.
- Dividing by each network's regulated equity, to convert the distribution from £s to % RoRE.

Method for assessing regional factors risk

We quantify the *additional* risk from regional factors (RFs) not already captured by the efficiency scores used in the modelled regressed risk calculation. These risks include: (i) the risk that the forecast indices used to calculate the RF differ from the true value of these indices; and (ii) Cadent over /underspends relative to its RF allowance. We model risk associated with labour and reinstatement RFs in detail, as we consider risk is most material here. For other RFs, we assume risk is proportional to modelled regressed cost risk, noting that this is conservative and the true risk may be greater.

A. Estimate most likely performance

A

The efficiency scores used elsewhere in our totex analysis already capture the risk that, in expectation, the true regional adjustment required differs from Ofgem's calculated regional adjustment. Therefore, we do not quantify this risk here. Instead, we estimate the risk that Cadent over/underspends relative to Ofgem's regional factor allowance in the most likely outcome.

In doing so the most likely performance for each regional factor is calculated as Ofgem's regional factor allowance for each network multiplied by the expected % over/underspend, informed by the modelled regressed cost risk.

B. Estimate P10 and P90 performance

B

(i) Labour / urbanity reinstatement:
We calculate the risk that the outturn labour index differs from the ex-ante index used by Ofgem, due to the difficulty in forecasting indices. To do so, the P10 and P90 £s impacts are calculated based on the variation in the difference between Cadent's proposed and Ofgem's labour index. We take the 10th and 90th percentile of this variation and multiply this by Ofgem's RF allowances to get the P10 and P90 performance in £s terms.

(ii) All regional factors:
Ofgem's RF allowances for each network are multiplied by the P10 and P90 over/underspend, informed by the modelled regressed cost risk. This provides the risk of over/underspend at the P10 and P90. The £s values from (i) and (ii) are then summed, to get the P10 and P90 £s effective over/underspend with respect to RF allowances, for each Cadent network.

C. Convert to distribution of % RoRE

C

The P10, most likely, and P90 £s impact are converted to a distribution of % RoRE for each Cadent network.

This involves the following:

- Converting these outcomes to a triangular distribution of over/underspend.
- Applying the TIM to convert this distribution to the financial impact on each network.
- Dividing by each network's regulated equity, to convert the distribution from £s to % RoRE.

We only quantify the risk that the outturn index differs from Ofgem's ex-ante index for labour / reinstatement RFs. This is because: (i) we consider the risk most material here; and (ii) we wish to take a conservative approach to risk analysis.

Method for assessing real price effects risk

The quantified risk arising from real price effects (RPEs) is that GDNs over/underspend Ofgem's ex-post RPE allowance adjustment, since Ofgem does not capture the true effect of changes in input prices on totex over the price control period. This risk could emerge due to: (i) Ofgem using inappropriate price indices to capture exogenous changes in GDNs input prices; and/or (ii) Ofgem placing inappropriate weight (including no weight) on inputs (and therefore indices) which do not reflect the inputs share of totex for the notionally efficient operator of the GDN.

A. Construct an RPE index which reflects Cadent's true RPEs

A

For each Cadent network to construct an index capturing the 'true' RPE, there are two key considerations:

- **Choice of indices.** We use the indices proposed in Cadent's Business Plan.[39]
- **Weighting of indices.**
  - Within expenditure categories (e.g., labour) we weight indices in line with Cadent's Business Plan. [40]
  - We weight expenditure categories by the proportion of each network's RIIO-3 controllable totex they account for.

B. Estimate P10, most likely, and P90 performance

B

To find the P10, most likely, and P90 over/underspend for each network we:

1. Find the percentage difference, for each outturn year from 2020/21 onwards, between the networks' 'true' RPE index and Ofgem's index, normalising both indices to 1 in 2019/20.
2. Calculate the P10, most likely and P90 percentage difference between the indices for each network, setting the most likely value equal to the mean.
3. Apply these percentage differences to the forecast Ofgem RPE adjustment, in £s, to find the P10, most likely and P90 over/underspend of the RPE adjustment for each network.

C. Convert to distribution of % RoRE

C

The P10, most likely, and P90 £s impact are converted to a distribution of % RoRE for each Cadent network.

This involves the following:

- Converting these outcomes to a triangular distribution of over/underspend.
- Applying the TIM to convert this distribution to the financial impact on each network.
- Dividing by each network's regulated equity, to convert the distribution from £s to % RoRE.

Method for assessing risk for: (i) the Customer Satisfaction, (ii) the Complaints Metric, and (iii) the Unplanned Interruptions ODIs

To assess the risk of the above listed ODIs we assess each individual performance metric (as listed on the right) by the following method:

Performance metrics assessed by this method

- Connections survey average score [41]
- Planned work survey average score
- Unplanned work survey average score
- The complaints metric
- Average duration of unplanned (i) MOB and (ii) non-MOB interruptions

A. Estimate most likely performance

A

The most likely value for each performance metric for each Cadent network is estimated as the average of:

- The network's mean GD2 performance in absolute terms. (50% weight)
- The network's mean GD2 performance relative to the GD2 target. This is then applied to the GD3 target. (50% weight)

The above approach was used to estimate the most likely value as whilst some performance improvements are expected on GD2 absolute performance, maintaining the same level of relative outperformance of the target is unlikely as targets become more stretching.

B. Estimate P10 and P90 performance

B

To inform the P10 and P90 values for each performance metric and Cadent network we:

1. For each network and performance metric, calculate the percentage difference between each annual GD2 value and the mean GD2 value of the same network.
2. Use these percentage differences to calculate the industry-wide P10 and P90 % out/underperformance.
3. Apply the industry-wide P10 and P90 % out/underperformances to the most likely value of each Cadent network to obtain P10 and P90 values.

C. Convert to distribution of % RoRE

C

The P10, most likely, and P90 values of each performance metric are then converted to a distribution of % RoRE, for each network. This involves the following:

1. Convert the P10, most likely, and P90 values to a triangular distribution for each network and performance metric.
2. Calculate the financial implication in £s associated with each using the relevant targets, deadbands, caps, collars and incentive rates.
3. Divide by each network's regulated equity, to convert the distribution from £s to % RoRE.

Method for assessing risk for: (i) the Collaborative Streetworks and the (ii) 7 and 28 Day Repair Standards ODIs

7 and 28 Day Repair Standards ODI

We assess the risk associated with both performance metrics:

(i) The proportion of gas escape repairs completed in 7 days; and

(ii) The proportion of gas escape repairs completed in 28 days.

To do this we apply largely the same method as detailed for the performance metrics on the previous page.

We deviate from this method in the following ways:

- We estimate the most likely value as the networks' GD2 mean performance, as no GD2 target is available to assess the relative performance.
- We uplift the P10, most likely and P90 values of the performance metric of each network based on Cadent's expert judgement. This was applied as these metrics were not incentivised at GD2 and so we anticipate Cadent to make improvements on these metrics in response to the new ODI.

Collaborative streetworks ODI

1. We assume that Greater Manchester and Greater London participate as the central coordinators and so the collaborative streetworks ODI is relevant in these locations.

2. We estimate a dataset of collaborative streetworks for Greater Manchester. This is achieved by:
   - Calculating the total number of collaborative streetworks per active gas meter for each year of GD2 across all of Greater London. The number of active gas meters is used as a proxy for the extent of a gas distribution network within a local authority.
   - Multiplying this by the number of active gas meters in Greater Manchester in each year to obtain data points for Greater Manchester in each outturn year of GD2 data.

   These data points are all assigned to Cadent's North West network.

3. For each network and year, we split the number of collaborative streetworks into 'strategic' and 'minimum eligibility' projects based on the proportion each represented in Cadent's GD2 collaborative streetworks.

4. For both the number of 'strategic' and 'minimum eligibility' projects for each Cadent network we estimate:
   - **The most likely value.** This is equal to the network's mean number of relevant projects in the estimated GD2 dataset.
   - **The P10 and P90 values.** These are equal to the network's P10 and P90 number of relevant projects in the estimated GD2 dataset.

5. We then estimate the financial implications for 'strategic' and 'minimum eligibility' collaborative streetworks projects using the same method as outlined in step C on the previous page. Note, however, as the number of collaborative streetworks can only take discrete values we round all values to the nearest integer after estimating the triangular distribution.

Method for assessing evaluative PCD risk

A. Estimate the GD3 PCD allowance (FWACV only)

A

FWACV does not have an allowance associated with it in the GD3 DDs (unlike LMP, GMP and TVD).

Therefore, we estimate the FWACV allowance using the requested spends for each evaluative PCD in the GD3 BPFM released by Ofgem. We carry out the following at the network level:

1. Calculate the requested spend for FWACV as a % of the requested spend for LMP, GMP and TVD.
2. Calculate an estimate of the FWACV GD3 allowance using LMP i.e., if the amount requested for FWACV is half that of the requested amount for LMP, then the estimated allowance for FWACV is half that of LMPs allowance.
3. Repeat for GMP and TVD, then take the average of the three estimates to be the FWACV GD3 allowance for the network.

B. Calculate the P10, most likely and P90 project delay scenarios

B

We use a construction delay survey from Cornerstone Projects (2022), to estimate project delay. The following steps are performed:

- Based on responses to the question "*what % of projects in general do you estimate are subject to a delay?*", we estimate the average % of projects delayed, which is used to inform our most likely estimate of penalties.
- Based on responses to the question "*thinking of the last delayed project you have been involved with: What would you estimate the delay to be (as a % of the original estimated delivery time)?",* we estimate the P10, most likely and P90 delay time, and we know the expected/estimated delivery time is 5 years (the length of GD3).
- We assume that for each year of delay, allowances that are subject to penalties are reduced by the WACC * baseline PCD allowance. This is an assumption we have made as Ofgem has not explicitly stated what the penalty will be.

C. Calculate the late delivery penalty and convert to % RoRE

C

As we now have the allowance for each evaluative PCD for each network (part A), we calculate the expected penalty for each project delay scenario. For example, in the P10 delay case for LMP, the penalty for North London = (Average % of projects delayed * baseline LMP allowance) * (P10 delay time * delivery time * WACC). We repeat this for all networks, across all PCDs for the P10, most likely and P90 scenarios.

The product in the first set of parenthesis represents how much of the baseline allowance is subject to a late delivery penalty, and the product of the second set of parenthesis simplifies to (years of delay * WACC), which is our assumption that allowances will reduce by the WACC for each year of delay.

We convert all GD3 penalties in £s to % RoRE by dividing by regulated equity.

Method for assessing mechanistic PCD risk (Tier 1 Mains, Services and Iron Stubs), and Tier 2A Mains and Services volume driver risk

The method for Tier 1 Mains and Tier 1 Services is identical, so the method below will use Tier 1 Mains as an example. This method is also identical to the method used for the Tier 2A Mains volume driver. All analysis is carried out at the network level.

A. Estimate GD2 performance

A

1. We use the outturn volume data for Tier 1 Mains for the first three years of GD2 (provided by Cadent), and compare this to the target volume for the first three years.
2. We then calculate the % difference between outturn and target volumes for each diameter. We assume this is the % difference in volume for GD2.
3. Using Ofgem GD2 FD ex-ante unit costs for each diameter we calculate the implied change in allowance for GD2, and convert this to a % change in allowance by dividing the change by the Tier 1 Mains GD2 baseline allowance.
4. Step 3 gives us the % change in allowance for each diameter for GD2. We then sum across the diameters to get the overall % change in allowance for each network at GD2.

B. Estimate GD3 change in allowance

B

1. Ofgem has not provided the GD3 allowances for Tier 1 Mains, so we estimate it by taking the % of GD2 baseline totex allowance that is attributable to Tier 1 Mains, and apply this % to the GD3 baseline totex allowance.
2. We then apply the % change in allowance at GD2 (calculated in part A), and multiply this by our estimate of the Tier 1 Mains allowance in GD3, to get the forecast change in allowance at GD3.
3. Next, we apply the totex modelled regressed cost % over/underspends to the forecast change in allowance for each network, to get the forecast over/underspend in the P10, most likely and P90 outcomes.

C. Convert to distribution of% RoRE

C

To convert the overspend in £s to % RoRE, we:

1. Convert these outcomes to a triangular distribution of over/underspend.
2. Apply the TIM sharing rate to convert this distribution to the financial impact on each network.
3. Divide by each network's regulated equity, to convert the distribution from £s to % RoRE.

Tier 1 Iron Stubs follows the same method from part B, step 2 onwards.
For each network, our estimate of the % change in allowance for this PCD is equal to the average of the % change in allowances across Tier 1 Mains and Tier 1 Services.
Our estimate of the GD3 Tier 1 Iron Stubs allowance is equal to the total amount Cadent expect to spend.

Method for assessing mechanistic PCD risk – Operational Transport Emissions Reduction

A. Use Cadent expert judgement to inform GD3 performance

A

To estimate risk for this PCD, we use GD2 data provided by Cadent on the Commercial Fleet EV PCD.

To date, Cadent has underdelivered relative to the target for vehicles and charging points (with the exception of East of England charging points), and are not expecting to improve on delivery during GD2 or GD3.

Therefore, we take the % underdelivery at GD2, and assume this to be the % reduction in allowance at GD3 (assuming that the target level remains the same at GD3).

B. Estimate GD3 PCD allowance

B

We estimate that the GD3 Operational Transport Emissions Reduction PCD allowance at GD3 will be the same proportion of baseline totex that the Commercial Fleet EV PCD was at GD2 FDs.

We then apply the % change in allowance from part A to our forecast PCD allowance, to get the forecast change in allowance for GD3.

Next, we apply the totex modelled regressed % over/underspends to the forecast change in allowance for each network, to get the forecast over/underspend in the P10, most likely and P90 outcomes.

C. Convert to distribution of % RoRE

C

To convert the overspend in £s to % RoRE, we:

1. Convert these outcomes to a triangular distribution of over/underspend.
2. Apply the TIM sharing rate to convert this distribution to the financial impact on each network.
3. Divide by each network's regulated equity, to convert the distribution from £s to % RoRE.

Method for assessing risk for GSOPs

A. Apply adjustments to outturn GD2 data

A

First, we disaggregate the GD2 data into the two risk areas assessed: (i) GSOP 1 and (ii) all other GSOPs by subtracting each network's GSOP 1 expenditure in each year from its total GSOP expenditure in said year.

Next, we adjust each risk area's data for:

- **Changes in the size of payments.** As GSOP payments are indexed to the CPIH inflation index,[42] all GSOP expenditure is adjusted into 2023/24 prices.
- **Changes in the size of networks.** As GSOPs are customer-focused, expenditure is expected to scale with the number of customers served by a network. To adjust for changes in this over time, we: (i) divide GSOP expenditure, in both risk areas, by the number of customers served in each year for the relevant network; then (ii) multiply by the network's mean forecast number of GD3 customers.

B. Estimate P10, most likely, and P90 performance

B

To estimate the most likely value for each network and risk area, we set the most likely value equal to the adjusted mean GD2 value for the network and risk area.

To inform the P10 and P90 values for each risk area and Cadent network we do the following:

1. For each network and risk area, calculate the percentage difference between each annual adjusted GD2 value and the mean adjusted GD2 value of the same network.
2. Use these percentage differences to calculate the industry-wide P10 and P90 % out/underperformance.
3. Apply the industry-wide P10 and P90 % out/underperformances to the most likely value of each Cadent network to obtain P10 and P90 values.

C. Convert to distribution of % RoRE

C

The P10, most likely, and P90 values of each risk area are then converted to a distribution of % RoRE, for each network. This involves the following:

1. Convert the P10, P90, and most likely value scenarios to a triangular distribution for each network and risk area.
2. Divide by each network's regulated equity, to convert the distribution from £s to % RoRE.

Method for assessing safety disconnections volume driver risk

A. Use Cadent expert judgement to estimate changes in allowance

A

- We make use of data provided by Cadent, as well as expert judgement, to assess risk for the Safety Disconnections volume driver.
- For each network, we take the expected extra volume of GS(IU)R disconnections, beyond those included in the baseline, and look at the corresponding incremental cost.
- This incremental cost is our estimate of the increase in allowance at GD3.

B. Estimate the P10, most likely and P90 overspend

B

- Next, we apply the totex modelled regressed cost % over/underspends to the forecast increase in allowance for each network, to get the forecast over/underspend in the P10, most likely and P90 outcomes.

C. Convert to distribution of % RoRE

C

Finally, to convert the overspend in £s to % RoRE, we:

1. Convert these outcomes to a triangular distribution of over/underspend.
2. Apply the TIM sharing rate to convert this distribution to the financial impact on each network.
3. Dividing by each network's regulated equity, to convert the distribution from £s to % RoRE.

Method for assessing re-opener risk

A. Estimate GD2 re-opener actual spends and allowances

A

- Cadent has provided us with a list of re-opener applications for GD2, along with Ofgem's FD position.
- We use this data to calculate the allowances given in GD2, along with the 'actual' spend i.e., we take Cadent's submission and adjust this spend for work that may not actually occur due to a scope disallowance once Ofgem has made its funding decision.
- The outcome of this analysis allows us to estimate two figures: (i) the % of spend that does not actually occur; and (ii) the GD2 allowances as a % of 'actual' spend.

B. Estimate GD3 actual spend, allowances and overspend

B

Using Cadent expert judgement, we are able to produce a forecast spend for each of the 12 re-openers we analyse risk for.

1. We convert these forecast spends to 'actual' spends using figure (i) calculated in step A.
2. We then estimate the GD3 re-opener allowances using figure (ii) calculated in step A.
3. This allows us to then calculate the GD3 combined overspend (across the 12 re-openers) for each network.
4. This overspend is our estimate of the most likely outcome. To calculate the P10 and P90 outcomes, we take the spending range from the totex modelled regressed cost risk range and assume symmetrical overspend and underspend.

C. Convert to distribution of % RoRE

C

Step B gives us the overspend in £s in the P10, most likely and P90 outcomes. To convert the overspend in £s to % RoRE, we:

1. Convert these outcomes to a triangular distribution of over/underspend.
2. Apply the TIM sharing rate to convert this distribution to the financial impact on each network.
3. Divide by each network's regulated equity, to convert the distribution from £s to % RoRE.

The 12 GD3 re-openers we assess in our analysis: Digitalisation, Resilience, Complex Distribution Systems, London Subways and Tunnels, Co-ordinated Adjustment Mechanism, Net Zero, NZASP, Heat Policy, HSE Policy, Diversions and Loss of Development Claims, New Large Load Connections and Specified Streetworks. We do not assess the Cyber Resilience re-opener due to it being confidential, or the Tax Review re-opener as we do not cover tax in our analysis.

Method for assessing NARM-related risk

A. Estimate most likely performance

A

Cadent has provided its forecast NARM risk output delivery for each of its networks in GD2. We assume that NARM delivery in GD3 is proportional to delivery at GD2, i.e., each network will overdeliver compared to baseline NARM risk outputs by the same percentage (all Cadent's networks are forecasted to overdeliver). Therefore, we calculate the expected *additional* NARM allowance at GD3 for each Cadent network as the % overdelivery in GD2 multiplied by the GD3 baseline NARM allowance.

To convert this to a £s over/underspend, the assumed additional NARM allowance at GD3 for a network is multiplied by the most likely % over/underspend, as estimated for modelled regressed costs. In doing so, we assume that the over/underspend risk on additional NARM allowances, received through the NARM Funding Adjustment mechanism, is proportional to the risk on baseline NARM allowances.

B. Estimate P10 and P90 performance

B

To estimate the £s impact in terms of over/underspend at the P10 and P90, we multiply the forecast additional GD3 NARM allowances by the P10 and P90 % over/underspend implied by the modelled regressed cost risk, again assuming that over/underspend risk on these allowances is proportional to the risk on baseline NARM allowances.

As explained on page 62, we do not consider risk associated with the baseline NARM volumes, or risk from any unjustified NARM delivery in our approach. This is because: (i) risk on NARM baseline volumes is captured in baseline totex risk; and (ii) each Cadent network is forecasted to deliver within the NARM delivery deadband for GD3, which means that the forecast delivery volumes are automatically considered justified by Ofgem (assuming no effect from the CIO/UD).

C. Convert to distribution of % RoRE

C

The P10, most likely, and P90 £s over/underspend are then converted to a distribution of % RoRE, for each Cadent network.

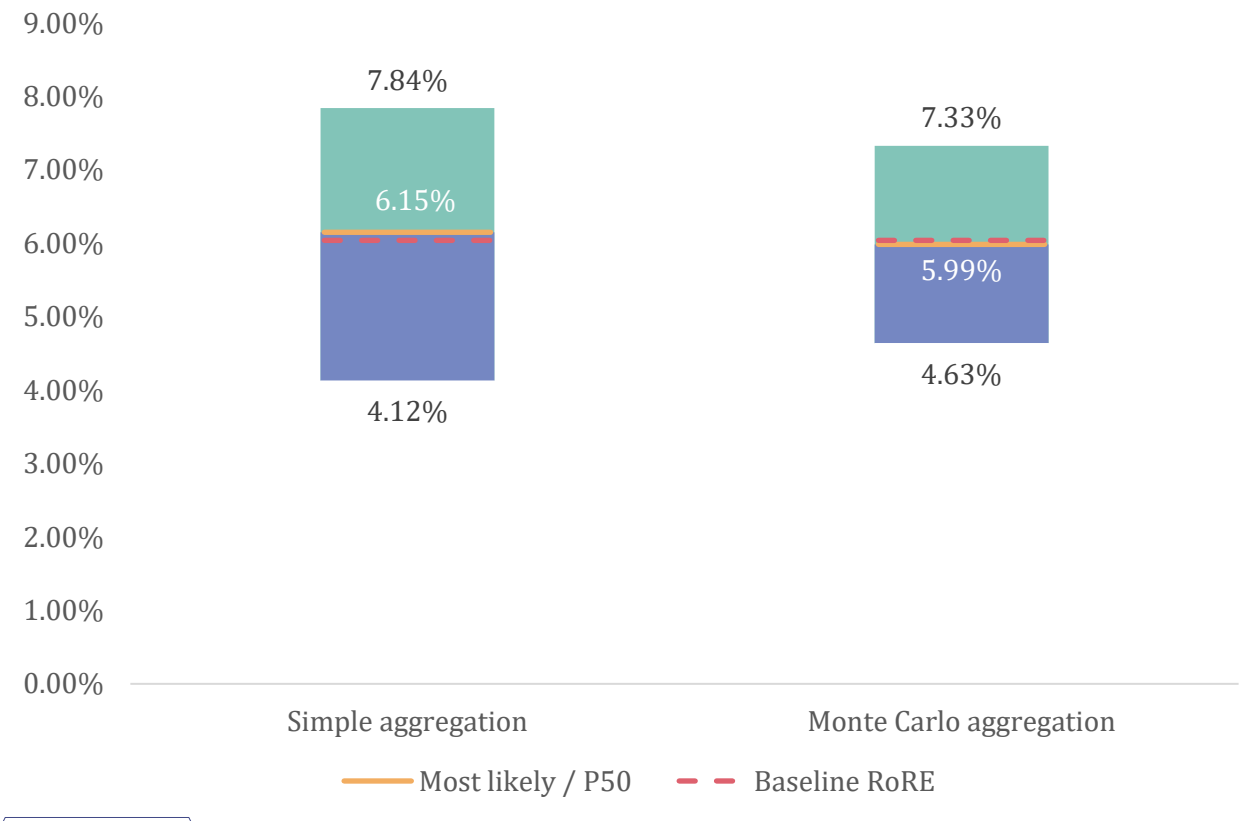
This involves the following:

- Converting these outcomes to a triangular distribution of over/underspend.
- Applying the TIM to convert this distribution to the financial impact on each network.
- Dividing by each network's regulated equity, to convert the distribution from £s to % RoRE.

ANNEX B: MONTE CARLO AGGREGATION OF OFGEM DD ANALYSIS

Applying Monte Carlo aggregation to Ofgem's DD RoRE risk analysis, in place of simple aggregation, causes both the risk range to narrow and the expected RoRE to fall

Figure 25: Comparison of Ofgem GD3 DDs risk analysis by aggregation approach (% RoRE)



Notes: The yellow line indicates the most likely value for the simple aggregation analysis and the P50 for the Monte Carlo aggregation analysis. We have applied the corrected BPI adjustment as an uplift to the full range of both distributions in line with our approach outlined on page 60. This ensures that both ranges presented above are on the same basis. This explains the difference between the simple aggregation range on this slide and on slide 24, which uses the uncorrected (Ofgem) BPI adjustment.

Source: Economic Insight analysis.

Ofgem's GD3 DD RoRE risk analysis used simple aggregation, by contrast our analysis uses Monte Carlo aggregation. We consider that Monte Carlo aggregation is more appropriate than simple aggregation, as explained on page 22. As a result, we re-calculate Ofgem's DD RoRE risk analysis using Monte Carlo aggregation, such that our analysis can be compared on the same basis to Ofgem's RoRE risk range. We detail how this was constructed on the following page.

The key effects of using Monte Carlo aggregation, in place of simple aggregation, on Ofgem's RoRE risk analysis are:

- **The risk range narrows.** Monte Carlo aggregation causes a narrowing in the risk range, as unlike simple aggregation, it enables networks to perform well in one risk area but poorly on others, hence narrowing the risk range as differences in performance across risk areas can offset each other.
- **Expected RoRE falls.** This is because under Ofgem's DD assumptions, ODIs have greater downside than upside risk. Hence, when Monte Carlo aggregation is used, this difference in upside and downside risk causes the expected RoRE to fall. Note, some of the reduction in the expected RoRE may reflect the change in definition of 'expected' from most likely (in the simple aggregation analysis) to P50 outcome (in the Monte Carlo aggregation analysis).

Method for constructing a Monte Carlo RoRE risk range using the same key assumptions Ofgem's GD3 DD analysis

Risk Area	A. Set the P10, most likely, and P90 values	B. Estimate the distribution	C. Apply Monte Carlo aggregation
Totex	Calculate the £ over/underspend for each Cadent network in the P10, most likely, and P90 outcomes based on Ofgem's assumed % deviations from the totex allowance.[43] These assumptions are: • **P10:** 10% overspend. • **Most likely:** 0% deviation. • **P90:** 10% underspend.[44]	1. Use the calculated P10, most likely, and P90 £s over/underspend to estimate a triangle distribution for each Cadent network of £s over/underspend. 2. Apply the TIM to convert this distribution into the financial impact on each network.	1. Convert the distribution of financial impacts associated with each ODI performance metric to a price control basis. This is achieved by taking independent draws for each year of GD3 from each performance metrics distribution and summing them. 2. Monte Carlo aggregate across all ODI performance metrics and the totex distribution. This is achieved by taking independent draws from each performance metrics' distribution and summing them. 3. Sum across the Monte Carlo aggregated performance distributions for each cadent network to find the performance distribution for Cadent overall in £s terms. 4. Divide by Cadent's total regulated equity, across all Cadent networks, to convert the distribution from £s to % RoRE.
ODIs	Use Ofgem's assumed P10, most likely, and P90 value for each performance metric.[43] These assumptions are: • **P10:** The performance metric value linked to the worse financial outcome. • **Most likely:** The target performance metric value. • **P90:** The performance metric value linked to the best financial outcome.[44]	1. Use the calculated P10, most likely, and P90 performance metric values to estimate a triangle distribution for each Cadent network and performance metric. 2. Apply the relevant targets, incentive rates etc. to convert this distribution into the financial impact on each network.	

References and notes (page 1 of 3)

1. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 77.
2. '*Our powers and duties – guidance*', Ofgem (July 2013); paragraph 1.3.
3. '*Our powers and duties – guidance*', Ofgem (July 2013); paragraph 1.6.
4. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 77.
5. '*RIIO-GD1: Final Proposals – Overview*', Ofgem (December 2012); page 1.
6. '*RIIO-GD1: Final Proposals – Supporting document - Cost efficiency*', Ofgem (December 2012); page 21.
7. '*RIIO-GD1: Final Proposals – Supporting document - Cost efficiency*', Ofgem (December 2012); page 20.
8. '*RIIO-GD1: Final Proposals – Supporting document - Cost efficiency*', Ofgem (December 2012); page 58.
9. '*RIIO-GD1: Final Proposals – Supporting document - Cost efficiency*', Ofgem (December 2012); page 60.
10. '*RIIO-GD1: Final Proposals – Supporting Document – Outputs, incentives and innovation*', Ofgem (December 2012); page 10.
11. '*RIIO-2 Final Determinations - Core Document*', Ofgem (December 2020); page 5.
12. '*RIIO-2 Final Determinations - Core Document*', Ofgem (December 2020); page 48.
13. '*RIIO-2 Final Determinations - Core Document*', Ofgem (December 2020); page 66.
14. '*RIIO-2 Final Determinations – GD Sector Annex (REVISED)*', Ofgem (February 2021); page 96.
15. '*RIIO-2 Final Determinations – GD Sector Annex (REVISED)*', Ofgem (February 2021); page 82.
16. '*RIIO-2 Final Determinations - Core Document*', Ofgem (December 2020); pages 22-23.
17. '*RIIO-3 Draft Determinations Overview Document*', Ofgem (July 2025); page 1.
18. '*RIIO-3 Draft Determinations Overview Document*', Ofgem (July 2025); page 90.
19. '*RIIO-3 Draft Determinations Overview Document*', Ofgem (July 2025); page 72.
20. '*RIIO-3 Draft Determinations – Gas Distribution*', Ofgem (July 2025); page 98.

References and notes (page 2 of 3)

21. '*RIIO-3 Draft Determinations – Gas Distribution*', Ofgem (July 2025); page 153.
22. '*RIIO-3 Draft Determinations – Gas Distribution*', Ofgem (July 2025); page 12.
23. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 75.
24. '*Ongoing efficiency for gas networks at RIIO-3*', Economic Insight (May 2025); pages 63-68.
25. '*RIIO-3 Draft Determinations – Cadent Annex*', Ofgem (July 2025); page 39.
26. '*RIIO-3 Draft Determinations – Cadent Annex*', Ofgem (July 2025); page 38.
27. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 75.
28. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 76.
29. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 76.
30. '*RIIO-3 Draft Determinations – Gas Distribution Annex*', Ofgem (July 2025); page 67.
31. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 76.
32. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 76.
33. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 76.
34. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 76.
35. '*RIIO GD3 BPFM_Draft Determinations_Jun25.xlsx*', Ofgem (July 2025).
36. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 76.
37. '*Cadent RIIO-3 Business Plan: Appendix 03 – Cost Assessment and Benchmarking Approach*', Cadent (December 2024); page 88.
38. '*Ongoing efficiency for gas networks at RIIO-3*', Economic Insight (May 2025); pages 63-68.
39. '*Cadent RIIO-3 Business Plan: Appendix 03 – Cost Assessment and Benchmarking Approach*', Cadent (December 2024); page 95.
40. '*Cadent RIIO-3 Business Plan: Appendix 03 – Cost Assessment and Benchmarking Approach*', Cadent (December 2024); page 95.

References and notes (page 3 of 3)

41. We apply the connections survey reward/penalty only where a network is forecast to exceed 1000 connections services in that year, in line with the threshold in the GD3 DDs. See: '*RIIO-3 Draft Determinations – Gas Distribution Annex*', Ofgem (July 2025); page 47.

42. '*RIIO-2 Final Determinations – Gas Distribution Annex*', Ofgem (February 2021); page 28.

43. We are interpreting Ofgem's high and low RoRE outcomes in its GD3 DD analysis to be the P90 and P10 outcomes, respectively.

44. '*RIIO-3 Draft Determinations – Finance Annex*', Ofgem (July 2025); page 75.

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