Cadent

Your Gas Network

RIIO2 Draft Determination

Cadent Consultation Response

Gas Distribution Sector Questions

4th September 2020

Navigating Our Response

Cadent's response to Ofgem RIIO-2 Draft Determination is structured as follows.

This document includes the response to **Gas Distribution Questions (excluding Q34)**

Contents: Gas Distribution Questions

Gas Distribution Questions

GDQ1 - Do you have any views on our common outputs that haven't been covered through any of the specific consultation questions set out elsewhere in this chapter? If so, please set them out, making clear which output you are referring to.

Summary of our views

This response relates to the Customer Satisfaction, Guaranteed Standards of Performance, Complaints Metric and Unplanned Interruption Common Outputs, regarding which the Draft Determination does not contain specific consultation questions.

While we are broadly supportive of many of the updates to common outputs proposed in the Draft Determination, and welcome the customer service improvements that they will drive, it is apparent that the Draft Determination contains errors of fact, judgement and application as well as failing to adequately consider key elements of our business plan submission.

The Draft Determination does not consider adequately the evidence we submitted regarding GSOPs that supports the provision of an efficient level of funding to GDNs. Without this, this could lead to increased costs for customers as GDNs would be incentivised to make inefficient expenditure decisions to mitigate the chances of a GSOP failure.

The Draft Determination does not incorporate appropriate benchmarking or equivalence in operational practices associated to unplanned interruption related GSOPs which discriminates against our London network.

In altering the Customer Satisfaction metrics for RIIO-2 Ofgem has failed to consider the evidence we provided that demonstrated an appropriate baseline for emergency response satisfaction, that customers report varied satisfaction levels dependent upon their communication method and that there are underlying affluence factors in London that impact upon satisfaction.

The Draft Determination contains errors of logic and inconsistent application when setting the minimum performance levels and excessive deterioration levels for unplanned interruptions in the Draft Determination. This results in ODIs that do not deliver Ofgem's stated policy decisions and could incentivise actions that are not aligned with our customers' priorities.

The remainder of this answer addresses each of these issues, and some others, in more detail.

Customer Satisfaction

The introduction of the CSAT incentive in RIIO-1 has driven significant improvements in customer service across all networks and performance can be shown to compare favourably against external benchmarks. We support Ofgem's intent to create a performance framework that encourages networks to maintain high levels of customer service through a financial ODI and ensure targets, caps and collars are set at a level that continues to drive the right behaviours by rewarding good performance and penalising poor performance.

The outcome of the RIIO-GD2 CSAT trial was very positive and through various improvements, including widening the response channels we saw increased customer response rates and a broader demographic of respondents. This is a great result for customers and really supports the delivery of Ofgem's objective to give customers a greater voice in RIIO-2. We are therefore supportive of using the RIIO-GD2 CSAT trial results in setting targets and reward/penalty levels. However, we believe there are aspects that don't deliver against Ofgem's policy position and that there are evidenced factors that have not been accounted for that are to customers' detriment. These can be summarised as follows:

- **GDNs should not be penalised for scores above the max reward in RIIO-1** – Ofgem have set a policy intent to not apply a penalty that would allow companies performance to deteriorate from levels they received rewards for in RIIO-1 (see paragraph 2.32 of the GD annex). Companies did not receive additional reward for scores above 9.0, 8.5, and 8.4 for ERR, planned work, and connections respectively. Therefore, there should be no penalty above these levels in RIIO-2. Ofgem's proposed score at which a penalty applies is in line with this for connections and broadly in line for planned works. However, for ERR the score should be adjusted to 9.0. In addition, GDNs have made significant improvements in CSAT over RIIO-1 and rank close to or above companies that are considered to be providing world class service in the retail sector. In the competitive sector, these companies would be rewarded though increased business and customer loyalty, and not penalised.
- **Adjustment to scores to account for channel factors –** Experts widely recognise that survey responses via telephone score higher for the same service than those received via other channels. This was evidenced in the results of RIIO-GD2 CSAT trial, where there was a statistically significant difference in connections scores based on what channel customers chose to respond through. The methodology needs to be adapted to account for these factors and ensure companies are not disincentivised to respond to increasing customer demand for more online and mobile engagement channels.
- **Adjustment to max reward/penalty to account for under-lying affluence factors in London** – Evidence indicates that customer expectations are higher in London, where there is a higher degree of affluence, such that customers score lower for the same level of service received nationally. Therefore, the max reward/penalty level should be adjusted to account for these under-lying affluence factors. We propose the max reward/penalty scores for North London to be adjusted by 0.15 on all three surveys as this is the evidence-based difference in regional scores from the homogenous Emergency call handling service.

In the Draft Determinations Ofgem proposed the following scores:

Ofgem RIIO-2 CSAT proposal					
	Maximum penalty score	Penalty starts at	Target	Reward starts at	Maximum reward score
ER&R	9.15	< 9.37	9.37	> 9.44	9.58
Planned work	7.87	< 8.51	8.51	> 8.77	9.13
Connections	7.43	< 8.38	8.38	> 8.86	9.33

Table 1: CSAT proposal

We are proposing the scores are calibrated as follows (adjustments in bold):

RIIO-2 – Cadent proposal (without dead-band or regional/channel factor adjustments)					
	Maximum penalty score	Penalty starts at	Target	Reward starts at	Maximum reward score
ER&R	**8.82**	**< 9.00**	9.37	> 9.44	9.58
Planned work	7.87	**< 8.50**	8.51	> 8.77	9.13
Connections	7.43	< 8.38	8.38	> 8.86	9.33

Table 2: Regional / channel factor adjustments

To account for underlying affluence factors in London, the maximum reward/penalty should be adjusted as follows for our London network (additional adjustments in bold):

Proposed London regional factor adjustment					
	Maximum penalty score	Penalty starts at	Target	Reward starts at	Maximum reward score
ER&R (London)	**8.66**	< 9.00	9.37	> 9.44	**9.43**
Planned work (London)	**7.72**	< 8.51	8.51	> 8.77	**8.98**
Connections (London)	**7.28**	< 8.38	8.38	> 8.86	**9.18**

Table 3: Proposed London Regional Factor adjustments

To account for channel factors the scores could either be split between channels (i.e. telephone and online) or a single score which is based on the fixed average score from the RIIO-2 trial but accounts for the proportion of response from each channel. The incentive value should be divided by the proportion of response received from each channel.

Calibrating targets and reward/penalty levels

We are supportive of fixed targets as this provides GDNs the certainty to implement long term strategies that continue to improve the experience for customers. Furthermore, the re-baselined targets have captured the improvements made in RIIO-1 and accounted for changes resulting from increased survey channels and a wider demographic of respondents observed through the RIIO-GD2 CSAT trial. However, as set out above, we believe a few changes are required to ensure the targets do not become disproportionately stretching and GDNs continue to be rewarded or penalised in line with customer and stakeholder expectations.

CSAT incentive proposal does not deliver against Ofgem's stated policy position

In paragraph 2.32 of the GD annex, Ofgem have set a policy position to not utilise a dead-band set at the lower quartile as this would allow companies performance to deteriorate from levels they received rewards for in RIIO-1. However, the max reward in RIIO-GD1 was capped, and companies did not receive additional reward for scores above 9.00, 8.50, and 8.40 for ERR, planned work, and connections respectively. Therefore, scores above these levels should not be penalised in RIIO-2. Ofgem's proposed scores for when a penalty applies conforms to this for connections. However, to resolve this inconsistency error, the penalty level for Planned work should be adjusted to 8.50 (from 8.51) and for ER&R adjusted to 9 (from 9.37).

In addition, when GDNs are ranked against other companies in the customer service sector, many rank above or close to the likes of John Lewis, Amazon, and M&S, who are renowned for providing great customer service. In the competitive sector, companies would be rewarded for satisfaction scores above 9 through increased customer interactions/business and loyalty. Therefore, in the regulated sector companies should be rewarded, or at the very least not penalised, for providing excellent customer service.

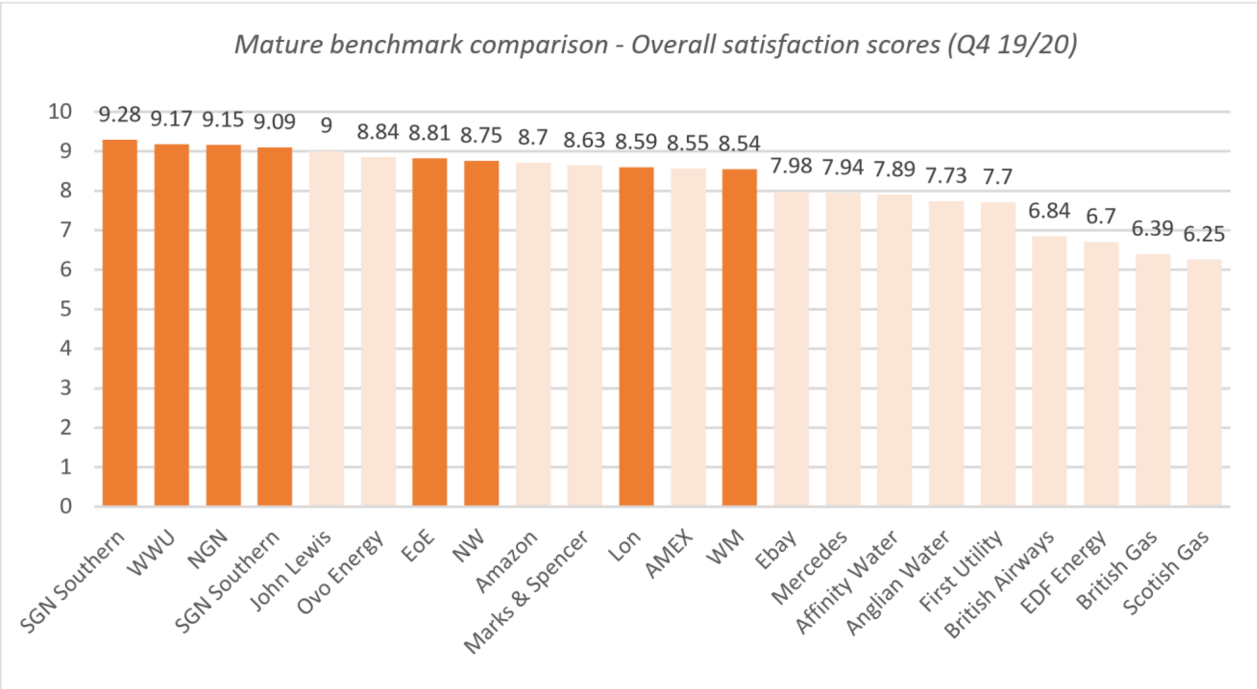


Figure 1: Mature benchmark comparison - Overall satisfaction scores (Q4 19/20) [Source: TTI Global]

Although GDNs have performed at very high levels in RIIO-GD1, there should be recognition that customer expectations continually increase and therefore networks must continue to invest to maintain or improve these scores e.g. a customer who scores 9/10 in RIIO-1 for a particular level of service will most likely not give a 9/10 for that same level of service if provided in RIIO-2. Therefore, GDNs must invest to improve the service and meet these continually evolving customer expectations.

Furthermore, Ofgem have set the target for the complaints metric recognising that a minimum performance level, at which GDNs receive a penalty, should not be set at a level that is too stretching. We are supportive of this principle and believe it should also apply to CSAT, particularly for ER&R.

There are evidenced factors that are not accounted for within Ofgem's methodology that are to customers' detriment

Channel factors

Experts widely recognise that survey responses via telephone score higher for the same service than those received via other channels. TTI Global, our independent survey partners, said that their overall research and historical survey experience suggests that scores received via telephone are overall more positive than scores received online. During a study on survey methodologies, TTI Global found that one of the foremost characteristics of telephone interviewing compared with online interviewing is in the presence of an interviewer. This distinction is accountable for the vast majority of divergence between collection methods. The human element to telephone interviewing allows for rephrasing and clarification of questions. It also means that the interview is potentially more adaptable to cater for varying abilities in the respondents. They also found that for online responses, customers provided a more honest opinion and noticeable lower scores for rating questions. This is often suggested as being the true customer feeling and is due to the interviewee feeling more anonymous without the social pressure of telling another person.

Therefore, TTI Global explained that their researchers gleaned insights from various studies across the customer service industry that implied some questions were answered in a more socially acceptable manner where the interviewer is present i.e. face to face or telephone surveyors. This insight is also supported by wider social or behavioural sciences which indicate that actions and reactions of people change dependant on the presence of other people. It is this school of thought that leads TTI Global to conclude that there is a small positive bias when comparing interviewer led methodologies (e.g. telephone surveys) with self-completion methodologies (e.g. online surveys). TTI Global have seen customer satisfaction surveys in the automotive sector and across research conducted for various UK Police forces, experience similar differences in results when changing from a postal to telephone survey methodology.

This factor was also evidenced in the results of RIIO-GD2 CSAT trial where we saw a significant difference in scores based on what channel customers used to respond i.e. for connections the average score for telephone responses was 8.47, whereas the average score for online was 8.15. We believe this difference needs to be considered when setting targets to ensure there is a fair and equitable basis for comparison, especially if one network receives a much greater proportion of online responses than another as the RIIO-2 trial showed:

RIIO-2 trial connections			
GDN	No. of responses		Proportion of online responses
	Telephone	Online	
EoE	450	208	32%
Lon	183	63	26%
NW	175	106	38%
WM	130	78	38%
NGN	425	8	2%

Sc	477	77	14%
So	581	41	7%
WWU	575	4	1%

Whilst there is ever increasing customer demand for online or mobile engagement channels, Ofgem's methodology set out in the Draft Determinations would disincentivise GDNs to respond to these requirements. If there is no change to this methodology, companies that have responded to customer demands to provide a greater choice of online and mobile engagement channels would be penalised, and those that have not would be rewarded. Therefore, there must continue to be an incentive for networks to invest in and improve their communication channels. During the trial NGN had a small take up of customers responding through the online channel (2% for connections, compared to c.30% on average for our networks), perhaps due to their online offering requiring further development which they plan to do in RIIO-2. The CSAT incentive should not discourage or disincentivise networks to delay these investments which will deliver improvements in the overall customer experience. The methodology needs to be adapted to account for these factors

Based on the trial results, we believe that channel factors should currently be considered for connections, but do not think they need to be considered for planned work and ER&R as the take-up of alternative channels from the initial default channel during the trial was limited and therefore the data is not statistically robust. If channel response proportions significantly change during RIIO-2 for these surveys, adjustments to scores could be considered.

We have developed two options for how scores for the connections survey could be calculated to account for channel factors:

Option 1: Separate scores by channel

The scores received during the trial from each channel could be used to determine the target, penalty/reward levels and the maximum penalty/reward as follows:

- Target – Emulating Ofgem's proposed approach, the targets could be set at average trial performance by channel. This was 8.47 for telephone and 8.15 for online.
- Penalty score – Maintain principle of penalties below target unless RIIO-1 max reward level is below target. The average score for online conforms with this principle (i.e. 8.15 is less than 8.40), however the average score for telephone should be adjusted from 8.47 to 8.40
- Reward score - There are not statistically robust returns for all channels for all GDNs (some GDNs have very low returns for some channels). Therefore, the UQ could be adjusted for each channel using the delta between sector averages for each channel. In the case of the connections trial results, the sector average was 8.40. But for telephone it was 8.47 and for online it was 8.15. The sector UQ was 8.90 and using the delta from the averages we would set the telephone reward level at 8.97 (i.e. +0.07) and online reward level at 8.65 (i.e. -0.25).
- Max penalty/reward scores – Emulating Ofgem's approach, the max penalty and reward levels could be set at 1.75 standard deviations from the targets. This was 7.60 and 9.34 for telephone, and 6.81 and 9.49 for online.

In summary:

Option 1: Connections – Separate scores by channel					
	Maximum penalty score	Penalty starts at	Target	Reward starts at	Maximum reward score
Connections (telephone)	7.60	< 8.40	8.47	> 8.97	9.34
Connections (online)	6.81	< 8.15	8.15	> 8.65	9.49

Table 4: Option 1: Separate scores by Channel

<u>*Option 2: Single set of scores weighted by channel response proportions*</u>

To avoid having multiple sets of scores by channel, there could be a single set of targets that are based on the fixed scores from the trial but are adjusted annually for each network based on their actual returns to account for channel response proportions as follows:

- Target – Emulating Ofgem's proposed approach, the targets could be set at average trial performance but adjusted to account for channel response proportions. For example, for connections, the average targets were 8.47 for telephone and 8.15 for online. If a network received 70% of responses through telephone and 30% response through online, the combined target for that network would be 8.37 (i.e. 8.47 x 70% plus 8.15 x 30%). If a network's proportion of response between telephone and online was 90% and 10% respectively, then the target for that network would be 8.44 (i.e. 8.47 x 90% plus 8.15 x 10%).
- Penalty score –Maintain principle of penalties below target unless RIIO-1 max reward level is below . This should be set at the lower of either the average score (accounted for channel proportions) or max RIIO-1 reward (i.e. 8.40)
- Reward score - There are not statistically robust returns for all channels for all GDNs (some GDNs have very low returns for some channels). Therefore, the UQ could be adjusted for each channel using the delta between sector averages for each channel. In the case of the connections trial results, the sector average was 8.40. But for telephone it was 8.47 and for online it was 8.15. The sector UQ was 8.90 and using the delta from the averages we would set the telephone reward level at 8.97 (i.e. +0.07) and online reward level at 8.65 (i.e. -0.25). These scores could then be combined based on the actual proportions for each channel received.
- Max penalty/reward scores – Emulating Ofgem's approach, the max penalty and reward levels could be set at 1.75 standard deviations from the average score and combined based on channel proportions.

In summary (assuming 50/50 proportions for online/telephone):

Option 2: Connections – weighted by channel response proportions						
	Network channel proportions (Telephone: Online)	Maximum penalty score	Penalty starts at	Target	Reward starts at	Maximum reward score
Connections (combined channel factor adjustment)	50:50	7.43	< 8.31	8.31	> 8.81	9.28

Table 5: Option 2: Channel factor adjustment

These scores would be adjusted by network based on actual channel response proportions.

In the case of both options, the incentive value should also be divided according to the proportion of responses received from each channel to ensure reward or penalties are applied equitably.

Underlying affluence factors in London

Research studies show that there is a positive relationship between affluence and customer expectations. Throughout RIIO-1 we have seen a lower CSAT score in our North London network compared to other networks across all three surveys. Although this may be partly explained through lower levels of service, there is strong evidence to show that much of this is explained by higher customer expectations in London compared to other networks.

While differences in the level of service are, at least to some extent, within the control of GDNs, differences in customers' expectations are not under our control. As a result, incentive mechanisms based on customers' reported satisfaction may be biased by differences between the expectations and preferences of customers which are outside of GDNs' control.

There is evidence that customers in London and the surrounding area have higher expectations than customers in other parts of the country. Since we cannot control customers' expectations, incentive mechanisms which are set according to national target levels may grant rewards and penalties to GDNs due to the characteristics of their customers and not due to the quality of service that GDNs provide.

Difference in emergency contact centre satisfaction scores

Strong evidence that customers in London have higher expectations than customers in other parts of the country is shown by customers' reported satisfaction with the national gas emergency call centre. As this is a single, national service that we manage for all networks, the same service is provided to customers in all GDN regions.

As part of our ER&R CSAT survey, customers are asked about their experience with the Emergency contact centre. For the two questions related to this service, namely, the time taken to get through to an operator (Q2) and the information and safety advice provided by the operator (Q3), we saw a significantly lower average score for customers in North London compared to other networks. On average the score in North London was lower by -0.15 compared to other networks.

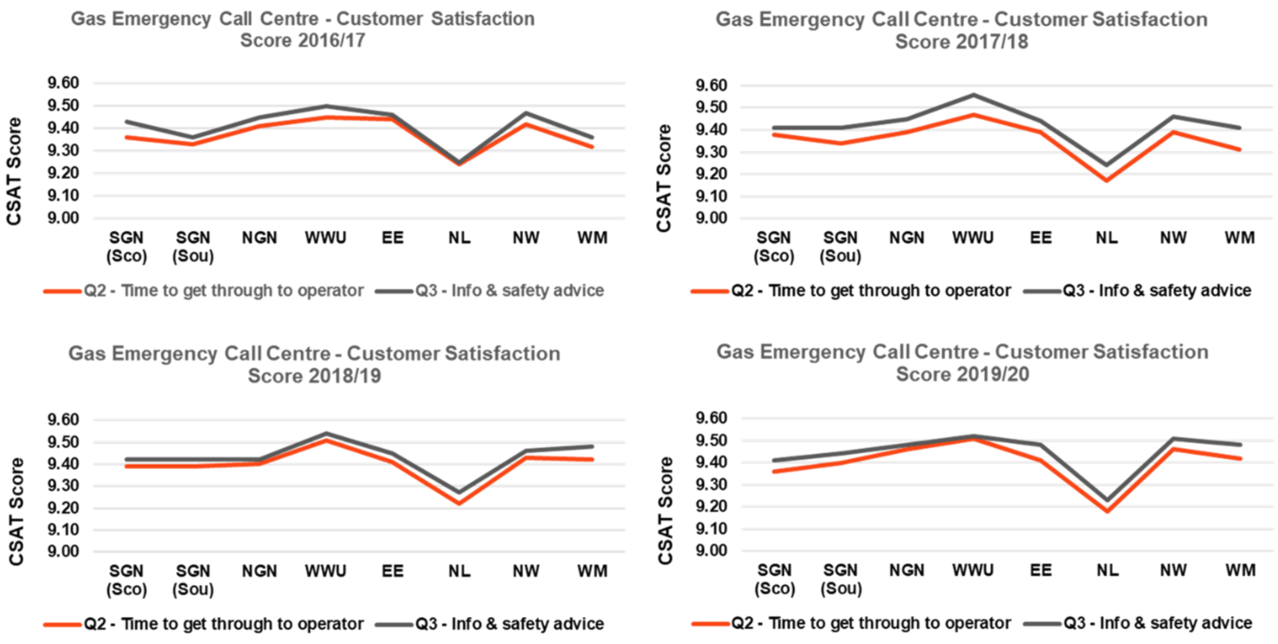
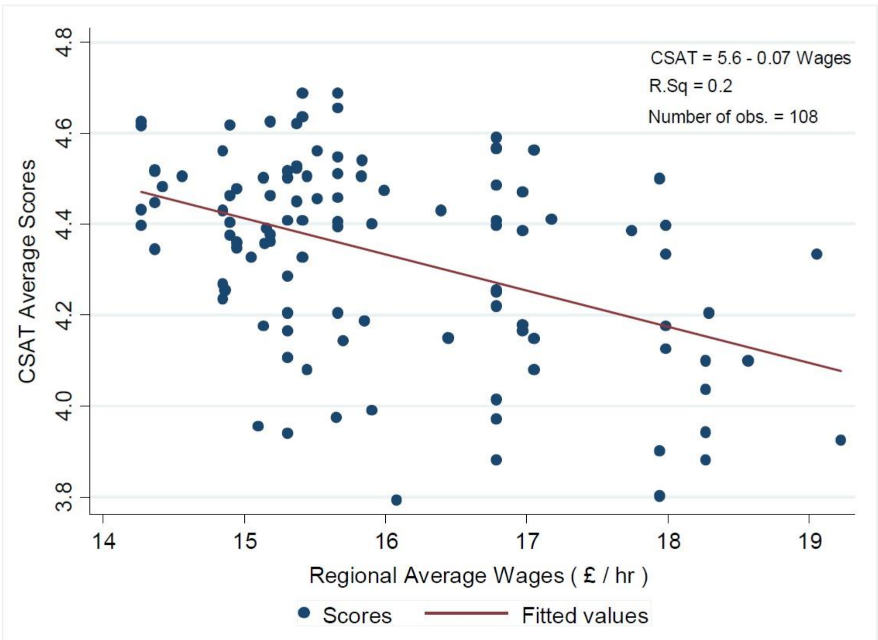


Figure 2: Relationship between affluence and customer satisfaction

In 2016, Thames Water commissioned Deloitte to investigate Ofwat's statistical methodology in its SIM measure. Deloitte conducted an econometric analysis of the CSAT component of the SIM, using a dataset of cross-company average CSAT scores, and a dataset of individual respondents from Thames Water's region. Deloitte found that higher income was consistently associated with lower CSAT scores.

In the figure below, Deloitte plotted regional wage data and Ofwat quarterly CSAT scores between 2010 to 2015. This showed that lower average regional wages are associated with a higher CSAT score



Source: Deloitte analysis
Note: The data reflects annual average CSAT scores from 2010 Q1 to 2015 Q4.

Figure 3: Correlation between Ofwat CSAT scores and Regional Average Wages (2010 – 2015)

Other socio-economic characteristics which are correlated with income, such as home-ownership and socio-economic group, also tended to be associated with lower CSAT scores. Deloitte therefore concluded that the PR14 SIM may award or penalise companies not only for the level of service they provide to their customers, but also for factors which are outside their control.

The Deloitte study suggests that, since London has the highest average income and wages of any UK region, London customers' appear to have higher expectations on average than customers in other regions. Hence, London customers report lower scores in customer satisfaction surveys for reasons beyond the control of the companies.

Furthermore, NPS data from suppliers within energy, telecommunications and postal services split between London & Thames Valley (more affluent) and elsewhere (less affluent) shows that NPS scores are consistently higher for the group of customers who are less affluent and vice versa.

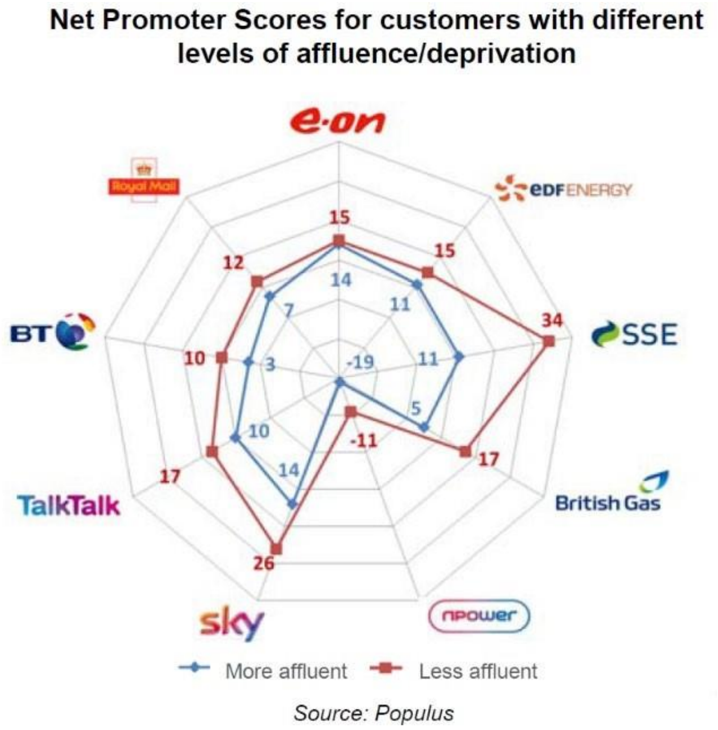


Figure 4: Net Promoter scores for customers with different levels of affluence / deprivation

Therefore, to account for these underlying affluence factors in London we propose the max reward/penalty scores for North London is adjusted by -0.15 on all three surveys as this is the observed difference in regional scores from the homogenous Emergency call handling service.

Complaints metric

We are proud of the significant performance improvements that have resulted from the changes we have made to our complaint handling process during RIIO-1.

We support the continuation of the complaints metric in RIIO-2 and accept the rebasing of the minimum performance level, at which GDNs receive a penalty, at five. This is in line with the ambition we demonstrated in our output case, will lock-in the improvements made in RIIO-1 and is a stretching but achievable target for high-performing companies.

Guaranteed Standards of Performance (GSOPs)

We are largely supportive of the changes in GSOP standards, the doubling of payments and caps as well as the removal of the cap for GSOP1 proposed by Ofgem. These amendments will provide increased protection for customers and are aligned to our customer strategy.

However, Ofgem has failed to consider the evidence we presented in our business plan that demonstrated it would be appropriate to provide funding for an efficient level of GSOP payments. Ofgem's Draft Determination, which provides no funding for GSOP, could lead to increased costs for customers as GDNs would be incentivised to make inefficient expenditure decisions to mitigate the chances of a GSOP failure.

Unless specifically funded, the restrictive financial package proposed by Ofgem in the Draft Determinations would not make it possible for us to maintain our existing approach of continuing to make GSOP payments even where exemptions could be applied. There are three options to implement Ofgem's policy proposals for GSOP in RIIO-2:

1. Provide an efficient level of funding for GSOP payments within ex ante allowances;
2. Provide an efficient level of GSOP 1 funding for unplanned MOBs interruptions in London only. This aligns to Ofgem's approach on the unplanned interruptions financial ODI where London's regional specific factors are recognised and treated separately; or
3. If no efficient level of ex ante funding is provided, maintain the current GSOP exemptions within RIGs for events outside of GDNs control for RIIO-2, this includes the ability to "stop the clock" on GSOP 1.

We have addressed each area of GSOP change proposed by Ofgem in their Draft Determinations below, except where those changes are addressed by a specific consultation question (see GDQ 5, 6 and 7).

Position on funding

As Ofgem failed to consider our evidence in making its Draft Determination we reiterate the key evidence presented in our Business Plan and provide three options to implement Ofgem's policy proposals for GSOP in RIIO-2:

<u>Option 1 – provide an efficient level of GSOP payments within ex ante allowances</u>

The following five points explain why an efficient level of GSOP payments should be funded by Ofgem in RIIO-2:

An efficient level of GSOP payments would be allowed in a competitive market: **Ofgem regulates revenues, using price controls, so that prices charged by monopoly energy networks are set to recover an efficient level of cost and no more. In a fully competitive environment, an efficient level of all costs, including those relating to failings or shortcomings, would be included within prices.** The efficient level of GSOP payments is greater than zero: **No business, regulated or unregulated, operates perfectly with no shortcomings. As would be expected, all energy networks incur a level of GSOP payments, consequently, the efficient level of GSOP payments must be above zero. This has historically been accepted by Ofgem with explicit or implicit allowances since Guaranteed Standards were introduced for gas distribution in 2002. The alternative approach would be to fund**

licensees to have sufficient resources to never fail a standard. This would be economically incoherent as customers would pay excessive sums for such a service.

Treating GSOP payments differently to other costs encourages GDNs to act inefficiently: **One of the strengths of Ofgem's RIIO approach has been the equalisation of incentives across different categories of expenditure, encouraging GDNs to adopt the lowest cost solutions. In RIIO-2, if GSOP payments are made entirely for the account of shareholders, with a maximum incentive of 50% on other costs, GDNs will be incentivised to spend an excessive amount to avoid a GSOP payment which is lower than this amount. For instance, to avoid a GSOP payment of £100 a GDN would spend up to £190 in other costs, which is not efficient, and undermines the RIIO approach. The table below highlights how GDNs are encouraged to act inefficiently due to GSOP payments being treated differently to other costs:**

Example if GSOP payments not allowed	GSOP penalty	Penalty avoidance
Outlay	**£100**	**£190**
Company incentive rate	**100%**	**50%**
Company impact	**£100**	**£95**

Table 6: GSOP penalty

Some payments are wholly due to factors outside the networks control: **It can take several weeks to restore to a MOB as a consequence of a public reported escape that requires us to cut supply to the building – an unplanned interruption. Factors that impact upon this restoration time include delays resultant from the need for planning authorisation from other organisations/authorities. In this instance, GSOP 1 payments to all affected customers in that building is inevitable. The recent work carried out by Ofgem's Interruptions Working Group into "clock-stopping" has highlighted a list of factors outside GDNs' control.**

The efficient level of GSOP payments is greater in some networks than others, so setting payments at zero penalises some networks more than others: **As a result of a high number of MOBs customers in London, and the duration of interruptions in these buildings, our London GDN incurs a far higher level of GSOP payments than our other GDNs. We acknowledge that the service we have provided to MOBs customers has not been as good as it should have been, which is why we have put forward an improvement plan for these customers, which Ofgem has accepted. However, under the improvement plan, the efficient level of GSOP payments will still be a significantly higher in London than elsewhere.**

Using our workings and assumptions for unplanned interruptions durations provided in our Business Plan Appendix 09.21 Cadent's Regional Factors, we have updated the efficient levels of GSOP payments based on Ofgem's revised policy position that introduces a doubling of payments and caps and annual indexation. The cost rises from our previous estimate of £10.4m for RIIO-2 in nominal terms, to £15.3m in real terms, an increase of over 50%.

£9.0m of the £15.3m relates to London, with about £7.5m of the £9.0m being GSOP 1 MOBs related. This forecast of efficient costs for London MOBs is within those implied by the minimum standard set out by Ofgem in the Draft Determinations[1]. It is important to recognise that London's higher efficient costs are a result of the significantly higher number of MOBs than any other GDN and during RIIO-1 the

[1] Ofgem has set a minimum standard average duration of 601 hours for unplanned MOB interruptions in London. Based on our forecast of almost 6,000 unplanned MOBs interruptions during RIIO-2 this would equate to around £8.5m of GSoP1 payments.

financial circumstances have allowed Cadent to avoid the practice of "stopping the clock" that other GDNs utilise.

GSOP summary RIIO-2 2018/19 prices	21/22	22/23	23/24	24/25	25/26	RIIO-2
GSOP 1*	£2.81m	£2.75m	£2.62m	£2.55m	£2.50m	£13.24m
GSOP 2-14	£0.42m	£0.42m	£0.41m	£0.41m	£0.41m	£2.01m
Total GSOP	£3.23m	£3.17m	£3.04m	£2.97m	£2.91m	£15.31m

Table 7: Updated level of efficient GSOP costs based on Ofgem's draft determination policy positioning

Option 2 – provide an efficient level of GSOP 1 funding for unplanned MOBs interruptions in London only

Provide an efficient level of GSOP 1 funding for unplanned MOBs interruptions in London, in line with Ofgem's approach on the unplanned interruptions financial ODI where London MOBs are separated out. This separation is to address regional specific issues related to significant variance in MOBs populations between our London network and all other networks.

Our MOB improvement plan, implemented at the end of 2018/19, has already delivered significant benefits to customers through utilising innovative techniques to reduce the likelihood of supply interruptions, reduce durations and improve the customer experience received during an interruption. However, as explained within Option 1, under the improvement plan, the efficient level of GSOP 1 payments will still be significantly higher in London than elsewhere.

GSOP 1 summary RIIO-2 2018/19 prices		21/22	22/23	23/24	24/25	25/26	RIIO-2
MOBs	East of England	£0.18m	£0.17m	£0.17m	£0.16m	£0.15m	£0.83m
	London	**£1.61m**	**£1.58m**	**£1.48m**	**£1.46m**	**£1.42m**	**£7.53m**
	North West	£0.08m	£0.08m	£0.08m	£0.08m	£0.07m	£0.38m
	West Midlands	£0.09m	£0.09m	£0.08m	£0.08m	£0.08m	£0.41m
	Total GSOP 1	£1.96m	£1.92m	£1.80m	£1.75m	£1.72m	£9.15m

Table 8: GSOP Summary for London MOBs

Our London MOB population contains a higher volume of buildings which lead to longer interruption durations. These include buildings more than 40 metres in height and those requiring complex solutions to restore gas supplies, for example, where the riser is located within the fabric of the building.

Given the five points outlined in Option 1 above, plus the regional specific issues relating to MOBs in London it is in the best interests of customers for us to be allowed an efficient level of GSOP 1 funding for unplanned interruptions in London only. This funding would mean that we could continue to make GSOP payments to ensure customers are compensated for an interruption in their gas supply and not utilise exemptions within the current RIGS to "stop the clock" on GSOP 1 payments where delays are outside of a GDNs control.

Option 3 – If no efficient level of ex ante funding is provided, the current GSOP exemptions within RIGs for events outside of GDNs control must be maintained for RIIO-2, this includes the ability to "stop the clock" on GSOP 1.

If no efficient level of GSOP funding is provided (either Option 1 or Option 2) then the review of RIGs for RIIO-2 must maintain the GSOP exemptions relating to circumstances outside of GDNs control to limit shareholders' financial exposure.

Whilst we have not widely used the current exemptions within the RIGs, given the imbalance of the draft determination package we would need to utilise them during RIIO-2.

Existing GSOP standards

GSOP 2 – Private reinstatement

We support the proposal to strengthen the GSOP 2 standard for completing private reinstatement to 3 working days for PSR customers. However, as the PSR is continually growing, with registrations on a daily basis, consistent criteria are required to determine how long a customer must be on the PSR for this standard to apply.

This is necessary as in some instances individuals may be registered for the PSR whilst our works are in progress, potentially prompted by the activity of our field teams. In these cases, we would have already scheduled the reinstatement work for the geographical area based on the PSR information available when planning and commencing the work. As such, whilst we would prioritise the reinstatement of all customers registered on the PSR, it may not always be possible to deliver this within 3 working days where the customer has registered after our works have begun. Therefore, we suggest that customers must be on the PSR for a short, defined period, for this element of GSOP 2 to apply.

To support the successful delivery of a tightened GSOP 2 standard for PSR customers, it is vital that we spread the awareness of the PSR and ensure that those who should be registered on the PSR get the opportunity to do so. The vulnerability use it or lose it allowance will enable us and other GDNs to do this, however our customers and stakeholders asked us to go beyond this. As such, we proposed a customer supported 'Needs Identification' bespoke output which was rejected in the draft determination. We believe that the draft determinations have not considered the customer and stakeholder evidence supporting this bespoke output and believe that Ofgem should reconsider their position for Final Determinations. Please see our response to question Cadent 3 for further information.

GSOP 3 – alternative heating and cooking facilities for PSR customers

We support the proposed enhancement of GSOP 3 to include access to hot water for those with specific health needs aligned with the relevant Needs Codes and hot food for every 24 hours during a major incident (excluding the first 48hrs). Question GDQ5 covers our views on the proposed 48-hour exclusion period as well as the proposed extension of GSOP 3 to cover all interruptions, not just major incidents.

Please refer to our proposal to provide personalised welfare facilities within core question 37 which describes how we plan to go beyond GSOP 3 to provide additional products to PSR customers as well as providing personalised welfare customers to all customers in vulnerable situations, not just those registered on the PSR. The updated costings within question 37 have taken into consideration the enhancements that will be made to GSOP 3 for RIIO-2.

We are also supportive of the various other changes to GSOP 3 that Ofgem have proposed in the Draft Determinations, including the reduced exemption period from 8pm-8am to 10pm-6am, additional payments for failure until the relevant provisions are delivered to customers, and the introduction of a payment cap. We would encourage Ofgem to ensure that the payment level is a multiple of the proposed cap to assist with reporting requirements. Ofgem's current proposal of a £48 per working day payment does not multiply into the £500 cap and this should be adjusted to £480.

GSOP 12 – timely payment of GSOP payments

In their Sector Specific Methodology Decision, Ofgem proposed to update the GSOP 12 standard, moving from the existing 20 working days to 10 working days. We do not support this change as it would require amendments to industry processes that are not fully in GDNs control, so may not be deliverable. Instead we propose an alternative of 15 working days.

In the event of a GSOP failure we endeavour to make compensation payments to customers as soon as possible. One area where we are working to unlock greater value for customers, and reduce potential failures against GSOP 12, is supply restoration (GSOP 1). However, we do not have customer details in this instance.

Under the current process for processing GSOP payments where GDNs don't hold the customer's details, we send payments to the gas supplier for them to forward on to their customers. This process is completed via Xoserve. As Xoserve currently provide only two windows a month for GDNs to submit GSOP 1 failures, it will be impossible for GDNs to meet the 10-day target for a proportion of payments, perhaps as many as 10%.

While, GDNs are working with Xoserve to increase the windows they provide for receiving GSOP 1 failures, it is important that Ofgem allow for the fact that in this circumstance, which is beyond GDNs control, GDNs are currently prevented from meeting the ten-day standard.

Therefore, while we are willing to accept a tighter standard for GSOP 12, as we recognise that GSOP standards need modernising, we propose a reduction from 20 working days to 15 working days to ensure GDNs have it within their control to meet the requirement in all instances.

Alternatively, a staggered approach to the adoption of the tightening of this standard during RIIO-2 would help GDNs to drive the right behaviours for customers. As we move through RIIO-2 this standard would be kept under review to ensure the minimum standard timescales are set at the right levels that are in the best interests of customers. This could include the implementation of changes following the satisfactory conclusion of industry discussions with Xoserve.

Payments and caps

We are supportive of the doubling of payments and caps. We also support the plan to use indexing.

There needs to be a clear and consistent process for indexation across GDN's (i.e. triggers, payment timings and basis of indexation). As such, we believe that Ofgem should lead in calculating and publishing any changes as this would avoid inconsistency errors between GDNs and would allow customers to access a central location to understand the compensation levels they are entitled to under the Guaranteed Standards. There also needs to be clarity on when the new payment level is due as each year there will be jobs which start at the previous payment level and end when a new payment level is introduced.

Extending connections quotations to more connections customers (GSOPs 4,5,6 and 8)

We are supportive of extending connections quotations 4,5 and 8 to isolations (disconnections) and diversions for exit connections. We would welcome the opportunity to discuss the extension of GSOP 6 to diversions in particular as we are mindful of the diverse nature of customer needs in this area and would want to ensure that the proportionality on pressures and diameters and different permutations are accurately reflected within any criteria. We would not want any new GSOPs to restrict our ability to deliver a positive customer experience for diversions customers. We would suggest that the detail within the extension of GSOPs 4,5,6 and 8 continues to be developed with Ofgem and GDNs through licence drafting and the Customer and Social Working Group.

We have some reservations about the proposed extension to green gas enquires for connections. Please see our response to question GDQ6 for more detail.

Unplanned interruptions

We accept the minimum performance levels and excessive deterioration levels set for London unplanned MOBs interruptions as, whilst stretching, they deliver against Ofgem's stated policy decisions and are aligned to the MOBs improvement plan we have previously agreed with Ofgem.

However, there are errors and omissions in how the minimum performance levels and excessive deterioration levels have been set for our East of England, North West and West Midlands networks under the common ODI and the London non-MOB / major incident bespoke ODI. They do not deliver against Ofgem's stated policy decisions and could incentivise actions that are not aligned with our customers' priorities. This is because:

- There are errors in the approach taken to calculate the number of major incidents per network. This is particularly biased against our London network, where major incidents are only combined with shorter non-MOB unplanned interruptions.
- Flaws with the proposed methodology, which have been identified during bilateral meetings and our RIIO-2 business plan, mean it cannot account for changes in workload during RIIO-2. This would lead to potential penalties for companies that innovate to avoid types of unplanned interruptions that are generally shorter. This is particularly biased against our West Midlands network as they experience the second lowest number of short non-MOB unplanned interruptions and have the second highest numbers of high-rise MOBs over 40m which have the potential drive the longest unplanned interruptions.
- There are errors in the draft determination methodology and modelling that mean GDNs could maintain performance that is explicitly recognised as acceptable in RIIO-1 and receive penalties in RIIO-2.

This response explains the points outlined above further but in summary the Final Determinations must:

1. Remove major incidents from the measure as the current proposal is not aligned to the principles of good regulation and no issues have arisen that would demonstrate the necessity for regulatory intervention;
2. Set RIIO-2 minimum performance levels in line with the minimum acceptable annual performance seen per GDN in RIIO-1 for non-MOBs and MOBs individually. This will ensure that no GDN maintaining performance seen during RIIO-1 will receive a penalty in RIIO-2;
3. Use separate minimum and excessive performance levels for both non-MOB and MOB unplanned interruptions and do not combine these categories This will place greater focus on the

performance delivered for these different customers and ensure that companies do not receive penalties due to errors in interruption volume forecasts; and

4. Not add further reporting requirements or financial sanctions beyond those that GDNs are already exposed to. These include the unplanned interruptions ODI-F, the increase in payments for GSoP1, the removal of the cap for GSoP1 and the complaints ODI-F.

Volumes of major incidents

Major incidents occur infrequently and are predominantly driven by third party damage that is outside of GDNs control. As such, when and where they will occur is unpredictable. Therefore, the methodology to use different highest numbers of major incidents for different GDNs in the modelling is not logical or proportionate.

Data from the first six years of RIIO-1 has been used to forecast whether a GDN will experience up to one or four major incidents per year during RIIO-2. For Cadent, draft determinations have 'allowed' up to four major incidents per year in East of England but only up to one in London, North West and West Midlands. This is not logical or proportionate as major incidents are predominantly driven by third parties so could happen anywhere but is also not statistically robust as the data sample used is too small.

For example, the table below shows the number of major incidents we experienced in our networks during GDPCR1.

GDN	08/09	09/10	10/11	11/12	12/13	Total
EoE	0	2	1	1	0	4
Lon	0	2	0	0	1	3
NW	0	1	0	2	2	5
WM	0	0	1	1	0	2

Table 9: Cadent major incidents in GDPCR1

If this data had been used to forecast the maximum number of major incidents our networks would experience in RIIO-1 using the same methodology that draft determinations are proposing for RIIO-2 it would have been wrong and led to unjustified penalties.

For example, our East of England network experienced four major incidents over the whole of GDPCR1 but has experienced four major incidents in a single year during RIIO-1, as shown in the table below. The most major incidents experienced in a single year in East of England during GDPCR1 was two, so if this methodology and modelling approach had been applied for RIIO-1 penalties would have been received in two years.

GDN	13/14	14/15	15/16	16/17	17/18	18/19	19/20	Total
EoE	1	1	1	3	1	4	1	12
Lon	0	0	0	0	0	0	1	1
NW	0	1	0	0	0	0	0	1
WM	0	0	0	0	0	0	0	0

Table 10: Cadent major incidents in RIIO-1

We are also not aware, and have seen no evidence from Ofgem, of any issue with GDNs performance in responding to major incidents. GDNs are required to provide Ofgem with detailed written reports on every major incident, including their steps to restore customers' gas supplies. Ofgem has not raised any issues with any of our major incident reports and have in fact provided positive feedback on their quality.

As such, the inclusion of major incidents in this measure, particularly through an unsound and disproportionate methodology, is inconsistent with the principles of good regulation. These principles state that regulators should only intervene where necessary and that any policy solutions should be proportionate to the perceived risk.

As the draft determination approach is developed based on a statistically unsound data set, uses a methodology that cannot recognise the huge variance in types of major incident that may be experienced, nor the actions that would be required to restore supplies, and could impose penalties of up to 0.5% of revenue on an annual basis, it does not meet the standards set out within the principles of good regulation.

In draft determinations Ofgem has proposed that they may use their discretion to adjust the penalty amount if a higher number of major incidents was experienced than expected. Whilst we recognise the intention of this proposal, we do not believe that the inclusion of a discretionary measure is sufficient to address the errors and weaknesses in the proposed draft determination methodology. Ofgem should instead focus on mitigating the errors relating to major incidents within the draft determination methodology. There are four options to do this:

1. Remove major incidents from the proposed measure (our recommendation);
2. Exclude third party driven major incidents from the proposed measure;
3. Adjust the volume of major incidents built in to the minimum performance levels during RIIO-2 based on the actual number experienced; or
4. 'Allow' each GDN the same number of major incidents based on the highest number experienced annually in any single network historically. This is four.

These proposals do not change the requirement on GDNs to provide reports for each major incident to Ofgem. Therefore, any issues arising, such as problems with the speed of response, can be identified and addressed through that existing process.

We acknowledge that this proposal requires Ofgem to reverse their sector specific methodology decisions. However, we request that Ofgem do so in order to ensure implementation of a workable solution that is in the best interests of customers.

Setting a minimum performance level for major incidents

The type of action that will be required to respond to a major incident is unpredictable and dependent upon on a wide range of variables that are difficult to robustly forecast or model, especially given the small data set available. These variables include the number of customers impacted, the configuration of the GDNs assets affected, the weather, the local geography and the location and/or resilience of other organisations assets (i.e. railways, motorways, electricity distribution networks etc.).

As such, the methodology and approach to modelling adopted in draft determinations is not robust as it is impossible to compare a small number of historic incidents to set an expected restoration time.

This can be evidenced by a major incident in the Richmond area of our London network in 2019/20. In their modelling Ofgem has used data from the first six years of RIIO-1 to essentially set performance levels for major incidents. However, when you examine this data it shows a huge variation in average durations and no pattern that can be used to support forecasting of future incidents.

The average durations for major incidents in the first six years of RIIO-1 range from less than 5 hours (285 minutes) to just over 5 days (7,212 minutes), so there is low statistical comparability. Using this approach to forecast the length of the Richmond incident the result would be between these two bounds whereas the average duration was justifiably longer, due to significant complexities specific to this incident.

Case study: Richmond major incident, January / February 2020. Total length 9 days (12,595 minutes)

This incident was caused by a burst water main damaging a gas main leading to almost 2,500 gas customers being affected across 35 streets. While we had repaired our gas main within 24 hours of the incident occurring, it took significantly longer to restore gas supplies. This was due to:

- The need to apply to the courts for warrants to access 122 properties, 12 of which were then executed, to be able to safely isolate supplies so that we could begin to extract water from the network;
- The damaged section of main being located near the top of a hill meaning that once in our network the water flowed down the hill to a wider area across the local network than would normally be experienced during a water ingress incident;
- The need to extract over 150,000 litres of water from 30 separate locations across our network, with considerable traffic management required to enable these excavations;
- The need to utilise small tankers; due to the residential nature of the area, to remove the water extracted from our network. This led to multiple tankers being required and each making multiple journeys; and
- A large volume of water pooling at the bottom of the hill, including over 6 metres underneath the main railway line to central London. This area of railway was also enclosed by residential properties, resulting in restricted access and complex excavation.

If the minimum performance levels proposed in draft determinations had applied in 2019/20 our London network would have received more than half of the maximum penalty due to the modelling only 'allowing' up to one major incident (so in reality less than one) and setting duration performance levels on a small and not statistically robust set of data. This is inconsistent with Ofgem's stated position, set out in 2.85 of the Gas Distribution Annex, that if GDNs maintained their current performance they should not receive a penalty in RIIO-2.

There are two options to mitigate the issues with the draft determination methodology and modelling approach:

1. Remove major incidents from this measure (our recommendation); or
2. Set minimum performance level using the longest average restoration time seen historically across all GDNs, where Ofgem has not taken action in relation to the GDNs response time. For Cadent, across GDPCR1 and RIIO-1 this would be 12,595 minutes. We have not got access to GDPCR1 data for other GDNs, so would recommend that Ofgem review this as well.

These proposals do not remove the financial incentive on GDNs to restore supplies as fast as is safely possible. They would still be subject to GSoP1, where payments are being doubled and caps removed for RIIO-2, and the complaints incentive, which is worth up to 0.5% of revenue. GDNs would also still be required to provide reports for each major incident to Ofgem. Therefore, any issues arising, such as problems with the speed of response, can be identified and addressed through that existing process.

Combining major incidents with other categories of unplanned interruption

In addition to the issues regarding the calculation of the number and duration of major incidents, the approach to combine major incidents with other categories of unplanned interruptions is also biased against our London network.

In London major incidents are combined solely with shorter non-MOB unplanned interruptions. Whereas in all other networks they are combined with longer MOBs unplanned interruptions as well. This has a disproportionate impact on the combined unplanned interruption average duration in London when compared to other networks. When this is combined with London being 'allowed' fewer major incidents within the draft determination modelling than the East of England, Northern, Scotland and Wales and West networks it means that London has a higher risk of an unjustified penalty whilst maintaining RIIO-1 performance than other networks.

This again supports our recommendation above to remove major incidents from this measure.

Using average duration as a measure

As discussed with Ofgem following the publication of the SSMD and highlighted in our business plan submission, using average duration could lead to GDNs being penalised for responding to customers' priorities.

Our extensive customer engagement demonstrated that our customers valued the avoidance of an unplanned interruption more than a reduction in an unplanned interruptions' duration. However, the use of average duration as the performance measure for unplanned interruptions means that GDNs could be penalised if they innovate to avoid shorter interruptions.

As such, we proposed an alternative measure in our business plan, similar to that used in RIIO-ED1, which would combine a customers' likelihood of experiencing an interruption with the average duration of those unplanned interruptions experienced. However, this approach has been rejected by Ofgem.

While we do not agree with this policy position we acknowledge that Ofgem intend to maintain it. This increases the need for Ofgem to address the errors and flaws within their proposed approach.

Combining MOBs and non-MOB unplanned interruptions

As set out in our previous engagement with Ofgem the issue highlighted in the previous section, relating to using average duration, is amplified by combining different categories of unplanned interruption. Combining unplanned interruption categories will also reduce ability of stakeholders to understand GDN performance in this important area.

The major challenge arises from setting a fixed combined average duration based on an assumed forecast split in unplanned interruption volumes between MOBs, non-MOBs and major incidents. Even if the individual average durations remained the same for each of these categories, if the actual volume split differed from that forecast it would impact perceived / outturn performance. For example, if a GDN innovated or invested to find a way to halve the number of non-MOB interruptions experienced on their network it would make their performance against this measure look worse. This is despite the avoidance of the interruptions providing a more positive customer outcome. Conversely, if the actual number of non-MOB interruptions was higher than forecast the GDN would perform better against the measure, despite being less reliable.

We have already evidenced in this response how the approach to major incidents contains errors and that these have the greatest negative impact on our London network. Further to this, any changes in forecast to actual volumes between non-MOBs and MOBs would have the greatest negative impact on our West Midlands network. This is because it has the second lowest number of short non-MOB unplanned interruptions but has the second highest number of high-rise MOBs greater than 40m in height. As such, these MOB interruptions have a disproportionate impact on the combined measure.

There are three options to mitigate the issues with the draft determinations proposal:

1. Have separate minimum and excessive performance levels for both non-MOB and MOB unplanned interruptions (our recommendation);
2. Use actual volumes on an annual basis to set the combined minimum performance levels (utilising category specific minimum performance levels set at final determinations); or
3. Utilising a combination of historic and forecast unplanned interruption volumes use the lowest plausible volume of non-MOB unplanned interruptions and the highest plausible number of MOB and major incident (if not removed) volumes to set the minimum performance levels.

Ofgem has previously stated that they are unwilling to consider options 1 or 2 as they would require some reversal of their SSMD, which led us to use option 3 in our business plan submission. As the Draft Determination does not propose to adopt any of these suggested solutions to the flaws in the methodology, it is apparent that Ofgem has failed to properly take our evidence into account when making its judgement.

Instead the DD has combined the categories of unplanned interruptions, reducing the focus on specific issues and creating unintended negative side effects. This is not in line with the principles of better regulation which stipulate that regulation should be targeted and minimise side effects.

We recommend that the Final Determination implements option 1 above as this will provide specific focus on both non-MOB and MOB customers' experiences of unplanned interruptions, ensuring that they both receive service that at least exceeds a minimum performance level. It also mitigates the issues identified with combining the categories and avoids the need for either annual updates of a combined target or complex forecasting which is likely to be inaccurate.

Setting minimum and excessive deterioration performance levels

Defining our RIIO-1 minimum performance levels

In the Draft Determination Ofgem states that no GDNs have breached minimum performance levels in RIIO-1, with the exception of London MOBs. Therefore, this implies that Ofgem should select the slowest annual average duration for each category of unplanned interruption during RIIO-1, except for London MOBs, when setting an annual minimum performance level.

As shown in the tables below, for our networks this would be :

- East of England: Non-MOBs 11.1 hours (2016/17) and MOBs 432.3 hours (2017/18)
- London: Non-MOBs 13.6 hours (2018/19) and MOBs 601.3 hours (2016/17)

- North West: Non-MOBs 12.8 hours (2016/17) and MOBs 298.4 hours (2018/19)
- West Midlands: 9.8 hours (2016/17) and MOBs 601.3 hours (as we do not believe WM should have a longer minimum performance level than London)

GDN	2015/16	2016/17	2017/18	2018/19
EoE	7.9	**11.1**	8.1	8.1
Lon	9.7	12.0	10.8	**13.6**
NW	9.2	**12.8**	9.5	10.5
WM	8.7	**9.8**	8.2	8.9

Table 11: Average duration of unplanned non-MOB interruption (hours)

GDN	2015/16	2016/17	2017/18	2018/19
EoE	271.1	313.7	**432.3**	409.1
Lon	538.4	**601.3**	~~1,001.7~~	~~959.9~~
NW	95.4	140.0	59.5	**298.4**
WM	148.6	127.4	~~602.9~~ (we propose **601.3**)	259.3

Table 12: Average duration of unplanned MOB interruption (hours)

Setting performance levels differently or beyond this would mean that the measure does not meet Ofgem's key stated objectives to only penalise companies for significant deteriorations in performance relating to unplanned interruptions and that companies should not receive penalties if they maintain RIIO-1 performance levels.

Consequently, there is no need for Ofgem to model the individual category minimum performance levels, they should use the approach described above to deliver against their stated policy.

Draft determination modelling to set RIIO-2 levels

In reviewing the draft determination Monte Carlo simulation, we have identified a number of errors in how it has arrived at the proposed RIIO-2 minimum and excessive deterioration levels. These errors mean that GDNs could receive a penalty for maintaining performance levels seen in RIIO-1 which is inconsistent with Ofgem's stated policy. The errors we have found are:

- Using a statistically unsound data sample size to undertake Monte Carlo modelling to set performance levels;
    - To ensure statistical robustness while taking this approach the data for all individual interruptions should have been used.
- Combining MOB and non-MOB unplanned interruption categories before modelling (input stage) rather than after;

    - This is inconsistent with the approach to major incidents. It also fails to recognise that MOB interruptions are very different to non-MOB interruptions. This error negatively impacts networks that do not 'stop the clock' on MOBs interruptions significantly more than those that do.
- Using the average of multiple years to create fixed annual performance levels;
    - Ofgem state that all performance within RIIO-1, except London MOBs, has been within minimum performance levels. As such, Ofgem should use the slowest acceptable years for MOBs and non-MOBs individually.
- Setting the minimum performance level at the P95, which is inconsistent with Ofgem's statement that no performance (i.e. P100) has breached minimum performance levels in RIIO-1, excluding London MOBs.

Undertaking Monte Carlo modelling to set minimum performance levels is unnecessary and is overcomplicating the implementation of Ofgem's methodology. However, if Ofgem propose to re-run their model for final determinations the errors identified above must be corrected.

Ofgem and stakeholder visibility of RIIO-1 minimum performance level

As stated earlier in this response, the draft determinations set out that there has been no breach of minimum performance levels in RIIO-1 other than on London MOBs. However, it should be noted that Ofgem and stakeholders do not have the information to understand if some other companies have breached minimum performance levels during RIIO-1. This is because some GDNs consistently 'stop the clock' on some of their longest unplanned interruptions for a variety of reasons.

One GDN provided evidence to Ofgem, and all other GDNs, in September 2019 detailing scenarios where they 'stop the clock', including on MOB unplanned interruptions. In the example they provided if the stopped period is added to their RRP data it would suggest that the average duration experienced by their MOB customers in 2018/19, when considered on the same basis as we reported, was longer than in our London network whose performance we have acknowledged was unacceptable in that year.

We do not believe that this issue will only be present in just this one GDN or this one year. As such, Ofgem should work to understand what these networks' real minimum performance was during RIIO-1, particularly for their MOBs customers, to ensure the RIIO-2 measure is calibrated correctly.

Introduction of additional report and enforcement action

The regulatory principle of setting a financial incentive is that this determines the balance between customer and network risk. As such, the introduction of further measures in addition to the proposed financial ODI alters the incentive properties. This effectively increases the downside risk exponentially as the collar is essentially removed.

This downside risk is increased further as in addition to the proposed unplanned interruptions financial ODI there are further financial incentives within the framework to ensure that GDNs restore gas supplies as quickly as safely possible. These include GSoP1, where payment levels are being doubled and the cap being removed for RIIO-2, complaints, where there is a further penalty only incentive of up to 0.5% of revenue, and customer satisfaction, where there is a further incentive with a reward or penalty available up to +/-0.5% of revenue. GDNs must also report on performance in this area through the annual RRP and supporting strategic performance overview.

Therefore, it would not be proportionate or appropriate to have further reporting requirements or sanctions beyond these existing measures and caps. We would ask Ofgem to remove statements relating to further action beyond the financial incentive collar in the FD.

GDQ2 - What are your views on the reporting metrics we have proposed for the consumer vulnerability ODI-R?

As explained in our Customer Vulnerability Strategy, we agree that setting robust and meaningful performance targets, measuring performance against them and reporting actual performance back to customers and stakeholders is essential to drive ourselves and other organisations to continually improve. As such, we fully support the principle of agreeing some common metrics that are reported on annually.

In terms of the three metrics proposed in Ofgem's DD, we already measure customer satisfaction for PSR customers and see this is good practice in helping us to understand the specific requirements of different types of customers. It should be noted that given the relatively low response rate to the current C-sat surveys (despite lots of effort to increase this) if measured too frequently then the sample size can be such that the results read in isolation are often quite misleading. Therefore, an annual showcase of performance, including playback of initiatives to improve PSR customer experience is more appropriate.

The FPNES metric is an existing metric and directly relates to the proposed FPNES output measure. Whilst we believe that GDNs and other Network businesses should be relatively free to determine other measures in this area, as you will note in our customer vulnerability strategy, we (backed by our customers and expert stakeholders) understand that simply measuring FPNES connection by volume and a percentage against targets, only provides a very narrow view of the work we do to support customers living in fuel poverty. We propose that we therefore report on a far wider range of initiatives and performance stats at the annual showcase event (in addition to the metric proposed by Ofgem).

Average CO awareness is an interesting measure, but we believe that it is important to not only be aware of the dangers of CO, but far more importantly to be aware of the controls that can be put in place to mitigate against the dangers. Therefore, measuring the percentage of the public who know what CO is and that it might harm them is not a particularly useful stat. Rather, measuring the percentage of the public who have taken positive action based on their understanding the dangers of CO is much more meaningful. We therefore propose a measure such as the % of customers with a CO alarm installed as more valuable. By measuring 'action taken' in such a way, it will encourage companies to undertake quality awareness programmes rather than focus on quantity.

GDQ3 - What are your views on the design of the annual showcase events, including whether they should be held at a national or regional level?

Gas Distribution Questions

We support the concept of the annual showcase events. However, the focus, as written in the Gas Distribution Annex appears to be one of reporting performance levels as opposed to actually showcasing initiatives and innovative ways of doing things to support customers in vulnerable situations beyond the regulatory metrics. It is possible to 'showcase' performance levels through many forms, including reporting them on our website, Ofgem's website, through social media, etc. without the cost of effort of a showcase event.

Therefore, we believe that the showcase event should be to genuinely 'showcase' initiatives that we have trialled and are proving successful so that we can share with and learn from other GDNs, and potentially other organisations if the scope for the events allowed for multi-industry sharing, which we would also support. During RIIO-1 we have shared lots of great practice such as our Safety Seymour and CO Crew initiatives that have proven hugely successful in raising awareness of our communities of the potential harm associated with CO poisoning. We have shared this with other GDNs and they are now nationally applied, which has greatly benefited society. Our locking cooker valve innovation is another example of the sort of initiative that we believe should be presented at the annual showcase events. We also wonder (given our experience of success with such this) whether local innovators could be invited to showcase events to encourage them to understand problem statements (to then work on solutions for) and come with ready-made solutions to showcase themselves.

We believe that the approach described above lends itself to a national event – i.e. to bring the maximum sized group together and ultimately share as many good practices as possible. However, regionality is important so that we can stay close to the many communities that we represent. As such we propose that each year the event is staged in a different part of the UK.

GDQ4 - Do you agree with our position to change the FPNES from a PCD to a capped volume driver?

As described in our Customer Vulnerability Strategy, we do not believe that a single output focussing on FPNES will deliver anywhere near the level of social return as a far broader GDN set of initiatives to support customers living in fuel poverty. We will therefore seek alternative funding where possible and practical to allow us to deliver this additional value, especially as this area of our Plan was so well supported by customers, expert stakeholders, charities directly working with those living in fuel poverty and consumer expert groups such as Citizens Advice.

We do see the FPNES programme as valuable to customers as part of a wider package and the proposal to change the scheme from a PCD to a capped volume driver allows companies to deliver additional value to customers through this initiative, which we support.

Gas Distribution Questions

GDQ5 - For GSOP3, is a 48 hour exclusion period for the provision of access to hot water and food in the event of a major incident appropriate? Should this be extended to cover interruptions that are not a major incident?

For GSOP 3, we support the introduction of a 48-hour exclusion period for the provision of access to hot water and food in the event of a major incident.

We support an enhanced version of GSOP 3 (including the 48-hour exclusion period) being extended to cover interruptions that are not a major incident. The method in which we deliver this service may differ, for instance, for a major incident we may secure a hot food van as multiple customers are impacted in the same area, whilst for an individual interruption we may offer hot food vouchers or take-away meals. However, we recognise that the impact of a long interruption lasting more than 48 hours is no different if it occurs through a major incident or single interruptions and therefore, the provision should not be limited to customers impacted by a major incident only. We already routinely have personalised conversations with customers about their welfare needs during a normal interruption, and voluntarily offer an enhanced welfare service where this is applicable.

With regards to provision of hot water facilities, we would like to reiterate our proposal from previous Ofgem customer and social working groups that the service should be prioritised for those who require this provision for specific health needs and believe this can be aligned with specific PSR Needs Codes. Whilst further discussion will be required between Ofgem and other GDNs to finalise, our initial assessment suggests that hot water provisions should be provided to PSR customers with the following Needs Codes:

- 23 – Medically dependent on showering/bathing
- 29 – Families with young children aged 5 or under
- 37 – Water dependent for medical reasons

These facilities may be limited in the area e.g. gym shower facilities, so offering to all PSR customers as a minimum requirement may adversely impact those who need the service most.

Given these changes to GSOP3, we still believe our bespoke commitment to provide personalised welfare services to customers during a supply interruption goes beyond these minimum standards and BAU in three ways:

1. We are offering a wider range of welfare provisions (including temporary accommodation and innovative products meeting specific needs e.g. B-Warm blankets)
2. This service will be provided to customers beyond those registered on the PSR as we recognise the transitory nature of vulnerability and that the specific circumstance of being without gas can cause vulnerability
3. We have developed a comprehensive decision-making application working with numerous expert third parties (including Citizens Advice, Groundworks, NEA and Age Concern) to enable our

engineers to identify where additional welfare provisions should be provided and which ones to provide. This is unique to Cadent.

Please refer to our response to core question 37 which describes how we plan to go beyond GSOP 3 and the detailed costings which have taken into consideration the enhancements that will be made to GSOP 3 for RIIO-2.

Gas Distribution Questions

GDQ6 - In relation to our proposal to extend quotation GSOPs on entry and exit connections, is it sufficient – in regard to green gas entry enquiries – for these GSOPs to apply to the provision of initial and full capacity studies? Are there other parts of the green gas entry process we need to consider to ensure an improved service provision?

Before responding to question GDQ6, we are mindful of Standard Special Condition D12. Requirement to offer terms for the provision of gas entry points. Part 6. Nondiscrimination: In carrying out the provision of gas entry points the licensee shall not unduly discriminate between any persons or class or classes of persons.

We therefore require confirmation of how Ofgem define "green gas" to ensure that no potential connectee is being discrimated against.

The current voluntary standards that all GDN's have in place for entry connections are working well, with no negative stakeholder feedback received. We do not believe that there are sufficient additional benefits beyond the voluntary standards to justify making these Guaranteed Standards and would add further regulatory burden, therefore the best outcome for customers would be for initial and detailed entry capacity studies to remain as voluntary standards for the following reasons:

- Due to the bespoke nature of entry connections, the arrangements within the current voluntary standards provide GDNs with a flexible working environment to meet the bespoke needs of customers who prioritise quality information over timeliness;
- The provision of Detailed Capacity Studies is a paid for service by the customer and the studies provide optioneering for connection locations, sometimes across pressure tiers and also operating parameters which can be complex. GDNs engage with customers both prior and during the production to ensure these studies are accurate, complete and meet their requirements;
- Analysis for entry connections is becoming ever more complex and bespoke in the changing energy landscape as we move towards Net Zero and also the increase in Power Generation connections and the complexities of pressure requirements for both types of connections. It is vital that working arrangements for entry connections reflect this complex working environment;
- Given the current lower volumes of enquires we receive, we are able to balance the quality of studies with efficient provision to customers. However, we are mindful that external factors such as Government policy change associated with the Renewable Heating Incentive could drive a sudden uplift in enquires that we are not in a position to manage without compromising quality which could go against what customers want and need;
- Overall, working within a minimum standard GSOP environment for entry connections may limit GDNs ability to respond to evolving customer needs in this rapidly developing market. This ability to respond, and GDN flexibility, will be important to support the energy transition;

  - This could drive the wrong behaviours (e.g. customers receiving a less in-depth study than they would have previously, especially if volumes were to increase). It would also add regulatory burden for no additional value for customers.

There are no other parts of the green gas entry process that need to be considered to become GSOPs. Current voluntary standards work well for customers and stakeholders.

Gas Distribution Questions

GDQ7 - What are your views on our consultation position to monitor the provision of and adherence to appointment timeslots for purge and relight activity through an ODI-R? Are our suggested reporting measurements reasonable?

We support the introduction of an ODI-R to monitor the provision of and adherence to appointment timeslots for purge and relight (P&R) as we have strong evidence that our customers value this. However, we do not agree with the proposal to reject the CVP associated with this output. Ofgem have proposed to introduce a new common output to monitor appointments, therefore this implies that this commitment represents additional value to customers. It would be unfair for Ofgem to deprive us of the benefit while imposing the regulatory burden.

Offering P&R appointments represents additional consumer value

Ofgem suggest in the Draft Determinations that this commitment is not innovative and therefore should not receive a CVP reward. Although other companies offer a similar service, we believe our proposal goes beyond in three ways:

1. We are offering tighter time scales (i.e. 2-hour or 4-hour slots), whilst others offer AM and PM time bands. Ofgem refer to Ofwat's guaranteed standards for making and keeping appointments in the Draft Determinations as an example of existing 'regulatory precedence in other sectors'. However, under these standards the company gives notice of a two-hour time slot but does not offer customers a choice of selecting a time slot. This is a key difference as our proposal provides customers much greater choice and convenience.
2. We are offering this service free of charge whilst others charge their customers or reflect the cost of this service in their prices.
3. We proposed to set a stretching 90% adherence target (which Ofgem have chosen not to introduce).

For these reasons we believe this represents additional consumer value, which is supported by the willingness to pay analysis we completed, and hence Ofgem should revisit its assessment of Cadent's CVP in this area for the business plan quality incentive.

Common ODI could drive a reduced offering

Although we would support introducing a common measure that would apply to all GDNs rather than a bespoke ODI, we believe the DD's definition of this could potentially reduce our offering from that which we discussed with our customers. Our proposal is to proactively engage customers whilst we are completing the works on the street and offer them an appointment slot between the ranges of 2 hours or 4 hours to complete the P&R. This will allow customers to select a time most convenient to them and will significantly reduce unannounced visits. However, both NGN and WWU had proposed to only offer appointments when customers are not present or are unavailable (i.e. do not answer the door). This is a reduced offering and something we already provide today on an informal basis. Our proposal, therefore, provides greater customer choice and convenience and goes beyond what others are proposing. If a common ODI is introduced, we suggest that it is defined according to our proposal and all GDNs are asked to provide this service level. If Ofgem decide against introducing a common ODI, we believe that a bespoke reputational ODI should be introduced for our networks and there should be recognition that this service is innovative and goes beyond BAU, hence worthy of recognition through the business plan quality incentive.

Reportable measures

We believe the most valuable reportable measure is the 'percentage of times the technician arrives at the premises within the agreed timeslot' as this measures how often we adhere to the wishes of our customers and keep our promises. We see some value in reporting the 'percentage of times an appointment timeslot is offered' to measure the proportion of smaller range timeslots offered in comparison to all appointments. However, we see no value in measuring 'percentage of times a timeslot is agreed with the customer' as some customers may not take up the offer for an appointment slot but prefer that the P&R is completed as soon as possible. Therefore, performance against this will be based on what customers preferred and will not be a good indicator of strong or poor performance.

Customers do not want compensation when we fail

If appointment times are not met, our customer engagement and joint GDN research informs us that in addition to providing a revised appointment time, customers would like an apology and an explanation as to why we were not able to meet the appointment time. These were customers' preferred option rather than being paid compensation and was a key reason we concluded that a GSOP was not required which has been acknowledged by Ofgem in the Draft Determination (see paragraph 2.66 of GD annex). Therefore, we will not pay compensation voluntarily when we fail to meet appointments, as this would not reflect value to customers and customer preference.

Gas Distribution Questions

GDQ8 - Do you agree with our proposed option to provide Cadent and SGN with consumer funding through totex baseline or a financial ODI reward for collaborative streetworks activities?

Through our programme of enhanced engagement for RIIO-2, our customers and stakeholders have highlighted the importance of streetworks collaboration to minimise disruption and reduce the impact on consumers and society. Evidence from our qualitative engagement and quantitative business options testing clearly demonstrates consumer value, with customers, stakeholders and our CEG encouraging us to do more to collaborate with other utilities and Local Authorities. Commenting on our Business Plan, Deputy Mayor of London, Jules Pipe, stated: "Cadent's approach to engagement is to be commended. I welcome the commitment in your business plan to minimise disruption associated with your works in London and the initial funding you have directed towards supporting coordination activities"

Although there are great benefits from collaborative streetworks, there are various cost barriers in place that a financial incentive or totex baseline funding would help mitigate. Any incentive should be reward only as this is a new area with no benchmark and increased collaboration should be positively encouraged. There are two ways in which the regulatory framework could encourage collaborative streetworks in RIIO-2; through a financial output delivery incentive or a totex baseline allowance. We are working with SGN and the GLA to jointly develop our proposals, but we provide the principles of how each of the options could work in practice in this response. We believe the financial incentive would best meet customers needs.

How a financial incentive could work

SGN, in its business plan, proposed a 'Social Value Collaboration Incentive' based on a research study which identified a statistically significant negative impact of works on people who lived within 500m of them when measured over 30 days. We have used this measure as a starting point to develop our joint proposal with SGN for a financial ODI. Although this provides a strong basis for a measure we have proposed some enhancements to ensure it delivers the best outcomes to customers and stakeholders.

We have assessed each aspect of an incentive against Ofgem's ODI framework, which we summarise in the table below:

	Proposal	Reasoning
Reputational or financial	Financial incentive	The social value associated with streetworks collaboration is significant and a financial ODI will act as a strong incentive to deliver this value that our customers and stakeholders have encouraged us to do.
Reward or penalty or reward/penalty	Reward only	This is a new area with no robust benchmark for performance and there are already punitive measures in place to discourage poor streetworks performance.

Symmetric or asymmetric	Asymmetric	Reward only, therefore asymmetric.
	Proposal	**Reasoning**
Measure	No. of collaborative projects completed	The number of collaborative projects completed is a simple and accessible measure. We have proposed clear criteria to determine what is defined as a collaborative project incorporating input from the GLA. There may be value in developing a 'no. of days saved in the road' measure, however, additional data is required to ensure this is robust.
Target	No specific target	We do not believe a target should be set as the current baseline for delivering collaborative streetworks is low across the sector and utilities industry. A company will only be rewarded for the completion of collaborative projects and the incentive will be capped. Therefore, there are sufficient protections in place with no requirement for specific targets.
Incentive rate / value	£305k per collaborative project completed (subject to meeting eligibility criteria)	£305k reward is based on the calculated social value to gas consumers of a typical collaborative project (i.e. Epsom Road) subject to meeting the eligibility criteria. This value is conservative as it does not include the wider societal benefits and will not increase if the days saved in the road is higher than the example used for calculation. E.g. our Stoke Newington project is expected to be almost triple the number of days saved in the road compared to the Epsom Road project and will therefore generate significantly more social value.
Caps and collars	Reward capped at 0.5% of base revenue	Cap set at 0.5% of base revenue per network in line with other financial incentives across the framework.

Table 13: ODI proposals

Measure

SGN proposed an output which provides a £305k reward (based on the social value to gas consumers in the area) for every collaborative project delivered over RIIO-2. The social value to gas consumers was calculated based on SGN's Epsom Road project in Croydon which saved 85 days. Although there could be benefit in developing a measure based on days saved in the road, we believe further work is required to ensure the methodology to measure this is robust through the delivery of additional projects and associated data capture and evaluation. To provide assurance to Ofgem and stakeholders that GDNs are not over-rewarded for projects, we propose to develop a set of principles with the GLA on what is considered a collaborative project. Our initial view of these principles are as follows:

- 0.2km minimum project length, no maximum cap and/or

Gas Distribution Questions

- Schemes at 'high-profile' or strategic road network locations, schemes that are of high importance due to historic issues resulting from either providers' assets, works aligning with borough/TfL schemes and initiatives deemed of importance by the borough, TfL or GLA, or works considered to have significant customer impact

- Governance, commercial and technical arrangements agreed in advance
- Level two collaboration (as defined in the Collaboration Manual) as a minimum, entailing:
    - Steering group with representation from all the collaborative partners ○ Joint communications plan and customer communications
    - Paced Collaboration (as a minimum) e.g. when two or more utilities and/or a highway authority work in the same site, but one after another or sequentially
- The project must entail undertaking streetworks to install, renew, replace or decommission infrastructure assets, and such works must represent a permanent solution for customers, not a temporary repair to existing infrastructure
- A minimum of two collaborating parties must be involved in undertaking the streetworks.
- On site works must be undertaken and completed by the end of RIIO-GD2

Target

In RIIO-1 only a small number of collaborative projects were delivered due to the significant additional costs associated with collaboration. Over RIIO-1, working with the GLA, SGN have delivered one collaborative project (Epsom Road), whilst we have almost completed the delivery of an additional collaborative project (Stoke Newington). Therefore, the current performance across the sector is low and even delivering one collaborative project per year in RIIO-2 would be stretching, especially considering that we expect the cost of collaboration per project to be greater than the proposed reward in the early stages of this activity.

Incentive value and cap

As explained, we are proposing an incentive reward of £305,000 for every collaborative project completed based on the independently validated and calculated social value of a typical collaborative project (i.e. Epsom Road – See Simetrica report[2]). It should be noted that the calculated social value is restricted to the benefits to gas consumers. There are wider societal benefits to non-gas consumers that have not been included within the £305k social value. The GLA estimate that these benefits are significant in terms of air quality, reduction in road congestion etc. Hence by focusing the incentive solely on the gas consumer benefit, we are taking a very conservative view of the benefits in terms of the reward being provided to the gas network companies and generating significantly more social value on top of this. Furthermore, the proposed incentive reward is based on a single data point and the social value associated with each project will vary. We expect many projects to deliver value over and above £305k, for example, our Stoke Newington collaborative streetworks project is expected to save more than 240 days in the road and will generate social value way beyond £305k. Hence we believe using £305k as an average will if anything underestimate the actual social return that is delivered hence ensuring that rewards to networks are far outweighted by reward to customers and society from the incentive

[2] Simetrica report on **Valuation of the impact of works disruptions and supply interruptions using the wellbeing valuation method** https://www.sgnfuture.co.uk/wp-content/uploads/2020/01/SGN-023-Suppinfo-Annex-of-Social-value-regression-analysis.pdf

We do not believe there should be any penalty associated with this incentive. This is a new area with no robust benchmark for performance and there are already punitive measures in place to discourage poor streetworks performance e.g. S74s, permits and lane rental costs. In addition, collaboration will depend on obtaining buy-in from the various utilities and authorities involved, and in some circumstances collaboration may not be possible due to factors outside of a GDN's control. We will seek to collaborate in all opportunities where there is a clear benefit in doing so but do not believe a GDN should be penalised when collaboration has not been possible, as this could happen for a number of valid reasons (including some beyond our control).

However, we are supportive of applying a cap on rewards to ensure consumers are protected from excessive gains and the subsequent impact on their bills. We believe this cap should be set at 0.5% of base revenue per network in line with other financial incentives across the framework (e.g. CSAT, complaints, unplanned interruptions).

How a totex baseline allowance could work

Alternatively, Cadent and SGN could be encouraged to undertake collaborative streetwork projects through costs being funded via a totex ex-ante allowance. With this approach we could commit to deliver a number of collaborative projects over the RIIO-2 period and obtain an allowance based on the additional net cost for each project or enable this through a revenue driver. However for the reasons set out below we believe this is an inferior approach to the financial incentive.

Cost of collaboration

SGN calculated the net additional cost of collaboration at £400k per project based on the Epsom Road project. The associated costs were broken down as follows:

- Additional planning and preparation costs: c.£150k (e.g. senior management coordination, data sharing, project planning and construction design and management (CDM) compliance)
- Additional legal costs: in excess of £200k (e.g. to establish memoranda of understanding and other supporting documents, apportionment of costs for project changes, and the liabilities for compensation arising any project delays)
- Additional on-site costs: c.£200k (e.g. open cut trenches rather than carry out live insertion, additional reporting requirements, and inefficiencies as a result of timing and coordination (increased unproductive time on site)

However, there are a few cost savings resulting from collaboration that amount to around £50-100k, including:

- Reduced traffic management charges due to shorter overall duration
- Reduced lane rental charges in London for collaborative projects
- If a trench is shared, reinstatement charges could be reduced; (however, companies are likely to have to temporarily resurface sections of work to ensure risks of open trenches are reduced and do not cause inconveniences to road users and customers)
- Customer communication costs may be reduced (however the cost of coordinating communication to customers will increase as different standards and priorities are reconciled)
- Parking bay charges can potentially be waived by the local authority to support collaboration

Based on SGN's experience of Epsom Road Croydon, net additional costs are assumed to be in the region of £400k. We have assessed these costs with some of the costs we are incurring for collaborative projects and can confirm that they are within the same range.

We are currently delivering a collaborative project in Stoke Newington with Thames Water, TfL and Hackney Council which aims to save over 240 days in the road. There have been many savings made to all parties involved which will be fully calculated at the end of the scheme. The most rewarding cost saving to all involved so far has been the Lane Rental waiver which has saved £160,000 across all companies. However, there have been significant costs to enable and facilitate collaboration that we will be evaluating at the end of the project. Although, the project has not been concluded, the indicative additional costs associated with this project are as follows:

- Additional cost of labour due to squeezing the programme into the required durations allowed – c.£126k
- Wider communications with additional variable message sign boards and advanced warning signs – c.£26k
- Extra preliminaries for additional staff to support the collaboration project with joint CDM, TM planning and more frequent meetings – c.£73k

We expect additional legal costs and project completion costs that have not yet been calculated which we expect to fall in the region of £200k. Therefore, we believe the net additional cost of collaboration falls within the £400k range but will vary depending on various factors including the duration of works, road type, and authorities/utilities involved. Through undertaking additional projects and improvements in efficiency and learning, we expect these costs to reduce over time.

Totex baseline allowance

To establish a totex baseline allowance we could commit to delivering 30 collaborative projects by the end of RIIO-2 and multiply this by the net cost of an average project, which we calculate to be circa. £400k. This would amount to an allowance of £12m over the control. Through the Totex Incentive Mechanism, 50% of any outperformance or underperformance against this allowance would be shared with our customers.

Volume driver

A limitation of a totex allowance is that we do not know how many collaborative projects could be completed as it's extremely uncertain as to how many opportunities will even be suitable for collaboration. In addition, there is uncertainty around the associated unit costs of a project as we are at the early stages of undertaking collaborative streetworks and do not have enough data to set a robust cost and delivery benchmark. We cannot control the willingness of other utilities and authorities to participate in collaborative streetworks adding an extra degree of uncertainty. This could be somewhat mitigated through designing the allowance as a use it or lose it PCD or a volume driver.

The majority of the risk is carried by Cadent as we would need to bear the significant costs associated with streetworks collaboration, which without a mechanism to recover the costs would impact customers through increased disruption as there would be no incentive to collaborate.

A volume driver may work better than a totex allowance and mitigate the issues related to uncertainty around the number of collaborative projects we undertake, however, a significant drawback is that the unit costs associated with collaboration are not stable and will vary for each project based on a number of factors. As a result, it is difficult for us to express a view as to how material costs may be which is compelled further due to uncertainty around the frequency and probability of collaboration.

A drawback with the totex allowance approach is that we do not view streetworks collaboration as a cost issue that is dependent on external factors, but an activity that our customers and stakeholders have encouraged us to undertake in order to deliver social value. Therefore, we believe a financial incentive would provide greater encouragement to maximise collaborative streetwork opportunities, which would be in consumers' interests. A financial incentive better captures the customers and societal perspective as any reward would be based around the benefits and social value experienced by customers through increased streetworks collaboration. Whereas a totex allowance or a volume driver would cover the network costs associated with collaboration with some incentive to reduce costs, without recognition of the social value.

Scope

We understand the initial focus of the collaborative streetworks measure has been in Greater London as we have already developed a strong relationship with the GLA and believe that the most opportunities currently exist here. However, we believe Ofgem should extend the incentive to our other networks in RIIO-2 as there are similar opportunities for collaboration and we have strong evidence from our customers and stakeholders across all our networks for increased streetworks collaboration to minimise disruption from our works. Furthermore, our CEG has challenged us to deliver collaborative streetworks across all our areas without limiting it to our London regions. If the incentive does focus on Greater London, the Outer-Met areas of London in our EoE network should also be within scope as this fall under the remit of the GLA and we are already identifying collaboration opportunities within this area.

Monitoring and evaluation

As part of delivering this measure, we think it is essential that for each project the associated costs and benefits are monitored and evaluated. This will allow us to gather valuable data, share learning and to improve the output measure within RIIO-2 or in readiness for RIIO-3.

We are supportive of the principle to share learning amongst GDNs and wider stakeholders including other utilities and Local Authorities. The principles of the NIA framework for knowledge sharing could be adopted, including sharing key project information and benefits, but we would encourage an approach which minimises duplication.

The GLA already play an active role in monitoring and evaluating projects and publishing benefits and learning through their existing channels which reach a wide audience. This role could be continued over RIIO-2 to avoid any duplication of efforts and ensure independence in evaluating the outcome of collaborative projects. Furthermore, the wider social benefits, beyond those just experienced by gas consumers, could be captured to demonstrate the value of collaborative streetworks. Here is a summary of what could be monitored/evaluated and shared with others:

Delivery data	Benefits	Costs
• Number of opportunities identified and actively pursued • Number of collaborative projects/schemes delivered • Number of days in the road saved due to collaboration • Customer satisfaction during collaborative projects	• Improved customer experience, reduced complaints and positive reputation • Reduced costs due to procurement of shared services e.g. SLG, traffic management, single TTRO, single excavation/ reinstatement, shared site welfare • Reduced costs from lane rental (potentially waived) and parking bay charges • Economic benefits – Reduced duration of streetworks • Environmental/social benefits – Reduced carbon footprint, noise pollution and impact on air quality	• Cost of engagement with key stakeholders (Other utilities, councils, local authorities, DfT, TFL) • Cost of development / procurement of tools/systems to share plans and enable collaboration • Additional resource costs to identify potential projects and manage works with other utilities/authorities. • Programme management costs including numerous site visits, additional contracts for risk/liability, legal costs, public consultations • Cost of jointly procuring services e.g. traffic management, communications

Table 14: Monitoring and evaluation

Further protection and development of the incentive

We believe there is benefit in introducing a review for this measure during RIIO-2. Through delivering a number of additional projects in the early years of RIIO-2 we will be able to gather valuable data and learning to improve and evolve the measure for the remainder of RIIO-2 or RIIO-3 and ensure the incentive delivers the best outcomes for our customers. A review process set out in the licence could then be used to review the social value used in the incentive (i.e. £305k) to test it is still the best proxy for benefits delivered and to assess the cap level.

The collaboration projects we have delivered or are currently undertaking would be considered level 2 paced collaboration according to GLA's 'Collaborometer'. This is where two or more utilities work one after another under the same notice and will produced shared communication. As we become more experienced and deliver a greater scale of projects we would seek to find opportunities for level 3 semi collaboration in which there is additional collaboration at the work design stage, shared streetworks, and commercial contracts. Level 3 collaboration is likely to deliver a greater scale of benefits and would require additional costs to achieve this. Therefore, Ofgem could include a blank value in the licence for the incentive rate related to level 3 collaborative projects which could be updated at mid-period or at the end of RIIO-2. As we have no robust data to understand the likely costs and benefits associated with level 3 collaboration, Cadent and SGN would be incentivised to identify opportunities to deliver these projects and obtain a robust dataset that can be used to define the incentive rate.

Ofgem leading the industry

Finally, we think there is value in highlighting the opportunity for Ofgem to lead the industry in this area. Streetworks collaboration impacts the whole system and benefits all consumers and should be pursued by all utilities to minimise disruption. Currently there are very limited incentives within regulatory frameworks across the industry to encourage collaboration, except for avoidance of penalties or costs, which only secure minimum collaboration. If an incentive for collaborative streetworks is established within the gas distribution sector in RIIO-2, Ofgem will be leading the utilities industry and this incentive could act as a basis for future incentives within other sectors. We encourage Ofgem to lead discussions at the UK Regulation Group on establishing a future cross-sector incentive on collaborative streetworks to incentivise all companies and deliver benefits to all customers across the UK.

Cadent
Your Gas Network

Gas Distribution Questions

GDQ9 - How should we set targets for the shrinkage financial incentive?

Ofgem's proposals to date has focused on setting targets based on each GDNs levels of pressure and gas conditioning recorded in the final year of RIIO-GD1. However, since the Sector Specific Methodology Decision (SSMD) was published over a year ago, no workable solution, that meets Ofgem's general criteria for setting outputs nor the specific criteria set out in the SSMD, has been identified to implement their policy decision for the shrinkage financial incentive.

The key barrier to introducing this new financial incentive is the impact of factors outside of GDNs control, such as weather and peak demand, on GDN performance levels given Ofgem's decision to isolate these two shrinkage value levers (average system pressure and gas conditioning). These uncontrollable factors must be managed as they will lead to windfall losses and gains for customers and GDNs.

Without mitigation, these uncontrollable factors also mean that Ofgem's methodology for setting targets for the shrinkage financial incentive is inconsistent with the RIIO handbook which sets out that GDNs must have full, or sufficient, control over performance for an output to be set. It is also inconsistent with the SSMD which states that the shrinkage financial incentive is intended to drive action in areas within GDN control. Finally it is also inconsistent with the approach Ofgem has taken in assessing bespoke ODIs for RIIO-2, where networks' proposals have been rejected where there are elements of performance outside of their control.

We have worked constructively with Ofgem to identify ways, including the use of a dead-band, to mitigate these uncontrollable factors so that the policy decision set out in SSMD can be implemented, however these were dismissed in the draft determinations.

As such, unless an alternative approach to mitigate these uncontrollable performance factors can be identified there are only three possible solutions:

1. Set the targets for Ofgem's proposed measure at the sector average for system pressure and gas conditioning recorded in the final year of RIIO-GD1;
2. Remove the financial incentive and proceed soley with the reputational incentive proposed in draft determinations; or
3. Revert back to the financial incentive used in RIIO-1 but make adjustments to address the weaknesses within the measure (these weaknesses include the disproportionate impact of the final year within the mechanism and the use of inconsistent assumptions to set each GDNs targets).

Of these options, setting the targets at sector average would deliver most closely against the SSMD, whilst if implemented with a dead-band and on a control period average, rather than fixed annual, basis it would sufficiently mitigate the risk associated with factors outside of GDNs control. We describe our views on implementing a dead-band and assessing performance on a control period average basis in our response to GDQ11.

Option 1 would also be aligned with Ofgem's approach to setting the customer satisfaction incentive. As such, Ofgem would be setting environmental expectations consistently across all networks, just as they have set customer expectations consistently through the customer satisfaction incentive. As stated, in thedraft determination on the customer satisfaction incentive this approach leads to only GDNs delivering exceptional performance being rewarded. Whereas under the DD's proposal for the Shrinkage incentive customers would have to pay for 'lagging' performers only delivering performance that other GDNs had far exceeded in the previous price control.

This consistency in approach across environmental, customer service and cost performance would recognise the interactions between these key customer priorities and further require GDNs to balance their decision making between them.

Given the benefits described above, Ofgem should now proceed with option 1 for setting targets for the shrinkage financial incentive.

We agree that COVID-19 will definitely affect shrinkage levels in 2020/21 due to its impact on repex work. We also agree that there may be an impact on system pressure as COVID-19 has led to different patterns of gas use, for example due to temporary or permanent office and factory closures as well as increased daytime domestic use. However, this impact is more uncertain than the repex impact and will not be fully understood until the end of the performance year. This is because we have not seen peak demand conditions (i.e. winter) yet this year, which is when the impact will be greatest.

We have not seen, and do not envisage, any positive or negative impact of COVID-19 on gas conditioning levels. This work does not require us to enter customers' properties so has been unaffected, to date, from the impacts of the pandemic.

Any impact due to COVID-19 related shortfalls in repex work can be accounted for by adjusting the RIIOGD1 and RIIO-GD2 baselines by an equivalent amount of repex through the RIIO-GD1 closeout process. For average system pressure, our recorded values for 2019/20 and 2017/18 to 2019/20 are within 0.01 mbar of each other so there would be minimal difference between approaches. However, we believe that Ofgem should apply a principle of utilising whichever out of 2019/20 or 2017/18 to 2019/20 performance is assessed as more reflective of enduring performance across the GDNs.

Applying shrinkage financial incentive targets

At final determinations Ofgem will not only need to evidence how they have set the targets for the shrinkage financial incentive but also how these targets will be applied during RIIO-2. This is vital to ensure that the methodology does not create any unintended or perverse incentives for GDNs as they complete the mains replacement programme and their networks become more plastic.

For example, further work will be required to define how the gas conditioning element of the incentive will account for treated and untreated lengths of main. This includes ensuring that no incentive is created for GDNs to continue to treat sections of their network that were metallic during RIIO-1 but have been replaced with plastic pipe during RIIO-2. Likewise the measure will also need to ensure that pressure management is only assessed in remaining metallic pipes.

If these challenges are not addressed ahead of final determinations it is likely to lead to penalties to GDNs for delivering safety driven mains replacement work and for transitioning their network so that it is ready for hydrogen. Both of which would deliver greater environmental benefits than gas conditioning or pressure management so would be perverse to penalise under an environmental incentive.

Gas Distribution Questions

GDQ10 - Do you have any views on what clarifications are needed to ensure a consistent method of calculating the benchmark shrinkage volumes?

GDNs have held regular working groups throughout RIIO-1 to ensure that we all work in the same way and therefore that shrinkage is calculated on a consistent basis.

There has not been consistency between GDNs is in the input assumptions that they have each used to create their shrinkage forecasts submitted in RIIO-2 business plans. As such, at final determinations Ofgem will need to adjust each GDNs baselines for the shrinkage reputational ODI so that they are consistent not only with the final workloads allowed but that they also have consistent input assumptions across all GDNs and are aligned with the approach used to set the financial incentive targets.

For example, we modelled the mid-point between the 'seasonal norm' and a 1-in-20 winter which suggested a one-off increase of 0.75 mbar in average system pressure which has been factored in to our RIIO-2 shrinkage targets shown in our BPDTs. We also provided both the 'seasonal norm' and 1-in-20 scenarios in our EAP for transparency of our approach. However, our understanding from assessment of other GDNs business plans is that they have all assumed significant annual incremental increases in average system pressure, resulting in higher levels of shrinkage being forecast.

To address this all GDNs should be required to use the same input assumptions for average system pressure and gas conditioning, based around the sector averages, and there should be agreement on if 'seasonal norm', 1-in-20 or a point between is used in developing the average system pressure assumptions.

As discussed in our response to GDQ9, there has been an impact in 2020/21 on repex and there may be an impact on pressure due to the COVID-19 pandemic. We were obviously unaware of these impacts when we submitted our business plan, so once the impacts are understood the shrinkage forecasts for the RIIO-2 reputational measure will need to be adjusted.

Gas Distribution Questions

GDQ11 - Do you think a deadband should apply to the financial incentive? If so, please provide evidence as to how this could be quantified.

As set out in our response to GDQ9, we have worked constructively with Ofgem since SSMD to identify how a dead-band could work to mitigate the risk of performance under the financial incentive being predominantly driven by factors outside of GDNs control. However, these options were dismissed in the draft determinations with little explanatory rationale.

We still believe that applying a dead-band to the approach suggested in draft determinations would help mitigate these risks, however a more effective way could be to set the targets at the sector average for system pressure and gas conditioning recorded in the final year of RIIO-GD1 rather than at an individual GDN position. This alternative approach would enable the easier implementation of a dead-band without the need for complex algebra and rules, which have been unsuccessful to date, to develop 'dead-band factors' per GDN that would be required were individual targets to be set.

The sector upper and lower quartile should form the dead-band around the target of the sector average. This approach is very simple, would ensure only GDNs delivering exceptional performance in RIIO-2 are rewarded, would sufficiently mitigate against factors outside of GDNs control and broadly enable the implementation of Ofgem's SSMD.

Coupled with this, dead-band performance should be assessed on a control period average basis rather than fixed annual basis. By control period average basis we mean that each years' performance is added to the previous years' performance in the control and an average for the control period to date is created. For example if a GDNs average system pressure was 27 mbar in year one and 30 mbar in year two, their control period average performance at the end of year two would be 28.5 mbar. If their annual average system pressure for year three was 27 mbar, then their control period average performance at the end of year three would be 28 mbar. The reward / penalty due for this average performance could be adjusted year on year to avoid the need for a large true up at the end thus minimising customer bill volatility.

This approach would smooth out any one-off uncontrollable factors (for example weather shock) that could lead to in-year windfall gains or losses and instead reward or penalise the enduring performance over the price control period. These windfalls are unlikely to be corrected under Ofgem's proposed annual approach, especially for those GDNs setting the frontier as they are unlikely to be able to drive ASP down further whilst maintaining their obligations to customers.

For completeness and transparency we have also provided below details of the options we discussed with Ofgem for mitigating the impact of uncontrollable factors whilst setting targets at GDN specific levels. These conversations took place in advance of draft determinations and as discussed earlier in our response these options have been dismissed as unconvincing in the Draft Determiation proposals.

The options were:

1. Setting targets that adjust for uncontrollable factors ('adjustable baseline' option); or
2. Including an individual dead-band around each GDNs target.

Gas Distribution Questions

Developing the adjustable baseline option would require the development of a consistent measure of a 'cold day' across all networks and it's impact on pressure. This would be very complex, especially as Ofgem and GDNs have never undertaken analysis to isolate the impacts of a single variable (i.e. weather) on a single shrinkage value lever (i.e. pressure) before. As such, it would require retrospective analysis of many years' worth of data and require all other moving variables to be accounted for on each day through the period examined. As such, even if this was possible it is extremely unlikely that this could be achieved ahead of final determinations. Therefore, we ruled this option out in our discussions with Ofgem.

Therefore we proposed the use of individual dead-bands around GDNs targets. We identified that these dead-bands would need to reflect the GDNs' relative position to the frontier so that the average GDN would have a symmetrical dead-band, a lagging GDN would have an asymmetrical dead-band that required a larger movement to achieve reward than it would to be in penalty and that a frontier GDN would have an asymmetrical dead-band that required a larger movement to be in penalty than it would to be in reward.

The size of the dead-band could be set by the delta between upper and lower quartile performance. So, illustratively, if this was 1 mbar on system pressure then:

- The average GDNs dead-band would be +/-0.5 mbar;
- The leading GDNs dead-band would be -0.0 mbar for reward to begin, +1 mbar for penalty;
- The upper quartile GDNs dead-band would be -0.25 mbar for reward to begin, +0.75 mbar for penalty;
- The bottom GDNs dead-band would be -1 mbar for reward, +0.0 mbar for penalty;
- The lower quartile GDNs dead-band would be -0.75 mbar for reward, +0.25 mbar for penalty.

(Note: this illustration does not recognise that the upper and lower quartile positions would be between GDNs)

This approach would:

- Ensure GDNs are only rewarded for real improvements in performance, particularly lagging GDNs who would only be catching up on performance delivered by frontier GDNs in RIIO-1; and
- Ensure adequate protection for all GDNs from factors outside of their control, particularly those at the frontier who would experience greater impact.

Gas Distribution Questions

GDQ12 - What are your views on our consultation position for the four GDNs' EAP proposals in RIIO-2 as set out in this document?

We welcome the DD's broad acceptance of our EAP and the 30 Commitments contained within, although we note it has rejected specific outputs and replaced with "EAP Commitments" to be reported on annually.

We would welcome absolute clarity from Ofgem on their acceptance of all our 30 EAP Commitments and the associated funding allowed. Our funding request had been included in our Bespoke Output which has been rejected. With this information, we can then view any unfunded commitments and whether we want to report on these voluntarily.

In the Draft Determinations, the gas networks were asked to update their Science Based Targets to exclude leakage. Our response to this request is set out in our answer to Q9 above.

We note that Ofgem have asked for additional information before confirming our allowance to deliver a zero emission emergency responder fleet by the end of the RIIO-2 period. This information is being provided separately from this DD response.

The Draft Determination stated that our costs were higher than other networks costs. It is important to note that we have committed to deliver zero emission vehicles, whereas other networks have provided costs for hybrids or low emission cleaner diesels, which are not zero emission. We firmly believe we should be role models as we move to a net zero future, and we must set ourselves stretching targets, to show the art of the possible, and to support regional ambitions, which are generally pursuing zero carbon solutions much earlier than National policy makers.

This must be taken account of in any unit cost comparisons, and in any overall Totex benchmarking.

In the draft determination, Ofgem asked the network to confirm whether we were committed to maintain our ISO14001 accreditation through RIIO-2. Cadent is committed to continue this accreditation. We see ISO14001 as a business as usual commitment for environmental management, and maintaining Cadent's environmental management system, assessing risk and impacts from our activities, protecting the environment and driving continual improvement. Cadent continues to report both internally and externally our performance against the international standard to all relevant stakeholders.

In the draft determination, Ofgem describe our EAP commitment to establish a revised scope 3 emissions baseline which accounts for at least 80% of our supply chain by value, as lacking clarity, compared with the other GDNs. The other GDNs commitments refer to having 80% of suppliers by value meeting a Sustainable Procurement Policy. We think Ofgem are comparing different commitments. Cadent are referring to significantly improving our Scope 3 carbon emissions reporting to include 80% of our suppliers by value, and to have targets in place to drive reductions before the end of RIIO-2. This is not the same as other GDNs committing to a Sustainable Procurement Policy, and we already require our suppliers to abide by our sustainable Global Supplier Code of Conduct and this requirement will continue during RIIO-2: https://cadentgas.com/nggdwsdev/media/Downloads/Supplier-Code-of-Conduct.pdf.

Gas Distribution Questions

We therefore believe our commitments to include 80% of our suppliers business in our carbon reporting, establishing reductions targets, and requiring our suppliers to meet our Global Supplier Code of Conduct are extremely ambitious, and will provide a much clearer view of our impact on overall carbon emissions. We are of course happy to provide additional information should there be specific follow on information required to provide the necessary clarity.

On Ofgem's overall approach in the Draft Determinations to EAPs, we are disappointed that whilst Ofgem recognise that there is a wide range of ambitions, no clarity has been provided on what is considered the most or least ambitious. There is no reward, financial or reputational for the most ambitious, and this approach sends out a poor signal for ED2 and future price controls, that only minimum requirements should be considered when preparing Environmental Action Plans.

We believe our Environmental Action Plan is extremely ambitious, including delivering the first zero emission emergency response service in the UK, step changes in our environmental and sustainability performance, and overall carbon neutrality supported by offsetting by the end of RIIO-2.

As noted in our response to Q9 above, we are disappointed that some of the ambitious elements of our plan have been rejected in the Draft Determination and are unclear on the justification. We continue to believe these measures supported by our customers, including helping off gas grid communities, show our ambition and commitment to play a leading role to achieve net zero directly. We ask Ofgem to review the decisions in these areas and consider recognition for organisations seeking to do the right thing.

Gas Distribution Questions

GDQ13 - Do you agree with our consultation position to include progress on biomethane in GDN's AERs, alongside standard connections data?

We support the inclusion of biomethane progress information in the AER, however duplication must be avoided, so the same or similar data should not be requested to be reported elsewhere.

Gas Distribution Questions

GDQ14 - Do you have any other comments in relation to this section?

We would request that in the development of the new AER, duplication is avoided by ensuring information reported through the AER is not requested elsewhere in the regulatory reporting framework.

Cadent
Your Gas Network

Gas Distribution Questions

GDQ17 – What are your views on our proposed approach to setting unit costs for the Tier 1 mains replacement PCD?

We disagree with the proposed approach to setting unit costs for the Tier 1 mains replacement PCD as the approach proposed by Ofgem is inconsistent with the regression modelling exercise used to set allowances and will lead to tacit, but we believe unintended, penalties for companies.

Both approaches take into account regional factors, however the cost benchmarking and PCD methodology use different analysis to estimating unit costs, and in addition the PCD is based on the average unit cost, whereas the Cost Allowance is setting an 85^{th} percentile unit cost.

These differing approaches will lead to different unit costs for the same work which will then lead to inconsistencies in the application of the PCD. For example,

- Assume the implied unit costs resulting from the regression in the baseline allowance for a category of work was £100,
- However, the unit cost in the PCD uses an average, thus by default (unless likely event of average = 85^{th} which they are not) are higher, say £120.
- Then for every unit of underdeliver a tacit £20 penalty is applied.

It would also be possible to have limited unintended outperformance. If you upsized, then you would increase your revenue by more than you would if Ofgem used the 85th percentile.

We also have serious concerns about the approach Ofgem has taken to calculate repex synthetic unit costs and we consider they are not representative of the true industry average or in every case based on actual costs. In addition, the synthetic unit costs calculated rely on GD1 historical data so are not representative of GD2 costs. Please see GDQ33 for our concerns about the repex synthetic cost driver and the synthetic unit costs.

For this mechanism to work Ofgem need to use a bottom up or combination of bottom-up / top down to produce unit costs for each GDN consistent with the baseline allowance flowing from the regression. The unit costs between the baseline allowance and the Totex modelling need to be consistent and they also need to be at a level that funds the networks for the work that they are delivering at the same rate as the allowance.

Gas Distribution Questions

GDQ20 – What are your views on our proposed approach to setting unit costs for the Tier 1 services PCD?

We disagree with the proposed approach to setting unit costs for the Tier 1 services PCD as the approach proposed by Ofgem is inconsistent with the regression modelling exercise used to set allowances and will lead to tacit, but we believe unintended, penalties for companies.

Both approaches take into account regional factors, however the cost benchmarking and PCD methodology use different analysis to estimating unit costs, and in addition the PCD is based on the average unit cost, whereas the Cost Allowance is setting an 85th percentile unit cost.

These differing approaches will lead to different unit costs for the same work which will then lead to inconsistencies in the application of the PCD. For example,

- Assume the implied unit costs resulting from the regression in the baseline allowance for a category of work was £1,000,
- However, the unit cost in the PCD uses an average, thus by default (unless likely event of average = 85th which they are not) are higher, say £1,200.
- Then for every unit of underdeliver a tacit £200 penalty is applied.

It would also be possible to have limited unintended outperformance too. If you upsized, then you would increase your revenue by more than you would if Ofgem used the 85th percentile.

We also have serious concerns about the approach Ofgem has taken to calculate repex synthetic unit costs and we consider they are not representative of the true industry average or in every case based on actual costs. In addition, the synthetic unit costs calculated rely on GD1 historical data so are not representative of GD2 costs. Please see GDQ33 for our concerns about the repex synthetic cost driver and the synthetic unit costs.

For this mechanism to work Ofgem need to use a bottom up or combination of bottom-up / top down to produce unit costs for each GDN consistent with the baseline allowance flowing from the regression. The unit costs between the baseline allowance and the Totex modelling need to be consistent and they also need to be at a level that funds the networks for the work that they are delivering at the same rate as the allowance.

Cadent
Your Gas Network

Gas Distribution Questions

GDQ22 – What are your views on our proposal for a common PCD for capital investments?

A common PCD is not appropriate, it duplicates existing controls and introduces a significant and unnecessary regulatory burden not commensurate with the materiality of the spend (for example this would cover just £2m p.a in our West Midlands network whilst introducing increased complexity and ex-post clawback risk).

The mechanism set out in DD is both burdensome and disproportionate for gas distribution. Furthermore, the Cadent project list provided in Table 23 contains errors which introduce duplications with the NARMs PCD.

We are committed to delivering 100% of the project benefits set out in our RIIO-2 Business Plan. Failure to deliver these benefits will increase safety and supply risks, which would be visible to our regulators through existing reporting mechanisms including the RRP and its supporting SQ process. These projects are also required to meet our PSR obligations or customer driven demand. The Totex Incentive Mechanism ensures any financial savings are shared with customers, with further protection also provided by RAMs and the outperformance wedge.

The approach set out in DD, using independent auditors to track project specifications which will need to be set prior to the start of RIIO-2 is costly micro-management. We will comment further on this in GDQ23.

Following the correction set out below, the average spend for this PCD would be less than £2m pa in our West Midlands Network, with 25% of the projects across Cadent having total spend of less than £1m. Whilst a PCD for capital projects might be appropriate for Transmission companies, with annual spend averaging between £33m to £177m, they are not proportionate for gas distribution.

Ofgem error

In addition to the comments above, Ofgem have made an error in assigning NTS Metering/NTS Other Metering to this PCD in Table 23 of the Cadent Annex. These elements are already recorded within the NARMS PCD. Our metering investment is captured under NARMs category 'Odourisation & Metering – Offtakes – Offtake Meter – Meter Replacement' and removes £416,127 of monetised risk.

Gas Distribution Questions

GDQ23 – What are your views on our proposals for delivery, clawback and deliverables for the capital projects PCD?

The proposed 100% clawback for 'partial none delivery' is not appropriate. The mechanism described in the DD suggests that a 1% none delivery would result in a 100% clawback. This is clearly not proportionate nor a fair way of assessing these projects and introduces yet more asymmetric downside risk for networks. In addition as we stated in GDQ22 this is not commensurate with the materiality of the spend (for example this would cover just £2m p.a in our West Midlands network).

The proposed accountability mechanism, an independent audit engineering report, is not unworkable but it is disproportionate and unnesseccery, and it will add cost and stop innovation. It is input focused, pushing companies to focus on engineering specifications rather than the outcomes which should be delivered for customers. It also adds unnecessary costs and burden to the regulatory process.

Our projects are at different stages in their lifecycle, some at conceptual design others at detailed design (our approach is set out in Appendix 9.00 of our December submission). As such the specification, the detailed description of the design and materials of work to be delivered, continues evolve. New challenges/opportunities may be identified and as such our specification will need to change accordingly.

Whilst the benefits we will deliver for customers are clear and fixed, the exact specification of the scheme is not fixed and may continue to evolve even once work starts on site. There is insufficient time to allow meaningful engagement with Ofgem to fix a specification, as set out in 2.222, prior to the start of RIIO-2.

Even if an ex-post specification could be achieved, it would put unreasonable restrictions in place. Pining the specification down removes the incentive to innovate and improve in period and adds additional risk to companies: legitimate engineering issues encountered on site may require a change in specification and an increase in cost which under the proposed mechanism would then lead to 100% of funding being clawed back.

In addition, regulation to an agreed specification would incentivise companies to deliver a specification rather than the best in period solution for customers. The focus needs to be on ensuring we resolve the underlying 'customer problem', for example, an outcome delivering a 'safe and reliable crossing' or a 'site which meets our 1 in 20 license obligations'. A focus on outcomes is simpler to monitor and easier for customers to understand, than a checklist counting the number of components which have been installed. The table below gives examples of the outcomes which our projects will deliver.

Project	Outcome
PRS Capacity Upgrades	To maintain capacity resilience for the named sites, to ensure they each comply with our 1 in 20 licence obligation and maintain security of supply for customers.
Reduced Depth of Cover	To ensure compliancy with the PSR (1996) by: • Reducing the RAG status of the sections of pipes to green for submitted sites. • At the end of RIIO-2, no minor ditch crossings defects will be outstanding for more than 18 months.
Brunel Bridge Crossing Refurbishment	To remediate the pipeline crossing and associated pipeline support structures to demonstrate compliance with the: • Occupiers Liability Act (1957), and • Pipeline Safety Regulations (1996)

Table 16: Illustrations of project outcomes

The proposal for an independently audited engineering report is ill defined. It will add unnecessary costs and burden to the regulatory process. The requirement is also likely to extend the time required to close out the regulatory period.

Engineers would need to be employed at the start of the process to formalise the specification of work.

They would need to be employed at close out to check drawing, visit hundreds of locations, gain access to tunnels (confined spaces), bridges (requiring scaffolding access) and test the operation of valves. The engineers would need to be escorted and risk assessment would need to be completed. This is clearly not proportionate when a network may be investing as little as £0.5m pa.

Conversation with our supply chain suggest that even a more limited desktop review of completed work documentation by a qualified engineer would introduce costs ranging from £7,000 to £45,000 per project, dependent on the project size. The addition of site checks would substantially increase this amount. These costs will be passed on to customers, increasing bills unnecessarily.

The existing annual RRP process reports on the delivery of projects over £500k and would highlight any shortfall or over-delivery which could be examined by Ofgems engineering team through the SQ process or other regular meetings. This approach would allow targeted questions to be asked on areas of concern rather than applying a blanket response to all issues.

Gas Distribution Questions

GDQ24 – Do you agree with our approach for funding physical security for the GD sector? And do you agree that in light of the proposed baseline totex that the physical security PCD is no longer required for the GD sector?

We agree with the approach set out and that the physical security PCD is no longer required. We are pleased that you have accepted our £4.1m investment as sufficiently justified.

GDQ25 - Do you consider that the enhanced obligations framework for exit capacity and the additional information being sought are appropriate?

Whilst we agree that the RIIO-2 enhanced obligations framework for exit capacity will deliver benefits for customers by helping drive consistency in forecasting and engagement across gas networks it will not deliver the value for them that the NTS exit capacity incentive has in GDPCR1 and RIIO-1.

In the first six years of RIIO-1 the NTS exit capacity incentive has driven us to deliver savings of £32m for our customers by incentivising us to innovate in how we meet our 1-in-20 obligations. Although we agree with Ofgem that Uniform Network Code modification 678 dampens the incentive to innovate there is still underlying value for customers in incentivising NTS users, including GDNs, to find more efficient approaches to utilising exit capacity products and services.

As such, it will be important that the enhanced obligations help share learnings during RIIO-2 that may enable the identification and calibration of a whole system incentive to be introduced in RIIO-3 which could deliver better results for customers. This will be particularly important as the gas network is developed for greater use of biomethane, hydrogen and hydrogen blending all of which may drive new locational cost variance.

As well as providing our assessment of the enhanced obligations set out in draft determinations our response below also sets out our views on exit capacity costs being treated as pass-through during RIIO-2.

Enhanced obligations framework - methodology

We support the development of a consistent methodology. Of the activities set out in the Exit Capacity Enhanced Obligations Annex we already provide pre-forecast information and publish 1-in-20 Peak Day forecasts per individual 'network structure'.

NGGT currently produces 1-in-20 peak demand forecasts on behalf of the industry. As such, there would be significant value in this existing approach being shared with GDNs this year and for GDNs, NGGT, Ofgem and other stakeholders to work together to develop a consistent methodology, as well as ensuring consistent interpretation. If this methodology could be developed before April 2021 it could be utilised by GDNs at the next application window in July 2021 with bookings effective from 1st October 2021.

When developing the consistent methodology the impact of user commitment must be considered. We support the objectives of the framework to ensure a transparent and efficient process for booking exit capacity that accurately reflects our 1-in-20 peak day demand forecast. However, the existing process for booking exit capacity does not allow GDNs to accurately reflect their peak day forecast due to the risks associated with booking enduring exit capacity and the user commitment associated with that booking. It is plausible that the user commitment could lead a GDN to being identified as inefficient under the methodology because they are unable to reduce their bookings in response to changing demand conditions which leaves them in excess of their peak day forecast and confer unnecessary and otherwise avoidable costs on gas customers. As such, this will need to be addressed in the methodology.

It is also important to note that until this consistent methodology, and interpretation, is in place it will not be possible to assess the efficiency of GDNs bookings. As such, if the methodology can be developed this year the first full year where GDNs bookings can be assessed against it would be 2022/23.

As these obligations are developed it will be important to consider their alignment with the UNC, particularly around activity dates, which may need to be amended to support the new obligations.

Enhanced obligations framework - engagement

We support Ofgem's enhanced engagement proposals and believe they will be beneficial for all parties as well as customers. The proposals will mitigate the challenges currently experienced both ways between GDNs and NGGT, for example a GDN not knowing whether they can release Assured Offtake Pressures (AOPs) without knowing about the availability of flexible capacity first.

The obligations within the framework must not be limited to a one-off annual engagement activity but instead design principles for consistent and frequent dialogue between gas networks and key stakeholders.

Enhanced obligations framework - reporting

We agree with the reporting proposals set out in the enhanced obligations framework. The timing of the reporting obligations will be central to the success and effectiveness of the enhanced obligations framework. Therefore, the reports should be available by March to support with the annual application window in July.

Introducing a licence condition on the reporting elements of the enhanced obligations will ensure that all of the industry can learn and develop from the enhancements set out in the framework and enable their further development moving in to RIIO-3 including how they could be adapted and applied to other NTS capacity product users to ensure whole system thinking and decision making.

Pass through of NTS Exit Capacity costs in RIIO-2

Given the removal of the NTS Exit Capacity financial incentive and the introduction of enhanced obligations across GDNs and the NTS, which include establishing a consistent methodology for establishing GDNs' 1-in-20 peak demand forecasts, we agree with Ofgem that these costs should be treated as pass-through.

As Ofgem has described in 2.236 of the Gas Distribution Annex a decision had not been made on UNC MOD678, relating to NTS exit capacity prices, by the time GDNs had to submit their RIIO-2 business plans in December 2019. Ofgem has subsequently decided to adopt the 'postage stamp' approach under MOD678 so that exit capacity prices will no longer reflect levels of spare capacity. This decision will impact the NTS exit capacity costs that GDNs will pass through to customers.

When reflecting the new offtake pricing methodology introduced under MOD678 in the forecasts made in our December plan it leads to an additional £200m (fixed 18/19 prices) of costs that will be passed through to our customers.

During GDPCR1 and RIIO-1 we have responded to the NTS exit capacity charges and the financial incentive to reduce costs for our customers. Before Ofgem's decision on MOD678, offtakes with more spare capacity were cheaper than those with less capacity. As such, during GDPCR1 and RIIO-1 we innovated and adapted the operation of our networks so that we could reduce our bookings at 'expensive' offtakes and utilise 'cheaper' offtakes more extensively. This means that holistically we currently operate at an average offtake price that is lower than that which will be set by the postage stamp approach. We believe this will also be the case for other GDNs. As such, as soon as the 'postage stamp' approach goes live costs to GDN customers will increase in a manner that is beyond our control.

Gas Distribution Questions

GDQ26 - Do you agree with our proposal of using a top-down regression model?

No for the following reasons

a) In the context of 8 GDNs and 3 ownership groups, there is no single view of truth, rather a rich picture is needed of both totex and bottom up approaches – but the DD contains a single approach, which contributes to unreliability and is therefore unlikely to determine GDNs' true efficient costs.

b) **The DD's use of a single rather than multiple approaches is inconsistent with regulatory best practice and precedent including by Ofwat, the CMA, Ofgem for RIIO-1 and as proposed for RIIO-ED2 (July 2020) and the Gas Distribution SSMC.**

c) Work from NERA shows that:

- more robust models than at DD can change Cadent's DD ranking of 5,6,7,8 to 1,2,3,4
- a density driver rather than pre-modelling sparsity and urbanity adjustments is the best fitting model, would rank London top, and provide it with a further £131m – showing that far more pre-modelling Regional Factors are needed for London
- The RESET test is important, as Ofgem stated at ED1, and the failure of the DD model underlines the need to obtain a rich picture of approaches
- Given the uncertainties, there is no justification for raising the efficiency bar to the 85th percentile, which would lead to inadequate funding for many GDNs, with median being far more suitable

d) The DD approach removes costs from the model, in particular IT capex, LTS and Other capex projects >£0.75m, contributions and growth governors that results in a partex model, introducing bias towards GDNs with more non-load capex, and through their higher allowances, increasing costs for their customers. A true totex model would include all the above and GSOP payments.

e) A number of different time periods should be used, as by the CMA and Ofgem at RIIO-GD1 to help provide multiple views of efficiency, with most weight on the more reliable actual costs.

f) The failure to carry out a bottom up approach has had especially negative consequences for:

- IT costs, where capex has been considered separately from opex, resulting in a failure to consider totex efficiency
- Emergency, where the failure to reflect London's consistently higher internal PREs per customer leads to bias against that GDN
- Repex, Reinforcement & Connections, where synthetics have been revised counter to engineering logic resulting in a weaker view of relative efficiency and also the DD's inconsistency between cost allowance and PCDs.

g) We found multiple errors worth hundreds of millions of pounds. Corrections raise our share of industry MEAV from 46.8% to 48.7%, reduce Southern's CSV by 14%, and change the regression model, so that in the regression the workloads for disallowed projects are removed with their costs.

h) The process followed to date has been poor, a lack of transparency meant the DD's approach and results came as a surprise. As we suggested in summer 2019, we propose an additional consultation to update the approach and correct errors, with a knock-on delay to Final Determinations, moved to early 2021.

i) The approach is very hard to follow largely due to the absence of linked spreadsheets, which need to be in place for the next publication, as well as a more detailed map of the models.

j) External audit of the models would have found many of the errors in the DD approach, and is essential for the next step.

No, we consider Ofgem's use of the DD's proposed regression model flawed for a number of reasons:

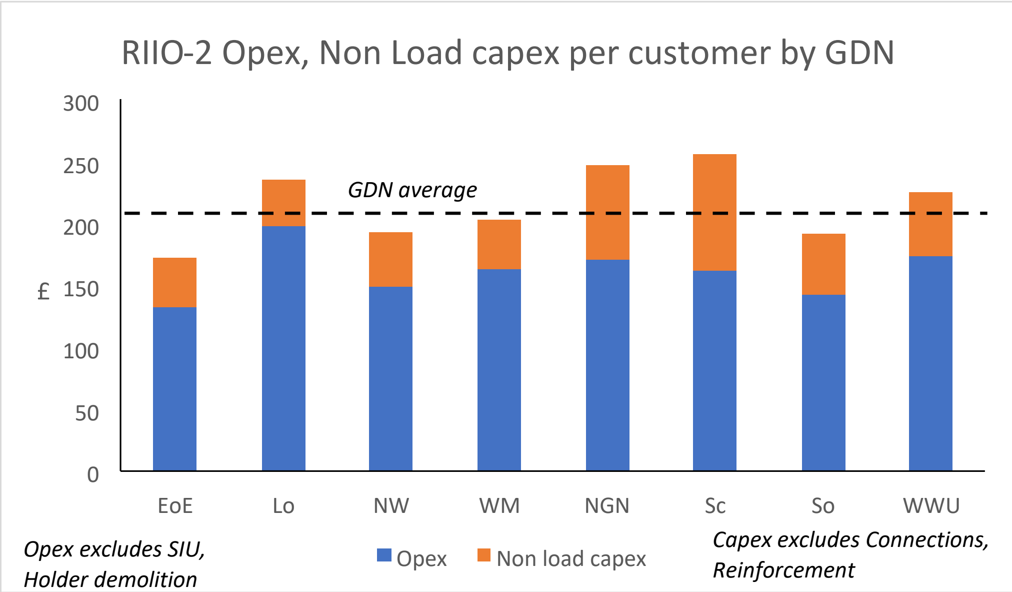
1. ***Ofgem's (over-)reliance on a single econometric model:*** it is unsafe, inappropriate and inconsistent with regulatory best (and prior) practice to rely on a single econometric model given any such model's inaccuracies and inherent weaknesses.
2. ***A balance of more robust models provides a very different picture for Cadent and especially for London****:* NERA have carried out a study that shows that very different benchmarking results can be obtained using different assumptions, which are more robust than those used at DD. Please find the NERA report in our information supporting this response.
3. ***Ofgem's use of a flawed and unreliable model:*** in any event Ofgem's regression model is significantly compromised/defective because it precludes a true like-for-like comparison of efficient costs and therefore is unreliable. This is because of:
    a. the failure of the RESET test, which means the model is inaccurate, as previously accepted by Ofgem;
    b. the exclusion of significant comparable costs;
    c. use of a single time period;
    d. the failure to apply smoothing to all capex; and
    e. numerous material errors in the model.
4. ***Ofgem's failure to implement a robust, transparent, fair and consistent process:*** it is the result of an opaque, flawed, insufficient and inconsistent process given that the model was not consulted upon (and in fact contradicts previous Ofgem statements regarding cost assessment). We propose a further consultation before FD to develop a much more robust approach featuring a rich picture of approaches, a true totex model, a bottom up approach, the use of more than one time period, smoothed capex and the elimination of errors.

We consider each of the above issues in greater detail below.

Our view of a robust approach to Cost Assessment consists of a number of different benchmarking approaches, as carried out by Ofwat, Ofgem at RIIO-GD1 and as typically followed by the CMA, which together form a rich picture, recognising that there is no single view of truth. We proposed both Totex modelling, as carried out by Ofgem at RIIO-GD1 to overcome organisational, accounting and solution choice issues, and Bottom Up approaches, to provide granularity, understanding of cost drivers and Regional Factors. We can also see value in using different time periods to provide different views of efficiency. This approach would build upon its predecessor, being evolutionary rather than revolutionary, and be developed after a careful process of engagement with GDNs. The modelling would also be transparent and easy to follow, and have been externally audited to remove material errors, making the consultation meaningful. The result of such an approach would be customers funding an appropriate level of cost, and networks being appropriately funded.

The approach to Cost Assessment contained in the DD is far from robust. There is one single benchmarking approach, which has many costs removed for separate assessment, meaning that it is neither a genuine Totex model nor a Middle-Up or Bottom-Up approach. The fact that it also uses only a single time period further compromises the comparability of networks. The current approach is significantly different from that used at the last price control review, with this departure being unexplained and unannounced, not having been discussed or developed with GDNs at the fourteen Cost Assessment Working Groups leading up to the DD. The models themselves are opaque and extremely difficult to follow, while the large number of major errors within them suggests that no external auditors have been used to verify its accuracy, and greatly reduces the value of the consultation. Were the DD approach to stand, it would neither result in customers funding an appropriate level of cost, nor networks being appropriately funded. This would challenge the fair bet principle regarding networks being able to earn the required rate of return and create incentives for us to minimise any discretionary spend.

The result of the DD approach to cost assessment is that the outcome is extremely unreliable and wrong, with modelling issues not having been resolved through engagement. The fact that the results of the cost assessment are wrong can be seen from the chart below, which compares the allowed opex and non-load capex cost per customer between GDNs, which should be broadly similar between GDNs. We have excluded Repex as this category of costs is primarily driven by the proportion of remaining Tier 1 metallic mains which is materially different across the networks.



The two GDNs with the highest Opex and Non-Load capex allowance per customer, NGN and Scotland, are ranked the first and second most efficient GDNs in the DD benchmarking, which highlights the counterintuitive results arising from the DD benchmarking, in particular those associated with IT capex and other non-load capex, largely assessed outside of the DD model.

One would not expect NGN and Scotland to have the highest allowance per customer. One would expect London to be the highest, significantly higher than the others, given the accepted pay differentials and the acknowledged working condition issues of operating in the most densely populated city in the UK, as reflected in our Regional Factors submission (most of which have been disallowed despite the flawed and unreliable top-down cost assessment process).

1. Ofgem's (over-)reliance on a single econometric model is wrong

DD contains a single approach to cost assessment over a single time period.

The use of any single approach to cost assessment is an error, for the following reasons:

a) The small sample size requires a number of approaches

Given that there are only eight GDNs and three ownership groups, any single approach to cost assessment is likely to be inadequate and flawed. The CMA stated in the 2015 Bristol Water inquiry, paragraph 4.76:

> *"We recognised that no benchmarking analysis or cost assessment method will be perfect, and there will always be vulnerabilities and limitations in any approach. Any method of estimating a company's future expenditure requirements (if it operates and invests efficiently) over the five year price control period is likely to raise significant risks of inaccuracy or other problems."*

The CMA used no fewer than seven models (reduced from ten in their initial findings) to assess the company's base expenditure requirements (para 4.156), plus a targeted review, including engineering analysis (para 3.34) – in a sector with 18 independent comparators. Even after these multiple approaches, the CMA was only sufficiently confident in its results to benchmark using the median level of efficiency, not the Upper Quartile (para 4.245).

We also note that Ofgem in the SSMD (para 12.128) decided against using a class 2 Return Adjustment Mechanism for gas distribution, gas transmission and electricity transmission because

> *"The concentrated ownership structures within the sectors meaning that one company could have material influence over the sector average, and as a result of this level of concentrated ownership, it may not be possible for a class 2 mechanism to be implemented in a way that is a fair outcome for all companies"*

Ofgem's concerns over the number of comparators apply at least as much to cost assessment as Return Adjustment Mechanisms.

b) Failure to use a bottom-up approach:

In particular, and further to the above point, we consider that it is an error not to carry out a bottom-up approach, similar to that in RIIO-GD1, because this would provide a different view to a true totex approach, and insights into cost drivers and regional factors. We note that some of the proposed but discarded bottom-up models currently fail the RESET test, but consider that the use of better drivers and further regional factors could resolve this problem. Nevertheless, it was the relative weakness of the bottom up modelling – as compared to a true totex approach – which led us to propose in our Business Plan that a weight of one third be applied to the bottom up approach. There are still important insights that can be gained from these models, they just need to be weighted appropriately.

The worth of the bottom-up approach was noted by the CMA in the Bristol Water inquiry, paragraph 4.46(a) as follows:

> *"Disaggregated models or more granular forms of benchmarking analysis may allow a more accurate estimation of the relationship between expenditure and specific cost drivers and allow a greater number of cost drivers to be taken into consideration."*

We consider that the DD's failure to carry out a bottom up approach has led to particular weaknesses in the approach to IT costs, Emergency, and Repex, Reinforcement and Connections drivers, as follows:

- In the DD's partex[3] approach, IT capex was excluded from the model and subject to Technical Assessment, but not IT opex. In a true bottom-up approach, we believe that expert assessment of IT & Telecoms costs is desirable, but that this must be on a totex basis – combining both opex and capex – otherwise the work is fatally flawed, given the solution and accounting trade-offs between capex and opex.
- The DD's lack of focus on Emergency costs has led to a failure to address the disproportionate workload arising in London (and also Scotland). The existing Emergency driver, with its use of customer numbers as a proxy for PREs within buildings (which are outside GDNs' control) does not reflect the fact that London and Scotland consistently have more PREs within buildings per customer than other GDNs, as has been discussed several times at CAWG. Due to the DD's failure to address this issue, we have needed to raise an additional Regional Factor claim in our response to GDQ29.
- The use of implausible Repex, Reinforcement and Connections synthetic drivers, where Ofgem's desire to develop more and more detailed synthetic unit costs appears to have amended drivers in a manner inconsistent with engineering logic. Economic / technical rationale was one of the three Model Selection Criteria Ofgem proposed to use, as stated in the Tools for Cost Assessment consultation of June 2019. However, in these cases it does not appear to have been applied. In addition, the development of a bottom-up model for repex could have been used to set the unit cost for PCDs, instead the DD has an inconsistency with major unit costs being derived betwrrn the cost allowance and the PCD unit costs. This is discussed more in response to GDQ17 and GDQ20.

In addition, under a bottom-up approach, we agree that there is scope for expert review of major engineering projects with no workload driver, although, as at GD1, the results should be tempered by a recognition of the trade-offs between opex and capex.

c) CEPA noted that additional years' data does not increase the number of comparators:

CEPA's report from June 2019 (page 23) notes that despite the availability of additional years since GD1, the number of comparators has not changed and so although there are more observations the overall 'between' variance (i.e. the relative performance between GDNs) has not been enhanced to the same degree.

d) It is inconsistent with Ofgem's proposed approach in ED2:

In the ED2 Sector Methodology Consultation of July 2020, Ofgem's proposed cost assessment toolkit contains multiple approaches:

- totex modelling – where two models from ED1 provided different views and included substantially all controllable costs, unlike the "partex" approach of the DD for GD2;
- disaggregated / Bottom Up modelling;
- expert review; and
- potentially middle up modelling also.

[3] We refer to Ofgem's partial totex approach as 'partex'.

We do not understand why Ofgem's is proposing an inconsistent approach between GD2 and RIIO-ED2, where it proposes to use a rich picture approach to determine efficient costs for RIIO-ED2, but at precisely the same time seeks to apply an approach to gas distribution which is extremely thin and unreliable. This inconsistency has severe negative consequences for consumers and networks as it means that there is significantly less confidence in the allowed expenditure set for GDNs as opposed to DNOs (resulting in potential under and overpayment which would not be in the interests of consumers).

e) It is inconsistent with the SSMC for Gas Distribution:

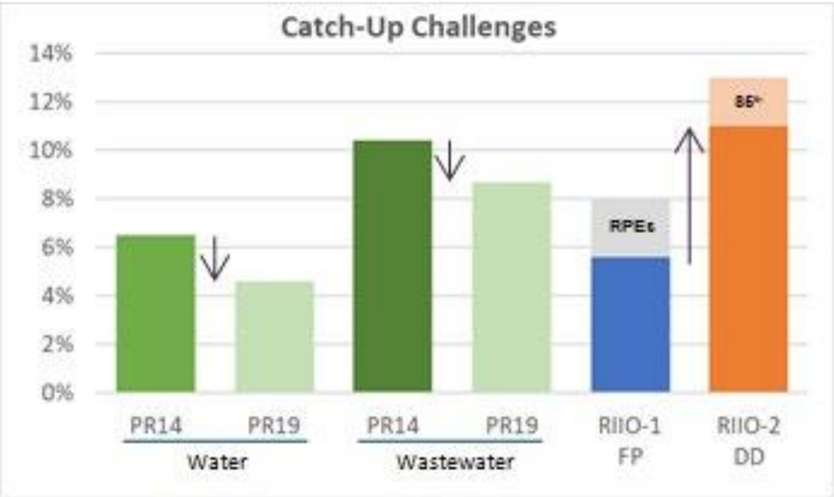
In the SSMC Ofgem stated its intention to evolve its approach from RIIO-GD1 and use several cost assessment techniques in para 6.51

> *"We propose to use a variety of tools to assess GDNs' cost efficiency in RIIO-GD2, including aggregated and disaggregated regression analysis, and technical and engineering assessments."*

The use of a single approach which is very different from that of GD1 is not consistent with Ofgem's consultation position as set out in the SSMC.

As we have stated consistently over the course of this price control review, we believe that Ofgem, as shown in electricity distribution in ED1 and ED2, and as for gas distribution at GD1, needs to use a rich picture approach to determine efficient costs, combining insights from a range of different benchmarking techniques. This need is particularly highlighted by the amount of errors and other failings we have identified in respect of Ofgem's single regression model, which we describe briefly in this response, many of which have we have already set out to Ofgem.

Furthermore, the approach has also led to an exceptionally high assessment of catch-up efficiency for individual networks, as compared to the last gas and water sector price control reviews shown below. This result, combinded with the ranking is unexpected, given Cadent's RIIO_1 transformation gap closure plans and our ambitious P40 plans. This raises question "is this single view setting out a biased result against Cadent?."



2. A balance of more robust models provides a very different picture for Cadent and especially for London

When the DD was published, we were both surprised and concerned at the result of the benchmarking, which was very different to what we had expected. Therefore, we decided to obtain an independent view on the validity and robustness of the DD's approach, and consequently asked NERA to carry out a study for us. Their full report is provided alongside our response.

Their report analysed results from six models, being the DD model with all its errors, plus five different, plausible sets of models:

0) the DD model;
1) the error corrected DD model;
2) the error corrected DD model, with a density driver;
3) the error corrected DD model with elasticity adjusted CSV weights;
4) the error corrected DD model with GDN specific CSV weights; and
5) the error corrected DD model with elasticity adjusted and GDN specific CSV weights.

The DD model - **Model 0)** is that used to calculate RIIO-2 allowances in the DD, as provided to GDNs on July 10th, in support of the publication of the DD.

As Ofgem has acknowledged, the DD modelling contains many errors. **Model 1),** the errors corrected model, seeks to correct those errors which we were aware of as at 21 August 2020 – there are others we have subsequently become aware of, and may be further errors, which are not addressed here. The errors that NERA have corrected in their modelling are listed in full on page 18 onwards of NERA's report, with the main ones associated with the DD's calculation of MEAV, Southern's repex synthetic, the failure to remove £55m of cost for the bespoke output associated with Cadent's hybrid vehicles, an error in calculating time trends, and the error caused by striking the regression using costs which have been reduced by workload disallowances, but against the original unadjusted workloads.

Model 2), the density driver model, removes the DD's sparsity and urbanity pre-modelling adjustments, and instead uses the error corrected CSV plus a density driver, as in Ofwat's approach at PR14 and PR19. The driver measures density as measured by population per km of main. This model finds the weights between the CSV and density and provides a different view of the need for Regional Factors in London GDN in particular.

Model 3) uses the error corrected CSV with elasticity adjusted weights to take account of the fact that each of the components of the CSV has a different relationship between fixed and variable costs, such that an increase of say 10% in one driver might be expected to increase costs by 10%, whereas for another driver it only be 5%. In contrast the DD CSV assumes a uniform relationship between workload and cost for all activities.

Model 4) uses the error corrected CSV plus company specific CSV weights, based on each GDN's pattern of expenditure across activities. The DD applies a uniform set of weights across the different components of the CSV, based on industry spend, which, in effect imposes a view of what the efficient balance of spend is across activities. NERA show how companies for which the balance of spend is different to the industry average will, purely from this reason, fare poorly if industry average weights are used.

Model 5) combines the approaches of models 3) and 4), reflecting the error corrected CSV plus GDN specific weights and elasticity adjustments by activity.

The results and GDN rankings from the six models are summarised below.

Summary of models - rankings

	Ofgem DD	Ofgem DD model with errors corrected	Error Corrected DD DD model with density drivers added	Error Corrected model with disag-weighted CSV weights	Error Corrected DD model with company weights in CSV	Error Corrected DD model with elasticities and company weights in CSV
Model ref	(0)	(1)	(2)	(3)	(4)	(5)
EoE	7	5	3	3	5	4
Lon	8	8	1	8	2	2
NW	6	2	2	2	3	3
WM	5	6	5	6	1	1
NGN	1	1	4	1	4	5
Sc	2	3	7	5	6	6
So	3	7	8	7	8	8
WWU	4	4	6	4	7	7
Adjusted R2	0.86	0.90	0.98	0.91	0.56	0.60
RESET test	FAIL	FAIL	FAIL	FAIL	PASS	PASS

The results shows that:

- GDN rankings are very different across the five plausible models. Model 5) shows Cadent as ranking 1,2,3,4 as opposed to the DD which showed our GDNs as ranking 5,6,7,8.
- The most statistically robust model are Models 4) and 5) because they pass the RESET test – all other models failing. However, these models also have the worst fit of the data, as measured by the Adjusted R2.
- The model that fits the data best is Model 2) with the density driver, under which London ranks top.

What are the implications of this analysis?

- First, it is clear that there is no single view of truth, and that consequently, a rich picture approach comprising a number of pieces of analysis should be used.
- Second, given that an individual GDN can be anywhere between the most efficient and the least efficient, there is no justification for setting the benchmark at the 85th percentile. NERA suggest alternatives such as using the median level of efficiency, as used by the CMA in Bristol Water 2015, or alternatively to apply an efficiency benchmark above median, to the highest modelled cost for each GDN taken from a number of different approaches.
- Third, that at DD, the pre-modelling adjustments for London's Regional Factors are inadequate. Model 2) with the density drivers, has the best fit of any model, with density drivers which are statistically significant at the 99% level, and would result in a cost allowance for London that is £131m more than Model 1), error corrected DD. Given that we have only requested approximately half that amount - see GDQ29 – it seems likely that we have not identified sufficient Regional and Company Specific Factors for London.

3. Ofgem's use of a flawed and unreliable model

As noted above, the use of any single benchmarking approach in any price control review (including for the GB gas distribution sector) is an error in and of itself. However, we are especially concerned by the 'partex' model used in DD. Our concerns relate to a number of matters as follows:

a) Failure of the RESET test means the model is inaccurate, as previously accepted by Ofgem

The DD model (and all bar two of the plausible models in the table above) fails the RESET test.

The DD does not place very much weight on the RESET test, as evidenced by the use of the 85th percentile, and the comment from Ofgem's advisor in the Note for Ofgem on the computation of CSV weights, page 9, that "*beyond [testing a translog model], it is not clear what else can reasonably be done if a model fails a RESET test and having tested the translog form it would seem overly cautious to reject simply based on the RESET test alone".*

In contrast, NERA place considerable weight on the RESET test, observing on page 29 of their report that "*If the model specification is wrong, the estimated coefficients will be biased, and the cost forecasts for individual companies inaccurate".*

NERA also point out the inconsistency between the DD and the view previously held by Ofgem on the importance of the RESET test, providing some quotes from the RIIO-ED1 price control review. The first is from the July 2014 DD, Supplementary Annex para A3.4: "*some […] tests are more critical than others, particularly the Ramsey RESET test because it is directly relevant in assessing the validity of a given model specification".* The second is from the November 2014 FD Expenditure Assessment, para A3.2.4 *"key statistical tests are the RESET and the pooling test*".

b) Exclusion of comparable significant costs that disproportionately impacts Cadent:

Totex approaches provide value in overcoming trade-offs, between solution choices, capex and opex, accounting policies, organisation structures and cost allocation. Bottom-up approaches provide granularity, improving knowledge of cost drivers and regional factors, which can also feed into Totex approaches.

The approach to cost assessment as contained in the DD represents a hybrid or 'partex' approach, in that it neither represents a totex approach, nor a bottom-up approach, both of which were used by Ofgem at RIIO-GD1. Indeed it is also not a middle-up approach that was considered in RIIO-GD1.

We consider that costs for an activity should only be removed from a totex approach if they meet three criteria:

- activities are truly not comparable between networks;
- no adequate regression workload driver exists; and
- activities have little impact on other costs that are included within the totex regression.

In contrast, the DD's approach to Technical Assessment, as set out in paragraphs 3.139 and 3.140 of the GD Annex, is quite different: "The discrete nature of some investments limits our ability to model costs and benchmark through direct comparison. This may be because an investment is uncommon across networks, lacks historical comparators or has other highly unique characteristics. In these cases we have *undertaken a technical assessment.*"

We consider the DD's approach to be flawed for two reasons:

- First, because it treats investment and opex differently, allowing spend labelled as investment to fall under Technical Assessment, outside of the model, whereas that labelled as opex cannot.
- Second, because it takes no account of the interaction with spend which is included with the model the GDNs' choices as to how they spend their totex will drive the assessment of efficiency, rather than the total level of spend.

The DD's approach to Technical Assessment had led to the partex approach to modelling, removing many costs from the regression which do not meet our three criteria set out above.

The result, if unaltered, will not only cause an unreasonable set of allowances between GDNs, with some customers paying more than they should, and others less, but it will also damage future customers through the distortion of incentives. In the DD, some types of cost – in particular non-load capex – are favoured over others. This will cause GDNs to strive to minimise some costs, most notably opex, but not capex, leading away from the minimisation of totex, so that customers will (contrary to their interests) pay more than they should – as shown by the chart at the beginning of this response. This represents the very opposite of what the Totex approach introduced in RIIO intended to and successfully achieved.

Exclusion of capex projects > £0.75m and IT & Telecoms capex

a. In respect of the DD approach to capex projects, we fundamentally disagree with Ofgem's approach of excluding all capex projects > £0.75m and IT & Telecoms capex from its partex modelling:

Under a genuine totex approach, as applied at GD1, only exceptional capex projects – passing the three criteria above – would be excluded from the benchmarking. The only project we are aware of that would fulfil the three criteria for exclusion from a Totex regression are the Thames Tunnel and associated IP project, which has cost around £22m in RIIO-1 with a cost per km around 14 times the norm. The DD approach of removing all capex projects that are > £0.75m is removing a far greater value of costs from Totex benchmarking, and so greatly distorting its results.

The £0.75m threshold for capex projects is unexplained/justified and therefore arbitrary, which would be inevitable under such an approach. If a value of say, £10m had been applied, this would have led to very different results in the partex model.

There is a great deal of trade-off between Maintenance costs and capex, in particular LTS capex and also Other capex, not only due to solution choices, but also organisational structures and accounting practices.

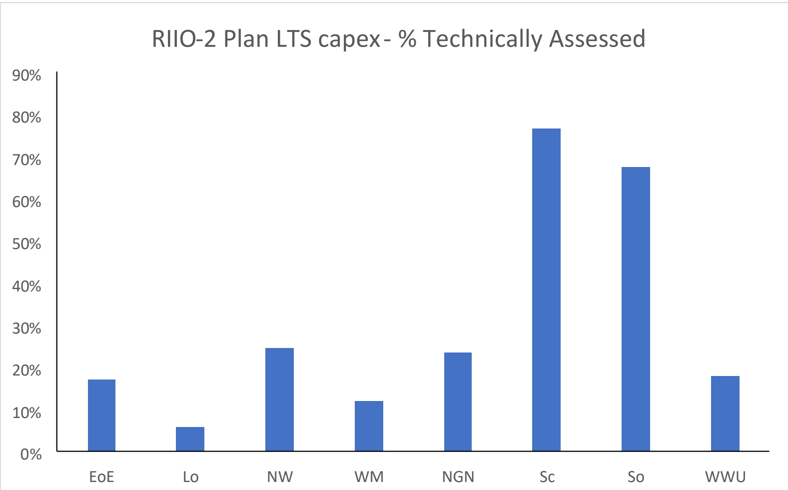
As stated at CAWG, Cadent's Finance function identified that a further £10m of Maintenance costs for 2019/20 could be capitalised, which we did not implement as being contrary to how the price control was set and regulatory accounts not being exactly the same as statutory accounts. At RIIO-GD1 Ofgem specifically recognised the Maintenance / capex trade-off in its bottom-up approach – it did not need to take any action in its Totex approach, as that approach treated opex and capex the same.

There are significant trade-offs between IT costs and other costs, in particular for staff. GDNs can choose to have more back office staff and less automated processes or more IT and less automated processes. There are many trade-offs between IT capex and IT opex, so that it makes no sense to treat them differently.

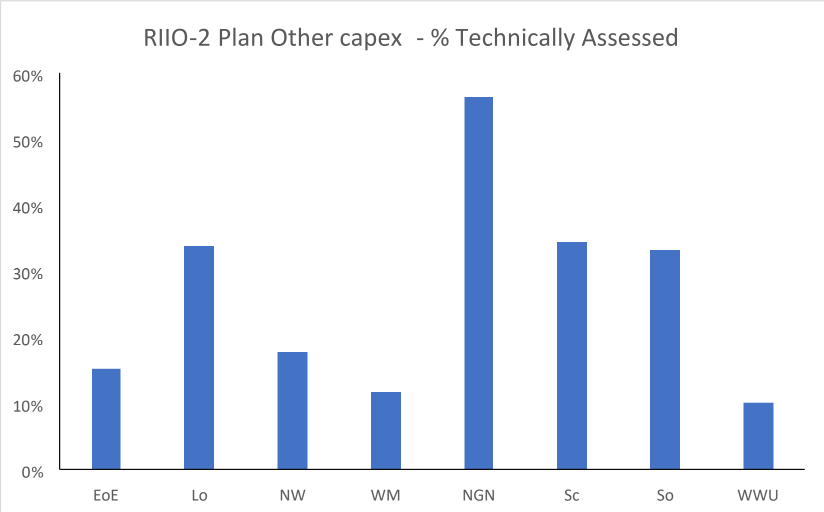
- Capitalisation policies differ between GDNs, so one GDN's capex is another's opex.
- Even within a GDN, the distinction between IT opex and capex is extremely fine in many cases. For example, if we incur software costs as part of a project, we capitalise these if they are "significant", and not related to data migration, training or research and development.

  Clearly considerable judgement may be involved in the capitalisation decision. ○ Whether an IT service is provided in-house or as a bought-in service drives whether costs are considered to be capex or opex, with the bought in service being entirely opex.
- The increasing use of software as a service, for example through cloud computing, acts to increase the opex proportion, although, so GDN choices over how to acquire software services act to drive the balance of IT costs that are labelled as opex rather than capex. ○ In respect of the costs associated with running the national emergency telephone number, Cadent has both capex and opex costs, whereas the other GDNs, who receive a charge from Cadent, will treat that cost entirely as opex.

In addition to the flawed logic, neither have the costs excluded for Technical Assessment been applied evenly between GDNs. The chart and table below show the proportion and value of plan costs which have been subject to Technical Assessment for both LTS, Storage and Entry, and Other capex – with IT capex being the main component of the latter.



LTS, storage, entry	EoE	Lo	NW	WM	NGN	Sc	So	WWU	Total
RIIO-2	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**
Gross	124	118	96	85	83	139	123	74	**843**
TA	-21	-7	-24	-10	-19	-107	-83	-13	**-284**
In partex model	**103**	**112**	**73**	**75**	**64**	**33**	**40**	**61**	**560**



Other CAPEX	EoE	Lo	NW	WM	NGN	Sc	So	WWU	Total
RIIO-2	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**
Gross	135	101	93	66	96	63	105	50	**709**
TA	-21	-34	-17	-8	-54	-22	-35	-5	**-195**
In partex model	**115**	**67**	**77**	**58**	**42**	**41**	**70**	**45**	**514**

The effect of the skewed application of Technical Assessment is to bias the benchmarking results in favour of those GDNs with a high proportion of costs subject to Technical Assessment, and against those where it is low. Even if none of the Technical Assessments were subsequently allowed, a GDN with a high value of Technical Assessment will benchmark well in the DD's partex model, and in the case of Scotland does form the benchmark, because so many of the costs for which there is no regression driver are removed from the model.

In particular, as shown above, the DD approach excludes NGN's high cost IT, and SGN's high cost LTS, Storage and Entry projects, with the result that the three GDNs appear significantly more efficient than Cadent in the model. On this occasion, with Scotland forming the 85th percentile benchmark the result is an unreasonable cost allowance for all other networks, given that the projects excluded are the chosen solutions to the same or similar problems faced by other GDNs where the costs are still within the regression model.

Indeed, there are further compounding issues and bias between networks created by this methodology. As an example, take IT capex projects. On this cost category Cadent is the most cost efficient (lowest average GDN), yet NGN has a Technical Assessment that determines an allowance of £30m - which is 17% above our Plan submission - but the DD removes the £40m Plan cost from the regression modelling. As a result, NGN's inefficient cost of £10m is excluded from the modelling and so has no consequence for NGN, but makes all other GDNs appear less efficient. In addition, although the NGN allowance is above Cadent's Plan level of spend, the DD proposes that Cadent has to apply for a UM in order to spend over £2m per GDN on IT projects. Further details on this issue are provided in response to Core question 18**.**

A consequence of the flawed logic and execution of this approach is that NGN customers end up paying more than they should, as shown in the chart at the start of this response. This outcome is not in the interests of NGN's customers, and the distortion effect it creates on the efficiency of other networks means that consumers generally will either over- or under-pay for such expenditure.

Exclusion of gas shrinkage costs

In addition to the inclusion of IT capex and projects >£0.75m in modelled costs, as at RIIO-GD1, the costs of shrinkage – the purchase of gas to cover leakage, own use consumption and theft – should be included in a totex model. Although Shrinkage is classed as a non-controllable cost by Ofgem, it is influenceable, hence the incentives at RIIO-1 on gas purchasing and leakage volumes. Cadent has spent tens of millions of pounds managing this cost, through MEG, data loggers and other pressure monitoring equipment, reprofiling pressure reduction equipment, and a team of 12 tasked with keeping the cost down (ultimately to the benefit of consumers). Therefore there is a significant trade-off with other costs that are included in the partex regression.

Exclusion of costs associated with repex stubs

Furthermore, we disagree that the costs of repex stubs should be removed from the regression for NGN and SGN and assessed separately. Fundamentally, the requirements of the mains replacement programme apply equally to all GDNs. If the HSE is content with the remaining lengths of Tier 1 mains attached to larger mains in some GDNs but not others, this has arisen from how GDNs have carried out the mains replacement programme. Pro-active GDNs have identified the issue, risk assessed options, put management controls (acceptable stub lengths) in place during RIIO-1, and agreed their position with the HSE through approval of their safety case. Those GDNs with which the HSE is content:

a. Have already been routinely replacing the lengths described as stubs and left by other GDNs.
b. Have incurred higher unit costs because of this work and so appeared less efficient up to now.
c. In the RIIO-2 period are still planning to routinely carry out this work – and so planning to incur higher unit costs than others. That is to say the approach followed in RIIO-1 which did not lead to a 'stubs backlog' being created will continue in RIIO-2.

Consequently, in both past and future cost benchmarking, the results are distorted by the fact that some GDNs are routinely carrying out stubs work while others have not. Therefore, in the future cost benchmarking, so that GDNs are treated on a like for like basis, the stubs related costs and workload should not be treated separately to the rest of repex.

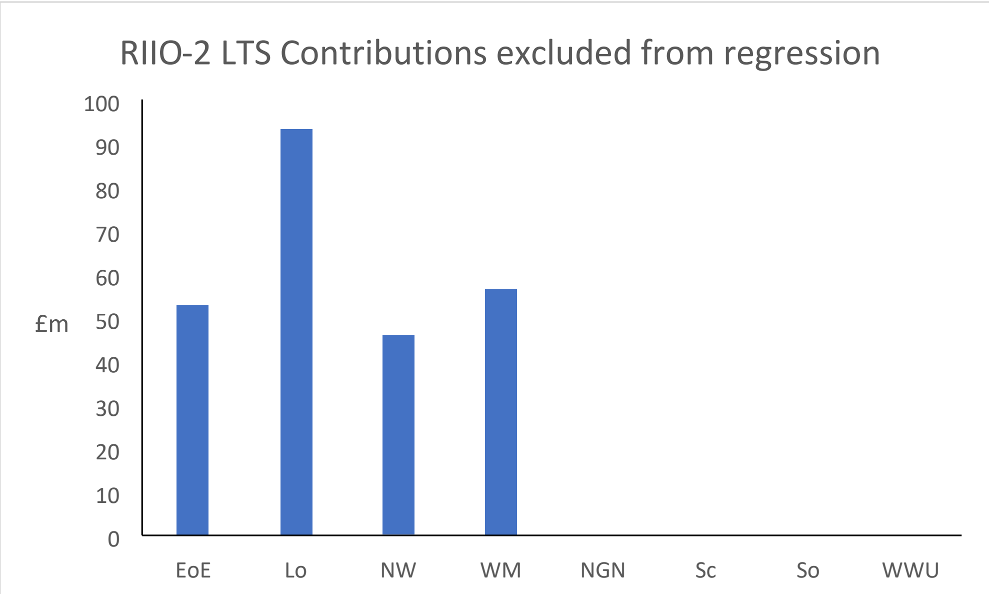
Exclusion of contributions (Net v Gross)

The approach models gross GDN costs against the totex CSV, and having struck the regression, makes a subsequent adjustment to reduce gross calculated allowances by the ratio of net to gross costs in the Business Plan. So if the Business Plan has a net to gross ratio of 0.95 in a 2021/22 for example, the gross modelled allowance for that year is multiplied by that same number to arrive at a net modelled allowance.

We disagree with this approach both in principle and in practice. In principle, efficiency should be assessed by measuring what work is proposed to be done and outputs delivered, against the cost to customers of carrying out that work. Contributions reduce the cost to customers so that they pay less, consequently, consistent with the RIIO-GD1 approach, we are clear that contributions should be included in the totex regression so that it uses net costs to strike the regression.

Where there is a workload driver in the model, for example for connections, the net approach might not change the regression result greatly, however a net approach would still provide a more complete picture of totex efficiency, as it measures not only how efficient a company may be in carrying out the physical work of a connection, but also how efficient it is in recovering much of the cost of the work.

However, where there is no workload driver in the model, such as for LTS, Storage & Entry, the difference between net and gross costs becomes much more important, presenting an incorrect view of efficiency. In practice, the DD approach of using gross costs makes a substantial difference to the regression result because, in particular for LTS, Storage & Entry, there is a substantial level of contributions in Cadent's plan, but none at all in those of the other GDNs, as shown in the chart below.



Cadent's Plans were reduced by around £250m for contributions to LTS schemes, for example for the Lower Thames Crossing, but none of these contributions have been taken account of in the regression.

While the gross costs of Technically Assessed schemes are removed prior to the regression, the fact that such a low proportion of Cadent's LTS schemes have been subject to Technical Assessment means that the regression shows a greatly distorted, far from robust view.

Exclusion of Growth governors

While we have not proposed any investment for Growth Governors in GD2, we disagree with the approach Ofgem has taken by excluding growth governors from the regression and treating them as non-regressed items. This approach creates bias in the model against Cadent and other GDNs which choose to invest in lower cost alternative solutions.

The table below shows the amounts included in Business Plans by GDNs for growth governors over the RIIO-2 period.

Growth Governors Normalisation	RIIO-2 total £m
EoE	0.0
Lo	0.0
NW	0.0
WM	0.0
NGN	4.8
Sc	3.2
So	9.4
WWU	0.0

	17.4

Growth governors are rarely installed on Cadent's networks as we focus on lower cost pipeline solutions. For example, when faced with a low pressure issue our modelling team will assess a range of options beginning with model testing and adjustments to network pressures, then assessment of network pinch points (locations where laying short lengths of pipe or the installation of valves can materially improve pressures) and finally laying longer lengths of pipe, upsizing existing pipes or governor installation. Installation of governors is generally more expensive and protracted due to the necessity to purchase or lease land for new installation, whereas installation of pipework can quickly resolve customer low pressure issues.

We chose, therefore, not to submit funding for this activity as volumes are low and volatile. By removing growth governor funding from the regression model, while leaving the costs of alternative solutions in the regression model, Ofgem is ignoring trade-offs between growth governors and alternative solutions. As a result it is artificially lowering the benchmark position, while funding the other GDNs to deliver governor solutions. We consider that Growth Governors are suitable for inclusion in the regression model, and we disagree with their exclusion.

Exclusion of GSOS Payments

Finally, as at RIIO-GD1, we propose that GSOP payments should be added into a totex model, and an efficient level of allowance made. GSOP payments are effectively penalties, however to eliminate all these penalties would cost more than the GSOP payment. It is also a fact that some of the payments are unavoidable as failure to meet the standard is outside our control, such as when landlords refuse entry. Thus, we consider it an error that further distorts the modelling outcome (and its reliability) to set allowances that do not account for an efficient level of GSOP payments, which is especially important in London, where GSOP costs are a particular issue, given its high number of customers in MOBs. As a minimum, we need the efficient level of additional GSOS1 costs that London faces to be recognised at FD.

c) The failure to use different time periods to provide a variety of views:

The DD benchmarking uses only one time period to determine the efficient level of costs, using time series data for the thirteen years between 2013/14 to 2025/26.

In order to form a rich picture view of efficiency, it is important that more than one time period is used. At both RIIO-GD1 and in the 2015 Bristol water inquiry, two time periods were used.

We consider that three different time periods could be used for RIIO-GD2, because each will provide a different view of efficiency, based on both actual reported and forecast costs and workloads, as summarised below:

a. RIIO-GD1 actuals – 2013/14 to 2019/20
b. RIIO-GD2 plans – 2021/22 to 2025/26
c. RIIO-G1 and RIIO-GD2 – 2013/14 to 2025/26

The DD Gas Distribution Annex, paragraphs 3.65 and 3.66 states that these time periods were considered, but given that the model performance was very similar across the different periods, Ofgem decided to use the thirteen year period to increase the sample size. We have run the regression for the RIIO-GD1 actuals and note that, while the GDN rankings are unchanged, the modelled costs are around 10% higher. While there are on average four years of ongoing efficiency between the two time periods, that is still a substantial difference, and one that needs to be reflected in allowances to provide a balanced view.

In respect of the relative weight to place on the different time periods, it is hard to be definitive because the present modelling is badly impacted by structural, formula and data errors. However, in principle, we believe that more weight should be placed on the historic period because:

- Past figures are, by their nature, more reliable than a forecast - no matter how diligently that forecast has been prepared, the future is always uncertain.
- We have described Cadent's plan as a "P40 Plan" – i.e. we have less than a 50% chance of achieving it. Consequently, to place a disproportionate weight on this Plan seems unwise, especially because, in a true totex model, with errors corrected, we believe that we would affect the benchmark level of efficiency.
- The overall understanding of costs and cost drivers is reduced compared to at RIIO-1, as evidenced by less robust bottom-up models, and this reduced understanding acts to compound the inevitable uncertainties about the future.

d) The failure to apply smoothing to all capex:

No matter which time periods are assessed, it is important that smoothed capex is used for all capex – not just the load related elements as at DD – we propose the use of 7 years, as was used at RIIO-GD1 to ensure consistency. This enables the inevitable lumps in capex to be smoothed over time, and gives a more representative picture of underlying efficient costs (which is the aim of the econometric modelling). At present, under the partex approach, only the load driven mains reinforcement and connections capex is smoothed. We believe it is key that all capex, non-load as well as load, is subject to smoothing.

e) The presence of numerous material errors in the regression modelling that distort and compromise its results:

We have already submitted to Ofgem multiple issues which we have identified as errors in the regression modelling, the more significant of which we set out below, divided between those relating to the MEAV, and other issues.

MEAV errors

a. MEAV MOBs: in the Step by Step Guide to Cost Assessment, paragraph 1.37 states that the MEAV for DD includes MOBs and Embedded Gas Entry Points. However, in the modelling used to derive the regression equation, another version of MEAV has been used, without these assets, which are significant and vary in importance across GDNs so biasing the results. Action: Ofgem should reestimate the MEAV according to para 1.37 of the Step by Step Guide.
b. MEAV NGN Storage: 4% of NGN's MEAV at DD is from Storage Assets. However, from the 2018/19 RRP it has no Storage assets in use, and the BPDT also shows zero assets in use from 2018/19 onwards. Action: Ofgem should restate NGN's MEAV to exclude the storage assets.
c. MEAV SGN MOBs: from the BPDTs, SGN have around 63% of the industry's MOBs MEAV. Given the profile of the issue in London GDN this seems highly implausible and contradicts the 2018/19 RRP, under which [SGN?] has around 14% of industry MOBs MEAV. We first raised this issue

with Ofgem in March, but no progress seems to have been made. Action: Ofgem to resolve this counter-intuitive situation and ensure MEAV calculations are updated accordingly.

d. MEAV WWU's mains and services growth: the GDN's projections of mains and services growth are significantly higher than those actually achieved. The MEAV shows growth of 233 km p.a., as compared to average growth between 2013/14 and 2018/19 of 67 km p.a. The projected pattern of growth is also implausible – with around half the projected growth being in Diameter Band F – with a high unit cost. Action: Ofgem to reduce the growth in WWU's mains and services population to an achievable level.
e. MEAV Pressure reduction assets: the unit replacement cost of these assets needs to be scaled to take account of throughput per asset. The scaling presently used dates from the last price control review but needs to be updated to reflect restated numbers of assets. Action: Ofgem to update scaling calculation and apply to the MEAV calculation.
f. MEAV mains and services: the DD has not updated for the revised Cadent numbers for mains and services, reflecting the submission of a central case for these activities, rather than the lowest plausible case as contained in the BPDTs. Action: Ofgem to include the revised Cadent numbers in the MEAV calculation.
g. MEAV mains unit costs: in the Linear Interpolation there is a transposition error for the 304.8mm to 457.2mm diameter band, where the lower number has been entered as 340.8mm. Action: Ofgem to recalculate the linear interpolation of mains diameter bands.
h. MEAV Embedded Gas Entry Points (EGEP) unit costs: at present the calculation assumes that these have a unit cost of £656,515, one quarter of the industry cost of a PRS, given that they are much simpler. We believe that a more accurate replacement cost of £180,000 should be used, as this is what Cadent typically quote, for both less than 7 bar and greater than 7 bar, for carrying out that element of the work of an EGEP that we subsequently adopt. Action: Ofgem to replace the EGEP unit cost with £180,000.

These errors are significant and disproportionately impact Cadent's efficiency relative to other networks, which further highlights the unreliability of Ofgem's over-reliance on its top-down regression model. When the above errors are corrected, this acts to increase Cadent's share of the industry MEAV from an average of 46.8% over the RIIO-2 period, to 48.7%. Given the significant weight given to MEAV in the modelling, this has a major impact on assessed efficiency and, in its current form, shows that Ofgem's approach is unreliable (particularly when used in isolation and/or not audited).

Other errors

a. The structure of the model is wrong: the regression equation is calculated using costs which have been normalised to strip out costs associated with work that Ofgem considers need not be done, for example elements of repex. However, the workloads used in the regression have not had a similar adjustment made – they include workload for which the costs have been removed. Subsequent to the regression, a workload adjustment is made to remove costs for workload that is not required. This structural flaw results in two errors:
    - The regression equation is inaccurate, as it is comparing apples and pears (i.e. does not perform the necessary like-for-like comparison which was intended), including workload for which the costs have been removed. This subjects the CSV coefficient to attenuation bias (see NERA Report for further information).
    - It removes costs for disallowed workload twice, once when costs are normalised, and again when the workload adjustment is made.

Action required so that the next version of the model be restructured so that the regression equation matches costs and workloads.

b. Due to a formula error, all GDNs have been given the Emergency CSV for the East of England GDN for all years, rather than their own CSV. This materially distorts the relative efficiency of Cadent as the East of England GDN has the highest Emergency CSV of all the networks. Action: that the next version of the model link each to each GDN's Emergency CSV.
c. The Bespoke Outputs for the Cadent GDNs for electric vehicles, totalling £55m, has not been removed during the cost normalisation process, as it should. Action: to remove Cadent's BO costs for electric vehicles from the normalisation files.
d. Due to a formula error, the workload driver for Southern's repex services is referencing over 100 cells, when it should be referencing 11. The impact is major, overstating the GDN's partex CSV by around 14%. Action: Ofgem to correct the Southern repex synthetic calculation, so that it only references other services.
e. The additional workload for Cadent's central case Mains Reinforcement and Connections activity has not been included within the partex CSV, although the costs have been included. Action: Ofgem to include additional workload to reflect Cadent's Central case for Mains Reinforcement and Connections.
f. The allowance for Scotland GDN's SIU are treated as a non-regressed cost by Ofgem in the DD. However, unlike every other non-regressed cost, the DD allowance is added back to modelled costs before the 85th percentile is calculated, and because the Business Plan forecast has been allowed in full, this acts to make Scotland appear more efficient and lower the ratio of its modelled costs to Business Plan costs. Action: Ofgem to treat SIU costs and allowances in the same way as other non-regressed items, and remove them from the relative efficiency calculation.
g. The DD model uses smoothed workload to calculate allowances. While it is logical to use smoothed workload to strike the regression equation, customers should fund what is proposed to be built in the RIIO-2 period, be that more or less than the smoothed amount.

In previous price control review Ofgem used external auditors to provide quality assurance over aspects of its modelling, from which GDNs and ultimately customers benefitted.

At DD, the existence of numerous errors (some of which are described above) does not suggest that any external audit was used for DD cost assessment, and we consider it key that more quality assurance is used before future documents are published. While GDNs have a role to play in validating models, we will need some time to do so, and also believe that the onus should be on Ofgem, which owns the models, to ensure that they do not contain significant errors. The continued absence of quality assurance will lead to not only GDNs, but also customers, suffering.

4. Ofgem's failure to implement a robust, fair and consistent process

Given the inherent weaknesses of and difficulty in developing accurate and reliable econometric models, we are disappointed that Ofgem has on this occasion acted opaquely, using a flawed, insufficient and inconsistent process, which has led to the incorrect benchmarking approach contained in DD. We set out below more detail regarding these concerns relating to Ofgem's process, and the lack of transparency, and give proposals for how both could be improved between now and FD:

a) Failure to ensure due process and to have regard to GDNs' previously notified concerns:

The development of the DD approach to cost assessment has followed a very poor process and this has contributed to the significant weaknesses and multiple errors in the chosen approach.

In our response to the Tools for Cost Assessment Consultation from June 2019, we were concerned at the lack of progress made to that point, and proposed an Initial Thoughts Consultation, to take place in the spring of 2020, to share Ofgem's developing thinking and modelling results prior to the Draft Determination, which would allow for two iterations of the approach before the Final Determination, rather than only one.

Instead of taking up our suggestion of a further paper, Ofgem held the last CAWG before DD on May 1st 2020, a little over two months prior to DD, and did not share developing thinking. The approach taken in the DD was not discussed at any of the CAWGs and does not address issues raised by GDNs during the three CAWGs held post business plan submission where Ofgem set out initial model options. A due process would have resolved issues like MEAV composition and calculation, RPE indexation indices, which were understood to be key issues before DD. We are surprised by the results of the DD benchmarking approach, and the weaknesses and errors within it, caused (to a large extent) by the poor process followed to date.

In addition, since publication, the GDNs have between them asked hundreds of questions, to try and find out how the modelling works. However the GDNS have only received partial responses to these requestes. For example, we only received the key global control file on August 5th, nearly half way through the response period.

The table below shows that, as at 2 September, 84 out of 113 questions which Cadent has asked have been responded to late, and the responses to questions are still outstanding. This has made the task of responding to the Consultation more difficult.

Draft Determination Queries MI					
Response Due	Resp. Before or On Time	Late Response	Retracted	O/stg	% O/Stg
113	6	84	3	20	18%

We believe that, as we flagged in 2019, there needs to be a further iteration of the approach before the Final Determination, with this DD being treated as an Initial Thoughts paper. Given that there are around three months between the closing date for responses to the DD and the original date for publication of the Final Determination, this does not seem enough time to prepare a further consultation, allow a reasonable period for responses, consider them fully, and amend the approach accordingly. Therefore, we propose that the date of the Final Determinations needs to be put back to early 2021, to allow for a cost assessment consultation in the Autumn.

Ultimately, it is more important to achieve a robust and reasonable outcome for the next five years, than to stick rigidly to the present timetable.

b) The lack of transparency:

The approach to modelling is very opaque and difficult to follow, so much so that Ofgem needed to hold a presentation to GDNs in early August to explain how the modelling works, and at the last GDN call on August 14th, no GDN had been able to run the files as Ofgem intended. The root cause of the difficulty is that the spreadsheets typically are not linked to each other physically, but instead there is a separate global control file that takes lines of data from one file and places it in another. Consequently, it is very difficult to trace numbers through from one spreadsheet to another, which seems likely to be one of the reasons for so many errors in the modelling.

From this point on in the process, we suggest that a series of physically linked spreadsheets be used, as at RIIO-GD1, in order to make the cost assessment approach more transparent, reduce the number of errors, and also to speed up and make more thorough any quality assurance. Without transparency it is exceptionally difficult to ensure that a credible robust result is determined, which only acts to increase the likelihood of a CMA appeal.

Concluding remarks

We have proposed above that Ofgem carry out a further cost assessment consultation in the Autumn of 2020 to develop a far more robust, reliable, reasonable and error free approach to benchmarking, and delay the publication of Final Determinations. Cadent stands ready to work with Ofgem to give such an approach as great a chance of success as possible.

Gas Distribution Questions

GDQ27 – Do you agree with our proposed approach to benchmarking modelled costs at the 85th percentile?

No, we do not agree with the proposed move to an 85th percentile for setting the efficient level for each GDN. The decision is not rational given the degradation of model fit, the use of a single model and previous regulatory precedent and econometrics best practice. This represents a significant error and the DD should set the allowance at the median for the following reasons.

1. ***Inappropriate and insufficient justification:*** Ofgem's justification for the move to the 85th percentile is limited and appears to be driven solely by the desire to limit companies' outperformance in GD2 on the basis of its dissatisfaction with companies' outperformance in the first six years of GD1 (para 3.24 RIIO-ED2 Sector Methodology Consultation Annex 2). This is a direct contradiction of Ofgem's stated objective for cost assessment as explained in paragraph 13.26 of the SSMD: "*we will aim to set expenditure allowances and output targets in a way that does not anticipate any sector wide outperformance, nor underperformance.*"

2. ***Flaws in the modelling methodology and errors in its application:*** There are serious issues with Ofgem's approach to modelling efficient costs which mean that it is unreliable, including the failure to develop a robust totex model. The regression model itself performs significantly worse than at RIIO-GD1 and also fails the RESET test showing that the model is not properly specified. This undoubtedly reduces the level of confidence in the model output compared to RIIO-GD1 to such an extent that we would question even using the upper quartile as the benchmark.

   During Bristol Water's appeal of its final determination in 2015, the CMA noted the importance of choosing a benchmark that reflected the robustness of benchmarking.

   > *"regulatory precedent from Ofgem and the CC has also recognised that a less demanding benchmark than upper quartile may be appropriate in cases where there was less confidence in the modelling results. The effect of modelling error and limitations will tend to mean that an upper quartile benchmark will require levels of efficiency that are, in practice, greater than the upper quartile."*

   Bristol Water Final Determination, paragraph 4.222

   The key point is however, that even with a 'robust' totex model, the use of just one version of the truth on that model that is looking at just 8 companies, still moves one to the conclusion that the gap to 85th, or even an Upper Quartile, is likely to unfairly bias against one or more networks.

3. ***Failure to ensure consistency and coherence with other changes***: The move to the 85th percentile is out of line with the RIIO principles and it wrongly and unfairly fails to account for other changes, such as the removal of the IQI and changes in cost sharing incentives. This combined approach undermines all cost incentives and removes the ability for the average GDN to recover its costs.

The Draft Determination methodology's output, sets a significantly higher industry catch-up than the RIIO-GD1 determination, out of line with recent determinations in the water industry, which themselves are being challenged at the CMA. This is a direct result of the poor explanatory power of the model used combined with the use of the 85th percentile to set the benchmark in spite of the significantly increased risk of error.

It is therefore an error to set the benchmark at the 85th percentile and best practice would instead support a move to setting the benchmark at the industry average, the median. This view is supported by the findings of NERA, who we commissioned to review the DD approach to cost assessment.

Please see our response to GDQ38 and 41 for our comments on the application of the 85th percentile to non-regression costs.

We disagree with Ofgem's proposal to set the benchmark at the 85th percentile.

Ofgem's justification for using the 85th percentile is flawed and without any robust justification (being justified on the basis of past performance). The approach also fails to achieve Ofgem's stated objectives/aims, including the one explained in paragraph 13.26 of the SSMD, which is to "*set expenditure allowances and output targets in a way that does not anticipate any sector wide outperformance, nor underperformance.*"

We consider the proposal a significant error, particularly given:

1. ***Inappropriate and insufficient justification:*** *The Draft Determination's (DD) justification* for using the 85th percentile is based on GD1 outperformance, which is an inappropriate basis for setting a benchmark. The choice of benchmark level of performance should instead be based on an assessment of the risk that the modelled costs are distorted by data or model error. In addition, the DD appears to erroneously assume that companies have been funded to achieve the 85th percentile.
2. ***Flaws in the modelling methodology and errors in its application mean that the 85th percentile which requires a higher model quality and greater precision, cannot be justified:*** including its reliance on the results of regression modelling comprising 84% of forecast controllable costs, is unsafe and is wholly inappropriate given the use of a single flawed partex regression model and is out of line with precedents set by the CMA and other regulators.
3. ***Failure to ensure consistency and coherence with other changes:*** Ofgem's process for engaging with GDN on cost assessment and failing to take into account the other changes it is making in relation to calculating the efficient level of totex, e.g. removal of the IQI sharing factor (which included the GDN's view on efficiency into the proposed allowances), which exacerbates the above issues.

These issues reflect the findings of NERA, who we commissioned to review the DD approach to cost assessment. The full report "Review of Ofgem's GD2 Draft Determination Cost Assessment" is submitted as one of the supporting files to this DD response. NERA similarly found that the DD approach to set the efficiency target at the 85th percentile reflected the

> *"aspiration regarding the level of allowances it considers appropriate for GD2, which has no basis in statistical or technical analysis. Indeed, regulatory precedent (including past Ofgem decisions) shows that the level of the efficiency target should be justified by assessing the risk that modelled costs are distorted by data or model error. Ofgem has made no such assessment when setting its efficiency target."*[4]

We discuss each of the issues above in turn.

1. Inappropriate and insufficient justification for setting the benchmark at the 85th percentile

Ofgem has proposed to set the benchmark at the 85th percentile on the basis that "*all GDNs have consistently outperformed their cost allowances to date while generally delivering a good quality service.*"[5]. In particular, Ofgem focuses on the point that between 2013-14 to 2018-19 GDNs actual totex

[4] NERA, Review of Ofgem's GD2 Draft Determination Cost Assessment, 3 September 2020 (page ix)

[5] Ofgem, Draft Determinations, Gas Distribution Annex, page 87

on average is 14% lower than the proposed allowed costs for RIIO-GD2, and 25% lower than RIIO-GD1 final business plan submissions, stating that "*we therefore believe it is reasonable to expect that all networks should be able to continue delivering efficiency improvements and achieve efficient performance over RIIO-GD2*".

We disagree with this as a reason for setting the benchmark at the 85th percentile and believe it represents an illogical leap by Ofgem. We are very concerned with this justification for the following reasons (without limitation):

a. First, the level of outperformance and underperformance in previous periods is not a rational or appropriate basis for setting a forward looking benchmark. Based on this policy approach Ofgem should have set the benchmark at the median (or even the lower quartile) for GDPCR1 because of the under-performance in the preceding price control. The point here is that out- and under-performance varies over time. Moreover, RIIO-GD1 allowances were based on a very different approach and did not include RPE adjustments and volume true-ups proposed in RIIO-GD2, the absence of which could drive a greater deviation in actual costs from allowed (up or down).
b. Second, the analysis behind this justification is misleading because it ignores the backloading of many GDN's NARMs and mains replacement programmes to the last two years of GD1, which visually overstates the outperformance when looking at the early years of RIIO-1.
c. Third, it wrongly fails to recognise that the investment requirements of the future are not the same as the past. This is particularly relevant in the GD2 period where (in contrast to GD1) GDNs will be required to make significant investments (in terms of volume with generally lower unit costs) to achieve Net-Zero and address the impacts of Covid-19 and Brexit.
d. Fourth, this level of outperformance was anticipated at RIIO-GD1 in the Final Proposals[6] where double digit outperformance of RORE was expected of efficient GDNs, indeed it was stated

> *"We have updated our RoRE analysis for FP. We note that the increase in allowed expenditure (and specifically in relation to tier 2 and 3 repex where we consider there is greater scope to outperform), as well as improvements in GDNs efficiency scores and thus income/reward penalty has increased the variation in expected returns. Figure 6.1 shows that the median GDN (and indeed all GDNs) is able to achieve double digit returns on a post-tax real basis."*

   This outperformance then manifests itself in lower cost base (and lower unit costs) in the base year performance of GDN plans, 2018/19. Our business plan forecasts were taken from this base year, so they are already reflected in our business plan forecasts.

e. Fifth, the previous level of under- or out-performance is not a sufficient or proper reason to move to the 85th percentile, and it is contrary to Ofgem's stated objective for cost assessment in the SSMD[7], where it said it:

> *"will aim to set expenditure allowances and output targets in a way that does not anticipate any sector wider outperformance, nor underperformance".*

[6] Ofgem, RIIO-GD1 Final Proposals – Overview, para 6.23

[7] Ofgem, SSMD, para 13.26

Ofgem's stated justification for the efficiency benchmark in the DD is inconsistent with the objective set out in the SSMD, without a proper explanation given for this significant (and adverse) departure.

The DD focus on RIIO-GD1 outperformance to justify the 85th percentile is confirmed in the RIIOED2 proposals, where Ofgem also proposes to use the 85th percentile, and it states

> *"Similar to RIIO-ED1, in RIIO-GD1 the efficiency benchmark was set at the UQ. Justification for changing this approach in RIIO-GD2 to the 85th percentile centred on sector wide outperformance of cost allowances throughout RIIO-GD1, and the better data, and improved robustness in modelling available in RIIOGD2."*[8]

This retrospective decision-making is inconsistent with the binding price controls set at RIIO-GD1 and we do not consider it legitimate to clawback past outperformance. As NERA find:

> *"retrospective decision-making is bad regulatory practice that dilutes companies' incentives to reduce costs, undermines investment incentives, and is therefore detrimental to the interests of customers."*[9]

This approach also creates a significant risk that GDNs are insufficiently funded to carry out their statutory and licence obligations in RIIO-GD2. This increased regulatory risk has been noted by Moody's who has raised concern about the increased risk of energy network companies not being able to recover their efficient costs.

> *"Where, however, regulatory developments lead to a scenario in which network **companies can no longer recover their efficient costs in a timely manner** or earn a fair return in prevailing market circumstances, **their credit risk will increase**. Consequently, further measures to promote legitimacy at the expense of the networks may cause us to review our assessment of business risk."*[10]

f. Sixth, the DD is factually wrong in para 3.25 of the GD Annex in stating:

> *"we further developed our approaches, building on more detailed and extensive data collection via BPDTs submissions. We have undertaken significant work to normalise GDNs data submissions through the use of adjustments and regional factors. We consider this has delivered improved comparability across GDNs, which in turn has enabled us to develop robust models, better reflecting industry cost structures."*

The DD's modelling does not represent an improvement on the modelling at RIIO-GD1. At RIIOGD1 the models Ofgem used passed the RESET test and had better fit (higher R-Squared) than the model proposed for RIIO-GD2. Additionally, the approach to modelling at RIIO-GD1 was more robust as a variety of models were used to provide a rich picture of efficiency. The DD also claim to have better data. Whilst the RRPs may capture more data, and the BPDT may ask for lots of detail, there are significant weaknesses observed in the data and analysis driven by it.

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[8] Ofgem, RIIO-ED2 Sector Methodology Consultation, para 3.24

[9] NERA, Review of Ofgem's GD2 Draft Determination Cost Assessment, 3 September 2020 (page 38)

[10] Moody's Sector Comment on Regulated Energy Networks, 3 August 2020

To name but two we would point to: a) the synthetic cost calculations where a material element of then rely on Ofgem's assumptions (see response to GDQ33 and GDQ36), and b) the data for the critical MEAV calculation is erroneous (see response to GDQ26).

These views were echoed by NERA who concluded that the DD regression modelling

> *"appears weaker than the suite of models it relied upon at RIIO-GD1…Given a weaker model, the benchmark at RIIO-GD2 should correspondingly be less, not more demanding than the benchmark at RIIO-GD1. At RIIO-GD1, Ofgem assessed that the accuracy of its modelling warranted a 75th percentile benchmark."*[11]

As such, we consider Ofgem's approach and justification to setting the benchmark to be inconsistent with Ofgem's duties to protect the interests of existing and future consumers and the need to ensure that for licence holders to finance their activities.

g. Seventh, we also note that in the DD Core Document, Ofgem implies the decision around the benchmark frontier is also based on an assumption that companies were funded to deliver efficiency improvements:

> *"For gas distribution companies we propose a benchmark frontier for modelled costs at the 85th percentile. We believe this is consistent with setting high but achievable expectations for GDNs' future efficiency gains, building on the improvements they were funded to deliver over RIIO-GD1."* [12]

This is not correct as GDN's have not been funded to deliver 85th percentile cost efficiency. Networks received no funding to catch-up with the Upper Quartile, we were incentivised to then outperform this Upper Quartile. Innovation funding was introduced, to encourage greater research and development expenditure, with around 65%-70% of this funding going to future of gas (hydrogen) research and other safety/security of supply and customer research. <u>In any case, any efficiency savings as a result of innovation will already be embedded in EU-KLEMs data and therefore reflected in Ofgem's on-going efficiency 'stretch' target</u> (see our response to question 11) without any further adjustment required. Setting the benchmark at the 85th percentile on the basis of innovation improvements is an error as it double-counts the stretch within the ongoing efficiency challenge.

2. Reliance on a single flawed econometric model

In our response to Ofgem's consultation on "RIIO-2 tools for cost assessment methodology" in August 2019, we highlighted the need for the benchmark

> "*to reflect the degree of confidence in the whole approach to cost assessment – not only the level of confidence in the data and the variability in modelling results but also, for example, to include the suitability of the drivers used and the scale of the assumption for ongoing efficiency*".

[11] NERA, Review of Ofgem's GD2 Draft Determination Cost Assessment, 3 September 2020 (page 41)

[12] Ofgem, RIIO-GD2 Draft Determination – Core Document, page 41

Where there was no more confidence in the entire approach to cost assessment than at RIIO-1, options such as benchmarking at median levels, applying uplifts or glide paths needed to be considered.

We consider **Ofgem's reliance on the outcome of its regression modelling, which uses a single flawed partex[13] model to assess 84% of forecast controllable costs, to be unsafe and therefore a significant issue when it comes to the question of setting the benchmark and determining catch up efficiency.** This is compounded by the overall approach to cost assessment in the DD, which is significantly less robust and reliable than at RIIO-GD1. Throughout our response to the DD (GDQ26GDQ41), we have identified a number of issues with the wider approach as well as issues with Ofgem's approach to modelling. The majority of these issues were also identified by NERA in its review of the DD approach to cost assessment. This leads to the conclusion that the resulting regression model is less robust and reliable than at RIIO-GD1 and would therefore require using a lower efficiency benchmark than that used at GD1. To summarise the key issues include (without limitation):

a. **Reliance on a single model**, which performs demonstrably worse than at RIIO-GD1 (see table below), rather than using a "rich picture" approach to determining efficient costs – given the small sample size (eight GDNs and three ownership groups) any single approach to cost assessment will not be robust and therefore is unreliable and the same applies to the underlying assumption that there is a single correct form of model.

b. **The model is not a totex model and excludes significant proportions of capex,** ignoring key trade-offs between activities and leading to erroneous estimation of company efficiencies. This results in a bias against low capex, high opex companies which introduces bias against certain operating models.

c. **The model itself fails the Ramsey RESET test showing the model is mis-specified** and therefore the random error in the model is likely to be greater than that at GD1. It is accepted econometric practice that a higher random error in the model means that lower confidence should be placed on it. Despite this, the DD has used a higher efficiency benchmark than in GD1 whilst the reliability of the chosen current model is demonstrably inferior.

d. **The approach to modelling time trends introduces a serious error** into the estimation of efficiencies.

e. **The CSV the model uses does not reflect the workload adjustments** Ofgem has made to the costs used in the model, and in error tries to adjust for these workloads post-modelling. This increases error in the model (as well as penalising GDNs twice for workload adjustments), therefore adversely impacting its reliability.

f. **We have concerns with Ofgem's approach to calculating the synthetic costs used** in the model CSV and we consider them inappropriate for use in the regression model. Response to GDQ33 and GDQ36 provide details, but one reason is the level of approximation within the process given the extra level of disaggregation being sought. Such errors regarding the calculation of synthetic costs further show that the model used by Ofgem is unreliable and should have therefore determined Ofgem to use a lower efficiency benchmark.

Comparative benchmarking models cannot separately identify genuine inefficiency from data error, omitted factors, and differences in cost allocation across companies. As such, the DD estimated

[13] We refer to Ofgem's partial totex model as a 'partex' approach.

efficiency scores may conflate company inefficiency and model or statistical errors. Therefore, setting such a demanding benchmark on poor modelling and data errors does not sufficiently acknowledge that part of the difference in costs across GDNs is related to factors other than GDNs' relative efficiency (such as measurement error and statistical noise). It also creates a significant risk that the modelled allowances will understate the costs GDNs will incur over the GD2 control period. As a result, the choice of 85th percentile is inappropriate and does not sufficiently acknowledge the difference. In particular:

> *"Setting a demanding 85th percentile benchmark is especially vulnerable to errors because it is based on a small number of companies…. Any modelling or statistical errors are liable to result in greater errors for individual companies than for the industry average. By setting the challenge effectively based on the efficiency scores of only the two top-ranked companies, it is particularly vulnerable to being affected by companyspecific errors. This increases the likelihood that the 85th percentile benchmark results in an unreasonably demanding challenge."*[14]

Ultimately, the percentile efficiency benchmark applied must reflect the level of confidence in the model. Irrespective of the model issues outlined above, **Ofgem's cost methodology adopted in the DD is taking a single model approach which fails key statistical tests and therefore has poor explanatory power**. The DD in moving to the 85th percentile is going firmly against regulatory precedent and econometric best practices and is not justified, as outlined below. In their determination for Bristol Water, the CMA set the benchmark efficient level at median based on the outcome of 7 separate models.

> **In Bristol Water's appeal the CMA state that all approaches are flawed**
> *"We recognised that no benchmarking analysis or cost assessment method will be perfect, and there will always be vulnerabilities and limitations in any approach. Any method of estimating a company's future expenditure requirements (if it operates and invests efficiently) over the five year price control period is likely to raise significant risks of inaccuracy or other problems."*
>
> **Bristol Water Final Determination, paragraph 4.76**

Indeed, the CMA[15] developed 18 models but they based their determination on 7 models in the end (para 4.143 of final determination). Though they did use the wider set for checks e.g. they checked that the average estimate of the preferred set of seven models was similar to the average across the wider set of 18 models, (see para 4.177 (e) of the CMA Final Determination).

3. Failure to ensure consistency and coherence with other changes

Further, we would expect any regulator's decision in setting the benchmark to be informed by its wider methodology. We see no justification for Ofgem setting the benchmark at an unprecedented level for UK water and energy regulated sectors (the 85th percentile), when its methodology is inconsistent with good regulatory practice and previous price controls. In particular, we note that in contrast to the previous price control (GD1) Ofgem has:

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[14] NERA, Review of Ofgem's GD2 Draft Determination Cost Assessment, 3 September 2020 (page 41)

[15] https://assets.publishing.service.gov.uk/media/56279924ed915d194b000001/Bristol_Water_plc_final_determination.pdf)

a. **Placed reliance on a single partex regression model (**as opposed to using multiple models which are then triangulated and, as was used in GD1, a bottom-up assessment of costs);
b. **Removed the IQI,** where at GD1 the final cost allowances were based upon 75% of Ofgem's view of efficiency and 25% of each GDN's view. Ofgem took this approach to recognise the model, results and target remain affected by measurement error;
c. **The level of London and East of England regional factor disallowance**, where Cadent has provided clear evidence of unique external influences but the DD rejects the costs, despite the sense check that sees both poor model fits and these two networks being 13% and 7% respectively less efficient than North West and East of England despite operating the same processes and supported by the same business support infrastructure.

Table 17: Comparison of RIIO-GD1 model performance and cost assessment approach to RIIO-GD2 DD

	RIIO-1 FP	RIIO-2 DD
Totex Model	Yes	No
(R^2)	0.96	0.86
RESET Test	Pass	Fail
IQI Uplift	Yes	No
Efficiency benchmark	75th	85th
Glide path	Yes	No
Totex sharing	63%	50%

The DD does not appear to have considered these issues when setting the benchmark, which is a serious error in methodology and results in an unreliable outcome. As a result, this represents another example where the DD materially change the balance of cost risk for GDNs with the likely outcome resulting in setting the benchmark beyond the efficient frontier. This creates a concern around whether the benchmark is reasonably and realistically achievable, including as to whether the related GDN is a relevant/appropriate benchmark.

We therefore disagree with Ofgem's proposal to set the benchmark at the 85th percentile.

Concluding remarks

From the issues described above, it is clear that the approach to cost assessment and the regression model is demonstrably less robust than at RIIO-GD1, and Ofgem's own errors in methodology have introduced significant error into the regression model. It is therefore wholly inappropriate (and an error of reasoning) to set the benchmark at the 85th percentile.

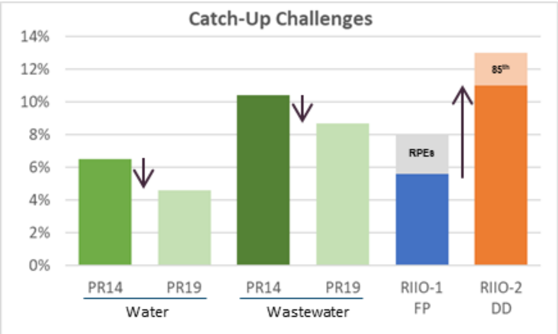
A more robust approach would assess the level of error in the model and set an appropriate benchmark based on that assessment. The choice of the 85th percentile does not make such an assessment and given the underlying weakness in the model approach a more appropriate benchmark would be the median or average. This is reflected in the CMA's 2015 re-determination of Bristol Water's price control, where the CMA noted:

> *"the regulatory precedent from Ofgem and the CC has also recognised that a less demanding benchmark than the upper quartile may be appropriate in cases where there was less confidence in modelling results. The effect of modelling error and limitations will tend to mean that an upper quartile benchmark will require levels of efficiency that are, in practice, greater than the upper quartile"*[16]

In the case of the Bristol Water determination, the CMA were concerned that an efficiency benchmark based on an upper quartile efficiency concept would be overly demanding if applied to the results of the econometric models that it used. As a result, the CMA applied the industry average as the efficiency benchmark. This is in a scenario where multiple models (with a larger number of independent comparators) were used to derive a view of industry efficiency, and nowhere in the CMA's comprehensive review did it consider it appropriate to take into the account the level of past industry out- or under- performance.

In addition to the CMA's decision in 2015, we note Ofgem's approach to increasing the size of the catchup efficiency challenge is out of line with recent determinations in the water industry where the size of the catch up challenge decreased despite Ofwat setting the benchmark at the 76st percentile rather than the upper quartile. The graph below illustrates the comparison between the catch-up challenges at PR19 and at RIIO-GD2 draft determinations.

Table 18: Comparison of catch up efficiency challenges



Given the challenge set in the DD, Cadent looked to NERA to provide an independent expert review of the DD cost methodology and its models. With regard to the topic of the 85th percentile, their conclusions led to the same view as Cadent's that the DD cannot justify the move to the 85th percentile, instead, they should perhaps look towards the use of the median. From the Executive summary we outline two paragraphs:

> *"Ofgem's decision to set the efficiency target at the 85th percentile reflects its aspiration regarding the level of allowances it considers appropriate for GD2, which has no basis in statistical or technical analysis. Indeed, regulatory precedent (including past Ofgem decisions) shows that the level of the efficiency target should be justified by assessing the risk that modelled costs are distorted by data or model error. Ofgem has made no*

[16] CMA, Bristol Water Plc – A reference under section 12(3)(a) of the Water Industry Act 1991, page 117

such assessment when setting its efficiency target."[17]

"In conditions where econometric cost modelling cannot identify robustly the efficient level of companies' expenditure requirements, we recommend basing allowances on a wide range of alternative methods (see above), and setting a less demanding efficiency target. For instance, in its redetermination of Bristol Water's PR14 price control the CMA applied a median cost target to reflect the limitations on the data and models available to it. We recommend Ofgem applies this same approach at RIIO-GD2." [18]

Based on the above inappropriate/irrelevant justification, modelling issues, and past practice/precedents in the energy and other sectors we strongly disagree with Ofgem's proposal to set the benchmark at the 85th percentile. Indeed, given above and looking at regulatory precedent form Bristol Water's PR14 appeal, a move to median would appear appropriate.

During Bristol Water's appeal of its final determination in 2015, the CMA noted the importance of choosing a benchmark that reflected the robustness of benchmarking.

"regulatory precedent from Ofgem and the CC has also recognised that a less demanding benchmark than upper quartile may be appropriate in cases where there was less confidence in the modelling results. The effect of modelling error and limitations will tend to mean that an upper quartile benchmark will require levels of efficiency that are, in practice, greater than the upper quartile."

Bristol Water Final Determination, paragraph 4.222

[17] NERA, Review of Ofgem's GD2 Draft Determination Cost Assessment, 3 September 2020 (page ix)

[18] NERA, Review of Ofgem's GD2 Draft Determination Cost Assessment, 3 September 2020 (page x)

Gas Distribution Questions

GDQ28 – Do you agree with our proposed approach to estimating embedded ongoing efficiency and values calculated?

No, the calculation has multiple errors, in both formulae and data input, and does not properly account for the phasing of efficiencies in the plans that under-estimates the level of GDN average embedded efficiency that should have been used in the DD (should have been c.1.0% p.a. not the c.0.6% p.a. used).

- Our business plan, has an underlying RIIO-2 ongoing efficiency of 0.94%p.a., when our four networks are combined with 1% p.a. for SGN's two networks and the 0.5%p.a. for NGN and WWU, the average should have been calculated to around 0.9%p.a..

- In the GD Annex, para 3.35, it quotes Cadent as having an Ongoing Efficiency of 0.53%p.a., but this was our view of a 'fair' central case for GDN productivity as a 'suitable level for ongoing efficiency". That is the case, but our business plan and the BPDTs used to calculate the average embedded ongoing efficiency was materially higher. As requested in the SSMD, Cadent submitted an ambitious front-loaded planning assumption of 1.1%p.a. over the 8 years 2017/18 to 2025/26, which included 0.94%p.a. over 5 years of RIIO-2.

- There are 2 formulae errors, 2 data errors and the lack of reflection of Cadent front load ongoing efficiency which materially understates the average GDN ongoing efficiency in the DD calculations. The impact of these corrections is given below:

Ofgem DD	0.6%
Formulae Errors 1& 2	0.81%
Data Errors 1 & 2	0.86%
Front loading	0.97%

- **Correcting the errors results in a material reduction in the disallowance of £74m.**

- This response must be read alongside our response to Core Document Q11, which provides further critique of the Ongoing Efficiency assumptions adopted at DD and identifies adjustments that will result in a net increase to the Cadent plan.

From review of the model "[10] OngoingEfficiencies" and the link through into model "[9] Allowances" we have identified a number of clear and material errors. The following errors were identified through our review:

1. Formula Errors 1 and 2 : under-value average GDN embedded ongoing efficiency a)

Error in 5 year calculation:

The calculation of the 5 year embedded CAGR is only calculating a four years movement from 2021/22 to 2056/26, to calculate a 5 year CAGR Ofgem take it from the preceding base year 2020/21, so the formula in file "[10] OngoingEfficiencies" are erroneous in tab "Inp_NetworkOE_GD" cells AK152-156. To outline the error, we illustrate using formulae in cell AK152:

=1-(AK145/AG145)^(1/5)

But AG is 2021/22, so formulae is taking just 4 years productivity movement, but formulae is dividing by 5 years. The correct formulae is:

=1-(AK145/AF145)^(1/5)

As a sense check, if you apply the formula to WWU only the erroneous formula gives a result of 0.4%p.a., but WWU as Ofgem state in DD submitted 0.5%p.a.. During the DD Question process, Ofgem agreed this was an error and will be corrected.

b) Formulae should be calculating 7 year not 5 year:

This is the wrong formula itself, it should be a 7-year forecast CAGR not a 5 year RIIO-2 CAGR.

In file "[9] Allowances" in each GDN Input tab the delta to average and the target is applied in 2021/22 with a 3-year compounded value derived from these cells, thereafter the annual movement. This is illustrated below for the work management cost category. As can be seen, the 2022 (2021/22) figure is using a cumulate 3 year additional discount, whereas other years are taking single year reduction.

	G	AG	AH	AI	AJ	AK
7	**Cost level**	**2022**	**2023**	**2024**	**2025**	**2026**
14	**Work Management**	0.977	0.969	0.961	0.953	0.945
	Movement	*-2.3%*	*-0.8%*	*-0.8%*	*-0.8%*	*-0.8%*

The formulae in these cells should be calculating the 7-year average. This is an inconsistency in the logic flow, an error. To correct, this Ofgem need to change the formulae to calculate 7-year value, i.e. correct to

=1-(AK144/AD144)^(1/7)

Note: To make the 7-year formulae work, NGNs 2018/19 cells AD1112-116 will need to have the value 1.0 entered, they are currently blank. NB the correction needs applying to all 5 rows.

The error was also notified to Ofgem through the DD Query process, Ofgem response was that they did not agree, and they chose to use five years due to data inconsistencies between GDNs e.g. some GDN did not identify any on-going efficiency pre-GD2 . While we recognise there may be data challenges (see next section on Data Errors), we are still concerned with Ofgem's approach to only look at embedded efficiency over 5 years particularly as Ofgem's ongoing efficiency challenge has been calculated over 7 years i.e. the on-going efficiency challenge in the first year of GD2 includes ongoingefficiency challenges between 2019/20 and 2021/22.

Therefore, Ofgem's approach to calculating embedded efficiency is clearly inconsistent with its application of on-going efficiency to totex allowances and should be corrected. To do otherwise penalises companies who did include GD1 on-going efficiency in their plan and is to ignore Cadent's higher 2019/20 to 2020/21 efficiencies that we are targeting from our Transformation programme.

With regard to data errors, these should be resolved for the FD and therefore, Ofgem should be able to correct this issue.

2. Data Errors 1 and 2: Input errors further under-value ongoing efficiency value **a)**

NGN data error:

After scanning NGN plan and their statements on ongoing efficiency (OE) we noticed that NGN rows 112 to 116 had the same values for all years – implying that NGN had a 0.5% OE in 2019/20 and then 0.0% OE for the next six years. This is different to the NGN business plan statements, as can be seen below

Annual Ongoing Efficiency Submissions
[Final] Ongoing Efficiency - Version 5 (29/06/20)
Annual ongoing efficiency assumptions for embedded ongoing efficiency
Data from:

	Ntwk	Cost Area	2019	2020	2021	2022	2023	RIIO-2 2024	2025	2026
110	NGN									
112	NGN	Direct Opex		0.995	0.995	0.995	0.995	0.995	0.995	0.995
113	NGN	Indirect Opex		0.996	0.996	0.996	0.996	0.996	0.996	0.996
114	NGN	Capex		0.995	0.995	0.995	0.995	0.995	0.995	0.995
115	NGN	Repex Mains		0.995	0.995	0.995	0.995	0.995	0.995	0.995
116	NGN	Repex Services		0.995	0.995	0.995	0.995	0.995	0.995	0.995
118	Sc									

They should be compounding as follows:

1.000	0.995	0.990	0.985	0.980	0.975	0.970	0.966
1.000	0.996	0.992	0.987	0.983	0.979	0.975	0.971
1.000	0.995	0.990	0.985	0.980	0.975	0.970	0.966
1.000	0.995	0.990	0.985	0.980	0.975	0.970	0.966
1.000	0.995	0.990	0.985	0.980	0.975	0.970	0.966

This has been confirmed as an error by Ofgem during the DD Question process.

b) Using wrong Cadent Data:

In the BPDT we submitted our efficiencies into table 2.12, but there was subsequently a supplementary question (SQ29) on the topic, which Cadent responded to on 20 March 2020. At the time, we thought Ofgem's questions focused on the use of annual or cumulative figures. However, during a subsequent telephone conversation it became clear that Ofgem's concern was with regard to our definition of ongoing efficiency. Cadent had included upfront costs to enable a transformation, which had led to negative productivity values being submitted in early years. We should not have, so we submitted revised figures, excluding these factors on 11 May 2020. These figures were consistent with our business plan submission, both BPDT and narrative.

However, we found that the values for Cadent input into rows 80 to 108 were not those of the email of 10th May. In response to the DD Question, Ofgem responded "We have not used the submitted values provided in Cadent_SQ_29_Follow_up. We noted inconsistences across data provided by some GDNs that was not fully resolved by the SQs raised in time for the Draft Determination". As the 11th May 2020 corrected for certain mis-interpretation in Cadent's BPDT, it is an error to not use the correct Cadent's figures whether or not the issues with other GDNs data have been resolved.

In addition to the above, we also raised concern on the following two queries which may be errors through the DDQ process and will therefore need investigating (and resolving where necessary) ahead of FD:

- SGN: is this an input error, 18/19 year should be 1.000, but it is 0.993?
- WWU: did they have zero change in productivity in the last two years of RIIO-1?

ngoing Efficiency Submissions
g Efficiency - Version 5 (29/06/20)
g efficiency assumptions for embedded ongoing efficiency

							RIIO-2		
8	Cost Area	2019	2020	2021	2022	2023	2024	2025	2026
76	iency - submitted values								
118	**Scotland**								
120	Direct Opex	0.993	0.991	0.989	0.964	0.958	0.952	0.933	0.935
121	Indirect Opex	0.993	0.991	0.989	0.980	0.972	0.963	0.951	0.943
122	Capex	0.993	0.991	0.989	0.983	0.977	0.971	0.965	0.958
123	Repex Mains	0.993	0.991	0.989	0.983	0.977	0.971	0.965	0.959
124	Repex Services	0.993	0.991	0.989	0.983	0.977	0.971	0.965	0.959
126	**Southern**								
128	Direct Opex	0.993	0.991	0.989	0.959	0.964	0.956	0.933	0.938
129	Indirect Opex	0.993	0.991	0.989	0.980	0.972	0.963	0.950	0.943
130	Capex	0.993	0.991	0.989	0.983	0.977	0.971	0.964	0.957
131	Repex Mains	0.993	0.991	0.989	0.983	0.976	0.970	0.963	0.956
132	Repex Services	0.993	0.991	0.989	0.983	0.976	0.970	0.963	0.956
134	**WWU**								
136	Direct Opex	1.000	1.000	1.000	0.995	0.990	0.985	0.980	0.975
137	Indirect Opex	1.000	1.000	1.000	0.995	0.990	0.985	0.980	0.975
138	Capex	1.000	1.000	1.000	0.995	0.990	0.985	0.980	0.975
139	Repex Mains	1.000	1.000	1.000	0.995	0.990	0.985	0.980	0.975
140	Repex Services	1.000	1.000	1.000	0.995	0.990	0.985	0.980	0.975

In the DD Question response regarding whether ongoing efficiency should be calculated on a 5 or 7 year basis, Ofgem's response also included the text "We choose this position given that data was inconsistent (some companies did not indicate any ongoing efficiencies during the remaining RIIO1 period, or indicated inefficiencies over this period, or did not start in 2018/2019 at 1. Subsequent SQ failed to adequately clarify this situation in some cases." In response we would note that:

i) It was WWU who identified no productivity (which on capex/repex is consistent with Cadent's planning assumptions)
ii) The negative productivity was Cadent, as outlined earlier this was due to wrong interpretation on our part, and the corrected figures were with Ofgem on 11th May
iii) SGN is the network which didn't start with 2019 being 1. We assume that this is either an input mistake and values slip a year, or they used 2018 as the base year in their plans. In either case the change does not have a material impact on the output of the calculation of the average embedded ongoing efficiency.

Given this logic, we firmly believe Ofgem can resolve before the FD the data errors and thus use the correct 7 year ongoing efficiency formulae error for consistency with subsequent application.

3. Formula Error 3 – not recognising front loaded plans

The formulae, corrected above, is calculating the CAGR, the average annual ongoing efficiency over 7 years. This results in an under-estimate of the value of the embedded ongoing efficiency, especially associated with Cadent's embedded cost efficiencies driven by our ambition built into our current transformation programme.

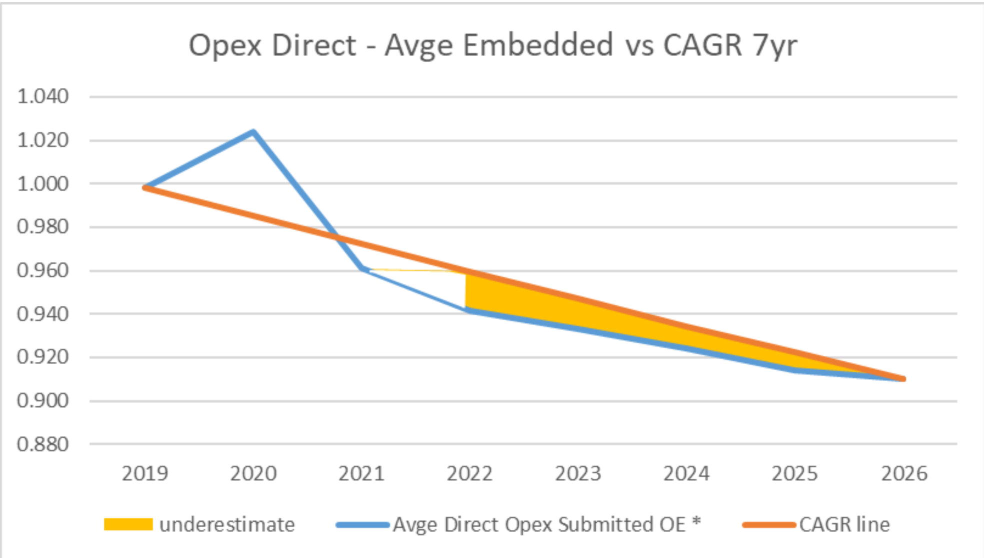
CAGR ignores the fact that overall Average Embedded Efficiencies are front loaded, i.e. higher productivity assumptions in years 2019/20 to 2021/22, a fact that Cadent included in its submitted business plan, see table extract below.

Table 09.02: Totex efficiency opportunities to 2025/26

17/18 to 25/26		RIIO-2 Period	
8 Year	p.a.	5 Year	p.a.
11.3%	1.5%	4.6%	0.94%

Note: In our plan we were using 2017/8 as base, hence 8 years rather than 7

The following graphic and table for Opex-Direct, row 145, illustrates this, with the under estimate amounting to 1.1%:



	2019	2020	2021	2022	2023	2024	2025	2026	7yr CAGR **	RIIO-2 Sum	% Under estimate
Avge Direct Opex Submitted OE *	0.998	1.024	0.961	0.942	0.933	0.924	0.914	0.910		4.623	
CAGR line	0.998	0.985	0.972	0.959	0.947	0.934	0.922	0.910	1.311%	4.673	1.1%
Equivalent Value	0.998	0.983	0.968	0.953	0.939	0.924	0.910	0.897	1.524%	4.623	0.0%

* row 144 of sheet "Inp_NetworkOE_GD" in file"[10] Ongoing efficiencies
** using correct formulae as in CADENT _DDQ_91

Note on above – it takes the DD file data, thus as well as illustrating the front-loading error also illustrates the data error regards incorrect Cadent figures used driving the negative productivity spike in 2019/20. Correcting the data still results in an under-estimation.

In conclusion

Our business plan, as illustrated above has an underlying 0.94%p.a. ongoing efficiency, when our four networks are combined with 1%p.a. for SGN's two networks and the 0.5%p.a. for NGN and WWU, the correctly calculated average is close to 1%p.a.. rather than the c.0.6%p.a. that Ofgem have used in the DD.

The table below outlines the outcome of correcting the above errors, overall the average GDN embedded ongoing efficiency is over 60% higher than the DD at 0.97%p.a.

Ofgem DD	0.6%
Formulae Errors 1& 2	0.81%
Data Errors 1 & 2	0.86%
Front loading	0.97%

As such we disagree with the calculation of average embedded efficiency as it contains multiple errors in both formulae and data input, on top of use of a simplification in logic that under-estimates the level of GDN average embedded efficiency **and <u>results in an extremely material disallowance reduction of £74m.</u>**

Note: This response must be read alongside our response to Core Document Q11, which provides further critique of the Ongoing efficiency assumptions adopted at DD and identifies adjustments that will result in a net increase to the Cadent plan.

Gas Distribution Questions

GDQ29 – Do you agree with our proposed pre-modelling normalisations?

No, we disagree with many of the DD's pre-modelling normalisations, because they are not consistent with other aspects of the cost assessment approach, elements have been cherry-picked, and some of the reasons for rejecting London Regional Factor claims are clearly wrong, all of which act to bias the result against London GDN, a fact which NERA highlight using a model with a density driver.

- NERA's model with the Ofgem CSV plus a density driver reverses the efficiency ranking of GDNs, with London top. This model fits the data better than error-corrected DD model, and can provide a part of the rich picture view of efficiency. As a minimum it sheds light on a reasonable value for London Regional Factors and company specific claims, in the pre-modelling adjustment approach.
- The pay regional factor needs adjustment for:
  - Using the most recent data, for 2017/18 and 2018/19 (the latter being present but unused), as they provide a more up to date view of the future than data from as far back as 2013/14, with robust sample sizes due to the use of two digit SOC codes
  - Weighting by pay levels to avoid a distorted view – no reason is provided for why the DD has changed the previous approach
- The notional labour content should reflect Ofgem's allowance for additional labour costs in London region, both through higher pay and lower labour productivity, otherwise it is inconsistent with other aspects of the price control.
- In assessing company specific factor claims the new threshold of 0.5% of gross totex is too high, and rejects valid claims. It should:
  - be net rather than gross – reflecting the costs customers pay
  - meet a reasonable and proportionate materiality threshold of 0.1% of price control revenue, based on the CMA (which also uses net totex rather than gross), which is appropriate to an area such as Company Specific Factors
  - allow for consideration of claims together, where they derive from the same underlying cause, especially given that the vast majority of claims relate to one GDN.
  - alternatively our London claims should be considered as part of the urbanity regional factor, for which no materiality threshold has been applied.
- For our Cathodic Protection claim, we observe that Cadent's ongoing costs are far higher than those of the other GDNs, and ask Ofgem to raise a Supplementary Question to quantify the impact of what we believe to be the physical engineering differences between our GDNs.
- For our Reduced Depth of cover claim:
  - we have additional evidence from Cranfield University and Wardell Armstrong showing that for East of England GDN as compared to elsewhere there is a higher proportion of agricultural land, this is far more likely to be tilled, there is a much higher risk of erosion through wind and water, and that changes in farming practices in this GDN's area in particular have made erosion a far greater problem now than previously
  - customers have benefited from the cessation of linewalking decades ago through not funding its cost: now that a problem exists and has been identified, Cadent is already spending tens of millions of pounds in RIIO-GD1, which will continue in RIIO-GD2

- For our London repex reinstatement costs claim it is wrong to state that the claim is immaterial because it represents over 0.9% of gross totex, and the DD is inconsistent in applying the adjustment to Opex but not investment.
- For our London Emergency job times claim, it is incorrect to state both that our claim had taken no account of quicker travel times – especially as the preceding paragraph states that we had – and that we had taken no account of the productivity benefits associated with urbanity – which was the reason for our sparsity claim, also discussed in the DD Appendix
- For our London repex plant hire claim, it is incorrect to state both that we had taken no account of potential longer travel times in sparsely populated areas as our analysis compared London unit costs with East of England – our sparsest GDN - and that our claim was already partly covered by the labour normalisation – as set up and dismantling costs are all recorded as Plant hire
- Given that DD rejects our proposed change to the Emergency driver, we make an additional claim for London GDN to reflect its consistently higher number of internal PREs per customer

No, there are a significant number of pre-modelling normalisations with which we do not agree. The methodology introduces further asymmetrical downside risk on Cadent, and in particular London GDN within the RIIO-GD2 framework.

We divide our response this question into seven sections, starting with the context provided for Regional and company specific factor claims provided by NERA's work on density drivers, moving to the four different categories of pre-modelling normalisation from DD, an additional claim arising the DD's choice of cost driver for Emergency activities, ending with a summary of our company specific claims: 1. Context – NERA's totex model with a density driver

2. Pay
3. Sparsity
4. Urbanity
5. Company specific factors from DD
6. Additional driver related Company specific factor – Emergency
7. Summary of Company specific claims

Each is considered in turn below.

Supporting information has been provided at the back of this response to provide further information on London Challenges.

1. Context – NERA's totex model with a density driver

When Ofgem published the DD we asked NERA to provide an independent view of the robustness of the approach to cost assessment, given the result was so different to that which we had expected.

After correcting for many of the DD model errors, NERA observed that London GDN was a clear outlier.

To investigate why, they carried out a piece of analysis to mimic the approach of Ofwat at PR14 and PR19, and carry out modelling if sparsity and urbanity were assessed within the model, rather than on a pre-modelling basis. Under this approach, all sparsity and urbanity regional factors are removed, and, using the data, the model finds its own weight for density and the DD's CSV.

The results of NERA's model are shown below, compared against the error corrected version of the DD partex model.

Network	Ofgem DD with All Corrections Applied		Corrected DD Model with Density Drivers added		Difference	
Network	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Allowed Costs (%)*
EoE	1,976	0.98	1,995	0.98	18	0.92%
Lon	1,468	1.09	1,598	0.96	131	8.92%
NW	1,528	0.97	1,529	0.98	1	0.06%
WM	1,139	1.00	1,160	0.98	21	1.88%
NGN	1,605	0.87	1,496	0.98	-109	-6.76%
Sc	1,103	0.97	1,071	1.03	-32	-2.86%
So	2,497	1.01	2,449	1.06	-48	-1.93%
WWU	1,585	0.97	1,546	1.02	-39	-2.43%
85th percentile		0.97		0.98		
Cadent	**6,111**		**6,282**		**171**	**2.80%**
Industry	**12,901**		**12,845**		**-56**	**-0.43%**

The model with a density drivers has results which are almost the exact opposite of the (non error corrected) DD. London GDN is shown to be the most efficient GDN, rather than the least efficient, with the other Cadent GDNs ranking equal second alongside NGN, rather than fifth, sixth and seventh, which is now the ranking of Wales and the West, Scotland and Southern GDNs.

To quantify the impact of this approach on London, the presence of the density driver adds £131 million to the allowance for London GDN over RIIO-GD2. Because the model itself is determining the relationship between density and costs, both at the very rural and highly urban extremes, it has quantified all Regional Factors related to density, not only those we have been able to find, quantify and then obtain Ofgem's acceptance for.

In respect of the robustness of this model, like the DD partex model, even once corrected for its multiple errors, this model also fails the RESET test. However, it does fit the data better, having an adjusted R squared of 0.98, as compared to 0.90 under the error-corrected DD partex model, and the density terms are statistically significant at the 99% confidence level. Therefore, this model appears a little more robust than the error corrected DD partex model.

Interestingly, under NERA's model with density drivers the allowance for the sparsest GDN, Wales and West, is similar to that provided by the error corrected DD model, suggesting that the sparsity adjustment made under the pre-modelling adjustment approach is broadly sensible, while concurrently understating the efficient costs of operating the London GDN in the dense urban environment.

However, the major shift in London GDN's results under the NERA model suggests that the Regional Factor for urbanity made under the DD approach falls well short of what is required, and that significant further adjustments need to be made, either through an enhanced urbanity Regional Factor, or through company specific factors. The fact that the DD approach falls short should not be a surprise, given that it did not take an even handed approach to assessing company specific claims, rejecting all those that have been put forward.

- On balance we consider that both approaches, with adjustments made pre-modelling and in the model, should be used as part of the rich picture approach to cost assessment we have consistently argued for. At the very least, the density driver should be used to shed light on a reasonable value for London Regional Factors and company specific claims, for use in the pre-modelling adjustment approach.
- We consider the DD Regional Factors, the DD approach to company specific claims, and our company specific claims in the sections below.

2. Pay

There are five aspects of the pay normalisation, covering both the calculation of the London premium, and how it has been applied, that constitute errors which bias the answer against Cadent:

- **The exclusion of data for 2018/19**: the calculation for future years uses the average London premium for 2013/14 to 2017/18. Data is present in the spreadsheet for pay differentials for 2018/19, the latest year, but has not been used, and there is no explanation of why not. We consider that the data for the latest year is the most relevant for assessing future pay differentials, and must be included in the calculation. Not to use the latest data represents an error.
- **The weight on early years' data:** the best information on the extent of the London premium in the RIIO-2 period will be given by the more recent data, rather than that from as long ago as 2013/14, which is now seven years ago, and will be twelve years old by the end of the RIIO-GD2 period. Placing reliance on data which is long out-of-date represents an error when far more recent data is available, especially in the context where the use of two digit, rather than three or four digit SOC codes, should overcome any concerns over more limited sample sizes. We can understand why Ofgem would be reluctant to place 100% reliance on the data from a single year, 2018/19, so propose using an average of the two most recent years, 2017/18 and 2018/19, both of which show a similar pay uplift for London region, which would cause it to increase from 21% to 23%.
- **The failure to weight codes by pay:** SSGCA explains that the SOC codes are no longer weighted by labour spend but rather by FTEs. There is no explanation for why this change has been made, but this is not a robust methodology and is therefore an error, as the amount earned across different job types affects the overall London premium, as demonstrated in the example below.

DD approach	People	National hourly salary	London hourly salary	London multiple	People split	London pay uplift	Average	A
	No.	£	£	No.	%	No.		B
Job A	100	50 80		1.6	50%	0.80 20 22	1.1	A+B
Job B	100				50%	0.55		
							1.35	

Correct approach	People	National Average hourly salary	London	Hourly pay National	London	London pay uplift
	No.	£	£	£	£	No.
Job A	100	50	80	5,000	8,000	
Job B	100	20	22	2,000	2,200	
				7,000	10,200	**1.46**

The example shows that weighting for pay can make a signficant difference to the result and that the correct answer, showing the expected increase in a GDN's costs, is provided by the second approach.

- **The exclusion of Training and Apprentices:** the DD assumes that 100% of the labour cost of Training and Apprentices is not local, and therefore not subject to the London pay uplift. However, historically the vast majority, around 89% for London GDN, and 85% for all GDNs, of the labour costs for Training and Apprentices are for Apprentices and Craftpersons, who are recruited to work at a local depot and trained on the patch, not at any national location. Therefore the London labour adjustment should be applied, using Ofgem's methodology, to 85% of Training and Apprentice labour costs.
- **The failure to reflect additional London pay and productivity costs in the notional cost split:** the pay uplift is applied to an assumed quantity of pay, which is calculated for each activity by multiplying actual costs and allowances by a split of costs for a notional company – with the same balance of costs for each GDN. For example, each GDN's repex costs are assumed to be 65% labour. We agree that the starting point for the calculation should be a notional company. However, this needs to be adjusted to reflect the fact that a notional GDN operating in London has higher labour costs, through the pay and productivity uplifts, than other GDNs – which Ofgem has accepted as a principle and reflected in DD allowances. The adjustment needs to be made so that Ofgem's normalisation adjustments are internally consistent. The calculation needs to be performed, by activity, for each GDN with operations in the London region, namely East of England, London and Southern. We show below the extent of the difference it makes to the labour proportion of London GDN's totex.

	DD inputs	Lo pay uplift	Lo pay uplift	Inputs subtotal	Productivity uplift	Productivity uplift	Totex	Totex assumed
	No.	%	No.	No.	%	No.	No.	%
General labour	0.403	16.5%	0.066	**0.469**	5.6%	0.026	**0.496**	***0.427***
Specialist labour	0.298	16.5%	0.049	**0.347**	5.6%	0.019	**0.366**	***0.316***
Materials	0.135			**0.135**			**0.135**	***0.116***
Plant & equipment	0.043			**0.043**			**0.043**	***0.037***
Transport	0.024			**0.024**			**0.024**	***0.021***
Other	0.097			**0.097**			**0.097**	***0.084***
Total	**1.000**		**0.116**	**1.116**		**0.046**	**1.161**	**1.000**
Labour proportion	**0.701**							**0.742**

Labour uplift of 16.5% from Normalisation file for London GDN

Productivity adjustment of 5.6% found from 11.5% productivity uplift for Repex, connections, reinforcement, which represents 48.6% of London GDNs' DD controllable totex allowance [0.115 x .486]

In respect of other aspects of the pay adjustment calculations, we support the continued application of pay adjustments for London and South East regions, and the use of gross hourly mean wages (rather than annual wages as at GD1), because it is the right thing to do rather than an approach which benefits Cadent. We also support the assumption that 44% of Work Management work is carried out locally, the scaling of indices such that "elsewhere" equals 1, the application of pay adjustments calibrated to individual activities (rather than averaged over all activities), and the combining of Direct and Contractor labour indices.

We also believe that the application of 2 digit, rather than 3 digit SOC codes is reasonable, due to increased data accuracy and reduced data volatility. In particular we note the variability and frequent unavailability of the 521 SOC code for London Region, and consider that the use of two digit SOC codes should overcome any concerns over the use of small sample sizes in the calculations of the SOC codes, given the size of two digit sample is far larger.

3. Sparsity

Although Ofgem's decision to maintain the RIIO-1 sparsity adjustment differs from our evidence as presented in our Regional Factor Appendix, which suggested a lower level of adjustment, we recognise the evidence of the other GDNs, some of which argued for significantly greater adjustments, and so accept the decision.

4. Urbanity

We support Ofgem's decision to maintain the RIIO-1 urbanity labour adjustment for repex, reinforcement and connections, being 15% within the M25. However, we believe that a similar adjustment needs to be made for opex activities that are particularly affected by the difficulties of operating in London, the most densely populated city in Great Britain, in particular for Emergency – for which we have presented evidence for a Regional Factor (see below).

We also support the continuation of a reinstatement adjustment for work within the M25, for Repair and Maintenance, because this, in part, reflects the evidence we presented in our Appendix 09.21 Cadent's Regional Factors. However, we also believe, and our evidence showed that, the additional cost is actually 21% rather than 15%.

In addition, we fail to understand why a similar adjustment has not been made for repex. Ofgem agrees that reinstatement work is significantly more costly in London than elsewhere. Therefore, it would be logical for this adjustment, or one very much like it, to apply to all activities which incur reinstatement costs, in particular mains replacement because the activity is the same. We have presented evidence for a company specific factor under section 5 below.

We note that the DD applies no materiality threshold to Regional Factors – as contrasted with company specific factors (see section 5 below). Therefore, should any of our company specific factors for London fail the materiality threshold to be applied at FD, we ask that they be considered as part of an urbanity adjustment, for which no materiality threshold applies.

To highlight the difficulties associated with operating a gas network in London, our colleagues in Cadent Operations have pulled together a short note that summarises some of the practical issues they face in running a network in the capital, this is shown in the supporting information at the back of this response.

5. Company specific factors from DD

Our comments here relate to the assessment of materiality, and company specific claims.

a) The assessment of materiality

The DD has replaced the existing criteria for assessing company specific regional factor claims with more detailed proposals. The key changes are that:

- Ofgem has changed the criteria for assessment to remove a requirement that GDNs had taken "all feasible measures" to control additional costs, and replace it with "mitigation, wherever possible" to do so. We welcome this change as being more reasonable to companies and in customers' interests.
- The use of a 0.5% of a GDN's gross unnormalised totex as a materiality threshold, which introduces bias and exacerbates the DD modelling's poor explanatory power, and with which we have severe concerns, for five reasons.

First, we believe that the materiality threshold is too high, and removes claims that are financially significant. We note that the CMA (as stated in the 2019 response to Ofgem's open letter on price control appeals) has pointed to previous specific appeals where, on the basis of the relevant facts at the time, an error of 0.1% (of price control revenue) was not considered material. However, the CMA also made clear that this was not intended to be a "bright-line test", and that wider considerations in other circumstances may mean that in some cases the threshold for materiality may be lower, in other cases higher. We also consider that the London company specific and regional factors derive from the same cause – urbanity and so should be considered together.

Consequently, we believe that a cut-off point for materiality of 0.1% of base price control revenue represents a reasonable working assumption, which is equivalent to around 0.18% of totex, varying a little by GDN - and a third of the DD's 0.5% of totex threshold.

Second, we believe that it reasonable for individual claims to be considered together, if they are derived from the same or similar circumstances. This can be evidenced in two way:

I. First, where the reason for the additional cost is identical, but we divided it between bottom-up activities. For example, we made two claims for additional reinstatement costs for London, dividing them between mains replacement and other activities, consistent with a bottom-up approach. The DD's rejection of one of these claims on the grounds of materiality seems especially unreasonable.

II. Second, the vast majority of the claims for London GDN relate to the additional costs of working in the most highly dense urban environment in Great Britain. They may represent different features of this, for example, additional depot rental costs, and the congestion charge, but these claims are linked because they all have same cause.

If additional costs were widely spread across GDNs, we would agree that to treat claims singly, and not consider them together, would be reasonable. However, the claims are not widely spread between GDNs. We have carried out a programme of work for two years, across four GDNs, assessing potential regional factors and rejecting many of them, and have found that the vast majority of robust claims relate to London and not our other GDNs. Consequently, we believe it is reasonable to add them together.

We also consider that Ofgem has a good basis set by the CMA to add claims together. In the 2010 Carphone Warehouse Final Determination, the CMA stated in para 1.66 that it would be careful not to cumulate figures where they are "*unrelated and may lie in different and discrete aspects of the price control*". However, in our case it is clear that the claims are very closely related (as they derive from the same issue/circumstance) and are in respect of the same aspect of the price control (i.e. adjustments for Regional and Company Specific Factors), which suggests a good CMA basis for adding claims together.

Third, we consider that the comparison should be made with net totex, after deducting contributions, rather than gross. Customers will only be asked to fund net totex rather than gross, and we believe that at PR14 Ofwat applied its 0.5% threshold to net totex, rather than gross.

Fourth, were Ofgem to reduce the materiality threshold at FD, we do not believe that the other GDNs could claim to have been disadvantaged, because, when Business Plans were submitted up until DD, no explicit materiality threshold had been in force, and consequently should not have influenced what claims GDNs have put forward. In any event it is up to each GDN to make the case for what it considers material.

Finally, Cadent's response to the RIIO-2 tools for cost assessment is noted in the previous consultation's decision document as stating that "*a number of smaller claims together could become material, especially in respect of working in London, and that in these circumstances it would not be reasonable to apply a materiality threshold to each item individually*". However, it is not at all clear from the RCSF Annex whether Ofgem has given due consideration to our response/proposal in the DDs as it does not comment on it. This prevents Cadent from fully understanding the basis upon which (and reasons why) our claims were rejected due to "materiality".

b) Company specific claims

Of the fifteen company specific factor claims made by Cadent, one, in respect of Holford salt cavity, has fallen away because MEAV was used as a driver at DD, and the salt cavity is included within MEAV. Of the fourteen left, at the DD Ofgem accepted just two. One was for the Thames Tunnel capital project in RIIO-GD1, the other for the London Medium Pressure mains replacement project which has been treated as a Bespoke Output and assessed separately. Therefore, none of our twelve claims, which mostly relate to London GDN, seeking to reflect additional costs of operating a network in RIIO-GD2 have been accepted, demonstrating that an even handed process has not been applied. The resulting bias against London GDN means it would not be adequately funded, based on the DD.

The fact that so many of our claims for London Regional Factors have not been accepted at DD is one of the reasons why the DD modelling fails to recognise London's efficiency, unlike the NERA density model mentioned earlier. One would not expect significant differences in the efficiency of Cadent GDNs, given that all our networks operate under common ownership, organisation structure and procedures.

At the DD Ofgem rejected twelve of the nineteen claims Cadent put forward for:

i. Cathodic Protection
ii. Parking Bay suspension and TTROs
iii. Reduced depth of cover
iv. Repex and Repair reinstatement
v. Emergency job times
vi. Plant hire – repex
vii. Traffic Management hire
viii. London depot rental costs
ix. 24 hours shift patterns
x. London congestion charge
xi. London Local Authority tunnels
xii. London locksmiths

We consider the reasons for rejection below.

i. Cathodic Protection

Cathodic Protection *RIIO2 - £4.0m p.a.*	Material	Unique	Outside company control drivers	Excluded from cost Regional Factors	Excluded from Ofgem
[Original £3.4m p.a.]	Partly	No	No	Yes	Yes
Comment 1)	*Not an efficient level of expenditure*				
Comment 2)	*Would have incurred some additional maintenance expenditure in the absence of an Improvement Notice*				
Comment 3)	*Rejected as not beyond the control of an effic company*				

Functioning cathodic protection equipment is essential to ensure that our steel pipeline assets can continue to be used to convey gas to customers in a safe, economic and reliable manner.

Our claim for backlog expenditure to comply with an HSE Improvement Notice for Cathodic Protection was rejected on the grounds that GDNs should only be funded for an efficient level of expenditure, which this was not, and neither was the backlog beyond the control of an efficient company.

Upon further reflection, we agree with Ofgem's assessment and withdraw the claim for backlog expenditure on Cathodic Protection, arising from the HSE Improvement Notice.

However, having now had the opportunity to consider the content of all GDN Business Plans, we would like to replace it with a claim in respect of ongoing (i.e. non-backlog related) expenditure on Cathodic Protection, because we believe there must be fundamental engineering differences between the GDNs.

The table below sets out for Cathodic Protection in RIIO-GD2:

- planned spend, labelled as opex and capex, as set out in companies' published plans and BPDT tables;
- the backlog spend for Cadent GDNs;
- the ongoing totex CP spend – planned spend with backlog removed;
- how ongoing CP totex compares to Maintenance MEAV, the driver used in the Maintenance regression, because most of the Plan spend has been labelled as Maintenance;
- the additional ongoing CP spend in Cadent GDNs, found using the non-Cadent GDN average spend relative to Maintenance MEAV; and
- the materiality of the additional spend in Cadent GDNs, measured by comparison with RIIO-2 base revenue.

RIIO-2 p.a. CP Plan	**EoE**	**Lo**	**NW**	**WM**	**NGN**	**Sc**	**So**	**WWU**	**Total**	**Cadent**	**Other**
	£m	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	£m	£m
Opex	5.3	1.2	2.7	1.1	0.1	0.0	0.6	0.6	**11.6**	10.3	1.4
Capex	0.1	0.0	0.0	0.0	0.3	0.3	0.6	0.1	**1.5**	0.2	1.3
Totex	**5.4**	**1.2**	**2.7**	**1.1**	**0.4**	**0.3**	**1.2**	**0.7**	**13.1**	**10.5**	**2.7**
less Backlog	-2.5	-0.7	-0.7	0.0	0.0	0.0	0.0	0.0	**-3.9**	-3.9	0.0
Ongoing totex	**2.8**	**0.6**	**2.1**	**1.1**	**0.4**	**0.3**	**1.2**	**0.7**	**9.3**	**6.6**	**2.7**
RIIO-2 corrected Maint MEAV £bn	6,968	3,223	4,116	3,218	3,894	3,221	6,504	5,300	**36,445**	17,526	18,919
Ongoing totex / MEAV %	0.041%	0.018%	0.051%	0.034%	0.010%	0.009%	0.019%	0.014%	**0.025%**	0.038%	0.014%
less Non Cadent average	-0.014%	-0.014%	-0.014%	-0.014%							
Excess ongoing totex % MEAV	**0.027%**	**0.004%**	**0.037%**	**0.020%**							
Excess £m [% x MEAV]	**1.9**	**0.1**	**1.5**	**0.6**					**4.1**		
RIIO-2 Base revenue p.a.	475	356	364	271							
Materiality	0.39%	0.03%	0.41%	0.24%							

Opex per table 2.04 BPDTs: Capex per Cadent EJP page 4, NGN Business Plan page 147, Sc EJP table 1 page 7, So EJP table 1 page 7, WWU Business Plan page 180

The table shows that Cadent's level of ongoing CP spend is more than twice that of the other GDNs, £6.6m p.a. as compared to £2.7m. When measured relative to Maintenance MEAV, this represents an additional £4.1m of spend each year, which passes our CMA based materiality threshold of 0.1% of base revenue for each GDN bar London – so reducing our claim to £4.0m p.a.

The differences in the underlying expenditure are so large that they cannot conceivably be all, or even largely, due to efficiency, but rather must be due to engineering differences between the GDNs, such as:

- different proportion of steel LTS pipelines and mains that are protected by Cathodic Protection (the total length of steel main does not explain the differences, the proportion protected is not visible in the BPDT); and:
- a very different level of test post compliance through time.

We consider that in order to resolve this issue, Ofgem should either issue additional SQs to collect comparator data, as set out in the table below, or create a regional factor based on the observed differences relative to MEAV.

For Ofgem to assess Cadent's investment plan against the other networks, it is necessary to understand their relative levels of performance.

Normalising Factor	
Scale of steel network with installed CP. **This is particularly relevant for MP/LP systems where the choice to apply CP will be determined by local factors.**	i) The length, in km, of pipelines/mains which have an installed CP system. Split by pressure tier HP/IP and MP/LP ii) The total number of Test Posts within the asset stock split by pressure tier HP/IP and MP/LP
Compliance trend **Is a network fixing more/less faults than it finds? What % compliance is it delivering.**	We suggest that Ofgem ask all GDNs to provide the same data requested from Cadent on 6th March '20 (within CADENT_SQ_ENG_117), specifically: *Please provide the monthly Test Post compliance as a % for HP/IP and MP/LP for the GD1 period. Calculated as the total number of compliant test posts recorded (based on the DC-off potential reading) divided by the total number of test posts within the asset stock.* *A non-compliant test post is either one which does not provide the -850 to – 2000 mV reading or where a reading cannot be taken.*

Table 19: Proposed SQs to allow comparison of both expenditure and performance for each network

ii. Parking Bay Suspension and TTROs

Parking Bay suspensions & TTROs	Material	Unique	Outside company control	Excluded from cost drivers	Excluded from Ofgem Regional Factors
RIIO-2 - £0.4m p.a. ***[Original £3.6m p.a.]***	Partly	No	No	No	Yes
Comment 1)	*Not unique to London*				
Comment 2)	*Cost differences driven by factors both inside outside company control and*				
Comment 3)	*Cannot assess level of cost in other GDNs*				

The DD Appendix combined two claims, one for Investment for £3.2m set out in Section 4.3 of our Regional Factor Appendix, and another for Opex for £0.5m, as set out in Section 4.13 of our Regional Factor Appendix.

We have recently found that, in respect of investment, for East of England and London GDNs, the cost of parking bay suspensions have been included within Streetworks costs in the RRP for 2017/18 onwards, under Administration costs. Because Streetworks costs are subject to separate assessment by Ofgem as part of non-regressed costs, there is no need for a Regional Factor claim for Parking Bays for investment, and therefore, we withdraw the investment element of the claim.

In respect of the Opex element of the claim, we maintain that this is a valid Regional Factor.

We consider this to be material as it represents 0.13% of London GDN's base price control revenue – above our assumed CMA individual error threshold, and around 0.14% of its net totex.

Paragraph 1.56 of the DD's Regional and Company Specific Factor Appendix and the table on page 12 of that document explain that:

- the issue it not unique to London GDN;
- cost differences are driven by factors both within and outside of company control;
- there is a lack of comparable data for other GDNs, including that costs are not recorded separately for North West and West Midlands GDNs; and
- the issue is addressed by a DD cost driver.

In respect of the claim not being for unique circumstances, we acknowledge that all GDNs incur an element, however small, of Parking Bay Suspensions and Opex TTROs, but our London claim is that the level of activity and unit costs are uniquely higher in London than elsewhere, which we believe is consistent with Ofgem's statement in paragraph 1.39 of the Regional and Company Specific Factors appendix, second bullet:

> *"Is the claim unique in nature? The claim should be limited to a single GDN or a small number of GDNs. Only claims that reflect a material asymmetry between GDNs are justified."*

We have demonstrated a material asymmetry between GDNs in the costs that London pays for Parking Bay Suspensions and Opex TTROs, therefore we consider that the claim – for the additional costs in London GDN - should not fall because it is not unique. In addition, for these opex costs, we have accurate cost information for each of our GDNs - including North West and West Midlands - it was for investment related costs that we needed to make an estimate.

In respect of the issue being partly inside company control, paragraph 1.55 of the Regional and Company Specific Factors Appendix describes the factors driving cost differences as follows:

- level of activity undertaken – open cut replacement being more likely to require parking bay suspension, which is likely to be captured by a synthetic cost driver;
- Parking Bay Suspension scheme coverage;
- Parking Bay suspension scheme charges, which vary by Local Authority; and
- differences in risk appetite – GDNs may book longer parking bay suspensions to ensure work is completed before the suspension expires, or they may not.

Only the last factor appears to relate to "within company control". However, the risk appetite factor does not apply to opex activities, as these are typically not planned but unplanned work – the Repair Team will inform the Local Authority that it has occupied parking bays, rather than asking permission first – otherwise the Repair work could not be carried out, and public safety threatened.

The final reason given for not allowing the claim concerns the issue already being covered by a cost driver. There is an argument that the repex synthetic might cover an element of the additional costs (though it is difficult to see how this could be more than one eighth, given the synthetic uses industry average costs), however, that logic does not apply to Opex Repair activities, which have no unit cost synthetic driver.

In summary, we believe the Opex Parking Bay Suspension & TTRO claim to be material, relecting a material asymmetry between GDNs, outside of company control, excluded from Ofgem cost drivers and Regional Factors and consequently that the claim should be allowed.

iii. <u>Reduced Depth of Cover</u>

Reduced depth of cover	Material	Unique	Outside company control	Excluded from cost drivers	Excluded from Ofgem Regional Factors
RIIO-2 - £3.6m p.a.	Partly	No	No	Yes	Yes
[Original £6.8m]	*Affects all GDNs to some extent*				
Comment 1)	*Within company control*				
Comment 2)	*Other GDNs are continually maintaining the*				
Comment 3)	*requ*		*ired depth of cover*		

In our Regional Factor Appendix, this claim covered costs relating to Reduced Depth of Cover in all our GDNs, amounting to around £7m p.a. over the RIIO-2 period, with around two thirds of the cost in East of England. We presented evidence from the UK Soil Observatory, that soil use in East of England GDN was far more arable than the rest of the UK, which left it especially susceptible to reduced depth of cover, whether from natural erosion through water, wind, gravity, and natural oxidisation or human activity such as ploughing or laser levelling of soil for improved moisture distribution.

The claim was rejected as being immaterial in GDNs other than East of England, likely to affect all GDNs to some extent – with the fact that other GDNs had not raised it suggesting it may be a business as usual activity – and within company control, as Cadent only discovered the issue when linewalking was resumed in 2013/14, whereas other GDNs are continually maintaining the required depth of cover.

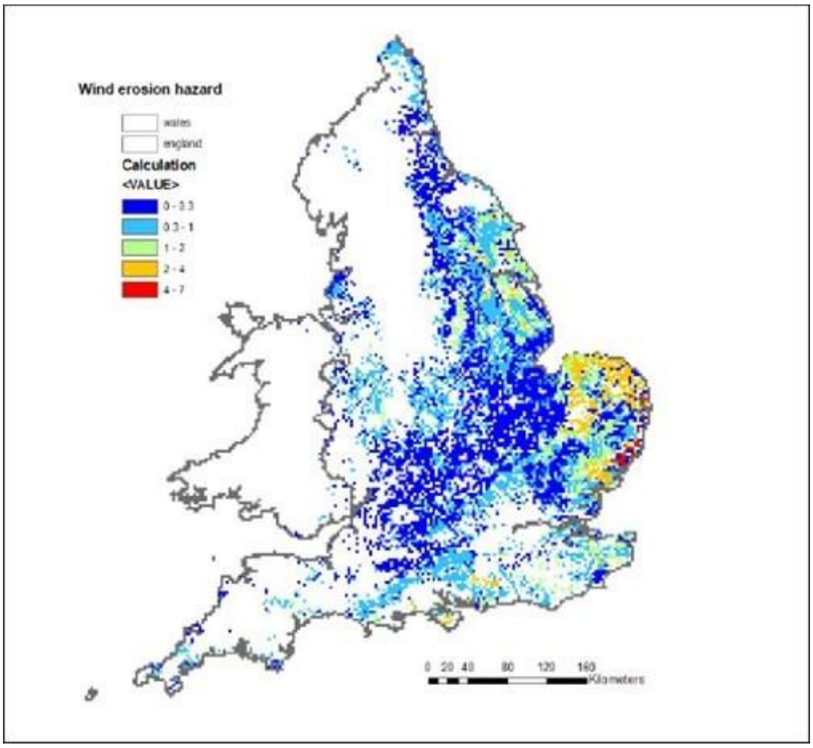
At the heart of this claim is the question of whether the efficient level of cost for managing the depth of cover over pipelines would be expected to be higher in any of Cadent's GDNs than any other GDNs.

Having considered the claim further, we believe that, yes, the efficient level of cost for managing depth of cover would be expected to be higher, but most notably for the East of England GDN, and therefore we modify our claim so that it covers the additional costs of the East of England GDN only, as compared to our other GDNs.

Since receiving the DD, we asked two groups of scientists, one at Cranfield University's School of Water Energy and the Environment, the other at Wardell Armstrong engineering consultants, to compare likelihood of soil erosion risk across different GDNs, and identify likely hotspots of soil erosion whether through water erosion, wind erosion, or farming activity, in the context of soil type and agricultural land use.

The Cranfield report found that:

- There was a significantly higher risk of soil erosion through water in Cadent's networks, than elsewhere in England & Wales, with 26% of Cadent's area being subject to a high risk of water erosion, compared to 16% elsewhere
- In East Anglia there was an especially high risk of water erosion, at 33% of the land area.
- For wind erosion risk, there was a far greater risk in East Anglia and East Midlands than elsewhere in the England and Wales, as shown in the chart below.



A full copy of Cranfield's report is submitted as a supporting paper to this DD responseattached.

The Wardell Armstrong report found that:

- In East of England there was more agricultural land than elsewhere – 70% as compared to 64% in the non-Cadent parts of England.
- In East of England that land was far more likely to be tilled – 72% as compared to 49% for the nonCadent parts of England.
- Tillage operations are more frequent now than in decades past because the growing season has been extended due to factors such as climate change and a wider range of vegetables crops being grown – with more frequent tillage leading to more soil erosion.
- The removal of hedgerows and shelterbelts since the 1980s has made tilled land more susceptible to soil erosion.
- Since 1970, the proportion of agricultural land that is tilled has reduced in some parts of the country , but increased substantially in East of England, where it is far higher than elsewhere, as shown in the chart below. This is supported by Defra data from 2020.

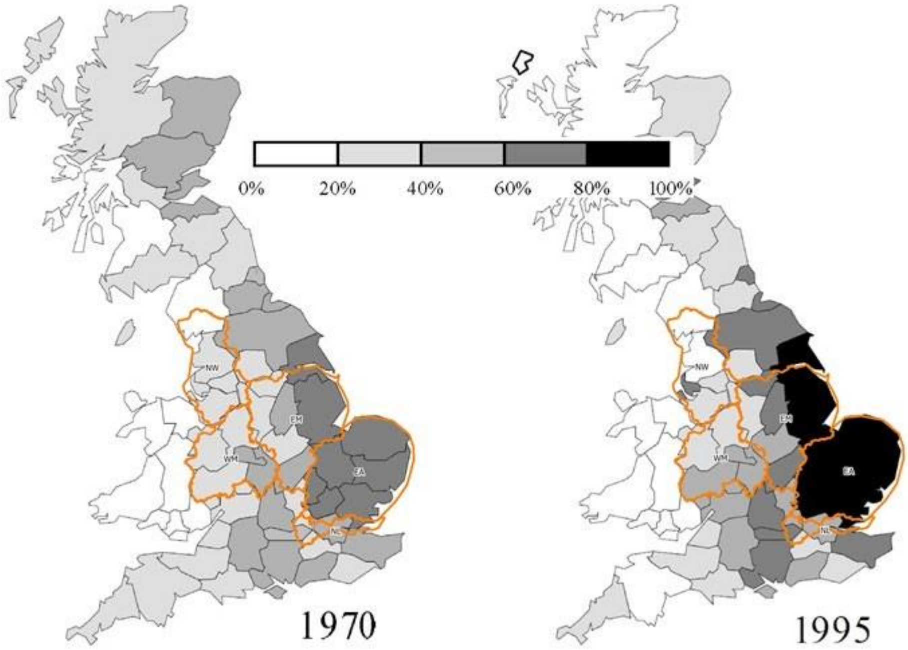


Plate 1: The amount of annually tilled land as a percentage of total farmed area by county; based on Defra statistics; reproduced from (Robinson and Sutherland, 2002). With Cadent's network boundaries superimposed

A full copy of Wardell Armstrong's submitted as a supporting paper to this DD responseattached.

Therefore, the evidence supports additional soil erosion, and therefore cost, in East of England, and that this has become far more an issue in recent years due to changes in farming practices.

In respect of whether managing soil erosion is business as usual for the other GDNs, we were unable to find any reference to soil erosion in the Plans of the other GDNs, which suggests it is not a significant issue, and, given the Cranfield and Wardell Armstrong reports, it would be expected to be a far smaller issue.

In respect of the fact that Cadent only resumed line walking, which began to reveal the extent of the issue, in 2013/14, we do not believe this to be relevant given that:

- The practice was stopped decades beforehand, well before network sales, so long ago that we have been unable to find precisely when it ceased.
- Deferring line walking, decades ago, when there was no need to carry it out – as supported by the Wardell Armstrong report - was an efficient use of resources from which customers have benefitted through not funding the practice.
- Cadent will have spent tens of millions of pounds addressing the issue in this price control period, for which no allowance was made.

iv. Repex and Repair Reinstatement

Repex and Repair reinstatement	Material	Unique	Outside company control	Excluded from cost drivers	Excluded from Ofgem Regional Factors
RIIO-2 - £3.4m p.a. ***[Original £4.3m p.a.]***	No	Yes	Yes	Yes	No
Comment 1)	*Repex claim is material*				
Comment 2)	*Once adjusted for urbanity productivity and reinstatement, is no longer material*				
Comment 3)	*Repair reinstatement claim is not material*				

There are two key reasons why the DD's assessment of the claim is incorrect and needs to be revised.

First, it is wrong to state that the repex claim is immaterial, even using the DD's materiality threshold, using the logic below:

- London GDN's gross totex was £361m in 2018/19 – the DD's 0.5% threshold represents £1.8m p.a. so any claim over that amount should not be removed on the grounds of materiality
- The two elements of the claim, both relating to reinstatement, one from the mains replacement contractors and one from the company's workforce, should be considered together.
- The total claim is for £4.5m p.a. being £2.9m from the mains replacement contractors, as stated in paragraph 1.60 of the Regional and Company Specific Factors Appendix, plus a further £1.6m from the Operations teams. The total claim is therefore 1.2% of gross totex.
- The DD allows a reinstatement Regional Factor for Repair and Maintenance, using a 15% uplift – these elements comprise only £1.1m of the claim, leaving £3.4m, around 1.0% of gross totex, and 1.1% of net totex, in respect of repex.
- It is not correct to state that the repex reinstatement claim is immaterial once adjusted for urbanity productivity and reinstatement, because repex reinstatement is entirely unaffected by these adjustments - at DD, the only Regional Factor applied to reinstatement was for opex.

The repex reinstatement claim is clearly material, even using the 0.5% of gross totex threshold, which we believe too high.

Second, Ofgem has accepted that reinstatement activities are 15% more costly in London for opex – although we presented evidence for 21%. Consequently, we do not understand the reasons for not extending the adjustment to repex. Consistent with the RIIO principle of treating costs in the same way, no matter how they are badged, the Regional Factor should be extended to repex.

v. Emergency job times

Emergency job times	Material	Unique	Outside company control	Excluded from cost drivers	Excluded from Ofgem Regional Factors
RIIO-2 - £2.5m p.a.	Yes	No	Yes	No	No
Comment 1)	*Acknowledge that emergency job times may be longer in highly dense areas*				
Comment 2)	*But will benefit from shorter travel time and higher productivity as less waiting time*				
Comment 3)	*Cadent has not considered these, so the claim is likely to be overestimated, and the cost difference immaterial*				

The two reasons stated in the DD for not allowing this Regional Factor are both factually incorrect.

The first reason given, in paragraph 1.66 of the Regional and Company Specific Factors Appendix, is that networks in dense areas will also benefit from shorter travel times. However:

- This runs counter to the previous paragraph in the DD, which states that Cadent presented evidence that we had found no meaningful relationship between population density and travel times. Our evidence showed average Emergency travel times for 2017/18, by operational patch, for internal and also external PREs, plotted against population density, and found no relationship – R squared of 0.00 and 0.06 for External and Internal PREs respectively. Nowhere does the DD dispute our evidence. Distances to travel in urban areas may be shorter, but speeds are slower, so travel times are similar for different operational patches.
- It flies in the face of the logic of how to run an Emergency service. All GDNs need to attend 97% of PREs within one hour for controlled escapes, and two hours for uncontrolled, whether in a sparsely populated area or a dense urban one. It follows that GDNs are likely to staff the Emergency service so that PREs can be reached in a similar period of time, no matter what the environment.

The second reason provided, also in paragaph 1.66, that Cadent has not considered the higher productivity as we will not need to have staff waiting to deployed in order to hit the response time standard, is demonstrably false. This represents the sparsity adjustment, which we proposed for the Emergency service in our Regional Factors Appendix 09.21, section 4.14, pages 56-61. Indeed, Ofgem's own document, twelve pages previously, acknowledges our analysis in paragraph 1.25 as follows:

> *" Cadent undertook its own analysis and submitted that overall, there is enough evidence to justify making an adjustment for Emergency, but the logic for making an adjustment for Repair is not as strong."*

Even if we had not proposed a sparsity adjustment, given that the DD contains one, larger than we proposed, to reflect the additional costs associated wih sparse areas, it is only balanced to reflect the additional costs associated with serving densely populated areas.

vi. Plant hire – repex

Plant hire repex	Material	Unique	Outside company control drivers	Excluded from cost Regional Factors	Excluded from Ofgem
RIIO-2 - £2.4m p.a.	Yes	No	Yes	Yes	No
Comment 1)	*Costs may also be higher in sparse areas due to longer driving distances*				
Comment 2)	*Some of claim may also be captured in labour cost adjustments, given Cadent's claim that higher labour costs add to plant hire expenditure*				

The reasons given for not allowing the Regional Factor claim have either already been taken account of, or are factually incorrect.

We agree that plant hire costs could be affected in sparse areas due to longer driving distances, although, as noted under Emergency job times above, we note that traffic speeds are higher outside of London, which would act to counter the effect. However, we took account of this in our analysis, because we compared our tender prices for plant hire in London, not with North West or West Midlands, our other more urban GDNs, but with East of England, our most rural GDN, which benefits substantially from the sparsity adjustment. In addition, the tenderer for London GDN was the same party as for East of England GDN, so we are comparing on a like-for like basis. Therefore, the fact that our tender prices for repex plant hire were around 20% higher in London than East, already took account of potential longer journey times in East.

The second reason given for rejecting the claim is associated with the detail of our evidence that plant hire cost 19.7% more in London than East. We demonstrated, that, not only would plant need to be hired for longer in London due to the 15% lower productivity in the capital, but also that additional storage costs – due to higher property costs – and additional labour charges to deliver, set up and dismantle plant, would be expected to add to costs – explaining why the additional cost was 19.7% rather than the 15% associated with lower productivity. The DD rejected our claim in part because the labour element of these additional costs may already be captured in the labour cost adjustment.

This would be true if plant hire costs were disaggregated between between storage, transport, set up and dismantling elements, but they are not. Our contractors pay for plant hire, rather than each individual sub-activity within plant hire, therefore, all the costs are reported as plant hire, not labour. Consequently, the second reason for not allowing the Plant Hire claim is incorrect.

vii. Traffic Management Hire

Traffic Management hire	Material	Unique	Outside company control	Excluded from cost drivers	Excluded from Ofgem Regional Factors
RIIO-2 - £0.2m p.a.	No	No	No	Yes	No
Comment 1)	*Claim represents 0.1% of totex and so is immaterial*				

For the RIIO-2 period, this claim was for additional Repair costs of £0.22m in London due to high unit costs, and £0.37m in East of England, due to a higher proportion of Repair jobs requiring traffic management. It was rejected in DD for being immaterial, although the table on page 13 of the Regional and Company specific factor Appendix – reproduced above – also stated that the costs were not unique, were not outside of company control, and were not excluded from other Ofgem Regional Factors.

London – higher unit costs

For London, the claim represents around 0.07% of net totex and 0.06% of base price control revenue. Because the claim arises from similar circumstances to our other, individually immaterial London claims, we believe that they should be considered together, and request that this approach is taken.

In respect of the claim not being for unique circumstances, we acknowledge that all GDNs have to carry traffic management activities, but our London claim is that the unit costs are uniquely higher in London than elsewhere, which we believe is consistent with Ofgem's statement in paragraph 1.39 of the Regional and Company Specific Factors appendix, second bullet:

> *"Is the claim unique in nature? The claim should be limited to a single GDN or a small number of GDNs. Only claims that reflect a material asymmetry between GDNs are justified."*

We have demonstrated a material asymmetry between GDNs in the unit rates London pays for Traffic Management Hire, therefore, we consider that the claim should not fall because it is not unique.

The table also shows that the claim failed for being within company control. In our claim we explained how we had carried out a tender exercise among competing suppliers in June 2017, which resulted in lower unit rates. We do not understand what else we could reasonably have done to reduce the unit rates for traffic management hire in London.

The London claim also failed for already being covered by Ofgem Regional Factors. Although the DD offers no explanation of this, we do not believe it to be correct, as traffic management hire costs are not reported under labour costs, or opex reinstatement, which are the only two types of opex cost for which DD allows for Regional Factors.

East of England – repair jobs requiring traffic management

For East, the claim represents around 0.11% of net totex but only 0.08% of base price control revenue. Because this lies significantly under our assumed CMA materiality threshold, and could not reasonably be considered together with other claims for East of England, we withdraw this element of the claim.

viii. London Depot rental costs

London Depot rental costs	Material	Unique	Outside company control	Excluded from cost drivers	Excluded from Ofgem Regional Factors
RIIO-2 - £0.7m p.a.	No	Yes	Yes	Yes	Yes
Comment 1)	*Claim rejected as not material*				

The claim for £0.6m for London and £0.06m for East – due to the Tottenham area of North London being in East of England GDN – was rejected on the grounds of materiality. For London GDN, it represents around 0.18% of gross totex.

As we set out under materiality above, we consider that the comparison should be made on a net, rather than gross basis, because that is what customers fund, with the additional rental costs representing around 0.20% of net totex. At this level of materiality, the additional cost would fall within our assumed CMA error threshold of 0.1% of price control revenue – being around £350,000, and so should be considered, either individually or collectively with other claims.

ix. 24 hour shift patterns

24 hour shift patterns	Material	Unique	Outside company control	Excluded from cost drivers	Excluded from Ofgem Regional Factors
RIIO-2 - £0.5m p.a.	No	Yes	Yes	Yes	No
Comment 1)	*Claim rejected as not material*				

This claim for £0.5m for London GDN was rejected in the grounds of materiality. For London GDN it represents around 0.13% of gross totex, or 0.14% of net totex. We consider that this is over our assumed CMA based error threshold of around £350,000 and so should be considered, either individually or collectively with other claims.

We note that the summary table shows that the DD considers this claim is already covered by an existing Ofgem Regional Factor, which we assume to be pay. We do not believe this the claim is already covered by the pay adjustment because unsocial hours working requirements are not representative of the economy as a whole. In addition, to the extent that those organisations captured in the ONS data may be working shift patterns, this would typically be to cover planned work, and not the unplanned Emergency work which these shift patterns are designed to cover.

x. London congestion charge

London congestion charge	Material	Unique	Outside company control	Excluded from cost drivers	Excluded from Ofgem Regional Factors
RIIO-2 - £0.2m p.a.	No	Yes	Yes	Yes	Yes
Comment 1)	*Claim rejected as not material*				

The claim for £0.18m p.a. for London was rejected on the grounds of materiality. For London GDN, it represents around 0.005% of gross totex, or 0.006% on a net basis, because that is what customers fund. Because the claim arises from similar circumstances to our other, individually immaterial London claims, we believe that they should be considered together, and request that this approach is taken.

xi. London Local Authority Tunnels

London Local Authority Tunnels	Material	Unique	Outside company control	Excluded from cost drivers	Excluded from Ofgem Regional Factors
RIIO-2 - £0.2m p.a.	No	Yes	Yes	Yes	Yes
Comment 1)	*Claim rejected as not material*				

The claim, also for £0.18m p.a. for London was rejected on the grounds of materiality. For London GDN, it represents around 0.005% of totex. Because the claim arises from similar circumstances to our other, individually immaterial London claims, we believe that they should be considered together, and request that this approach is taken.

London locksmiths

London locksmiths	Material	Unique	Outside company control	Excluded from cost drivers	Excluded from Ofgem Regional Factors
RIIO-2 - £0.1m p.a.	No	Yes	Yes	Yes	Yes
Comment 1)	*Claim rejected as not material*				

The claim, for £0.12m p.a. for London was rejected on the grounds of materiality. For London GDN, it represents around 0.003% of gross totex, or 0.004% on a net basis, because that is what customers fund. Because the claim arises from similar circumstances to our other, individually immaterial London claims, we believe that they should be considered together, and request that this approach is taken.

6. Additional driver related company specific factor - Emergency

In our Business Plan, Resolving the Performance Gap Appendix 09.20, we explained that, for the Emergency activity, we did not believe that the RIIO-GD1 driver - 80% customer numbers being a proxy for internal PREs on customers' own pipework – and 20% Repair Reports being a proxy for external PREs – was appropriate. This was because, as discussed on several occasions at CAWG, the number of internal PREs per customer in some GDNs is and has consistently been significantly higher than in others.

We did not propose this as a Regional Factor because, as we set out in our Business Plan, we considered that the issue was better resolved by amending the driver, to the maximum number of PREs in the preceding five years, given annual fluctuations with weather etc.

However, at DD, the original driver has not been changed. Consequently, we need to raise a further Regional Factor to reflect the addition costs incurred in London GDN due to the additional PREs per customer.

Our calculation, as shown below, has been in two steps. First, we needed to find the number of Internal PREs per customer in each of the seven years of the RIIO-GD1 from 2013/14 to 2018/19. To do this we sourced customer numbers from the BPDT table 5.09, and the number of internal PREs from individual years' RRP, table 7.4.

As shown below, for every year of RIIO-GD1 thus far, the number of PREs per customer in London, and also to a lesser extent Scotland, has been well in excess of the other GDNs.

Customers	**EoE**	**Lo**	**NW**	**WM**	**NGN**	**Sc**	**So**	**WWU**	**All**	**Excl Lo, Sc**
Ex BPDT 5.09	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
13/14	3,982,919	2,273,228	2,671,144	1,970,080	2,510,604	1,794,460	4,067,954	2,490,948	**21,761,337**	17,693,649
14/15	3,987,926	2,271,161	2,678,028	1,953,961	2,514,819	1,805,020	4,073,165	2,498,673	**21,782,753**	17,706,572
15/16	4,000,647	2,274,236	2,684,215	1,958,091	2,520,862	1,813,681	4,089,066	2,511,806	**21,852,604**	17,764,687
16/17	4,007,587	2,273,677	2,686,582	1,960,459	2,533,317	1,820,991	4,098,626	2,522,018	**21,903,257**	17,808,589
17/18	4,014,890	2,273,784	2,689,082	1,962,302	2,539,941	1,831,275	4,109,365	2,532,039	**21,952,678**	17,847,619

	EoE	Lo	NW	WM	NGN	Sc	So	WWU	All	Excl Lo, Sc
18/19	4,023,899	2,275,281	2,692,788	1,965,207	2,539,941	1,833,229	4,121,014	2,542,560	21,993,919	17,885,409
Average	***4,002,978***	***2,273,561***	***2,683,640***	***1,961,683***	***2,526,581***	***1,816,443***	***4,093,198***	***2,516,341***	***21,874,425***	***17,784,421***

Internal PREs (RRP) *Ex RRP*	**EoE**	**Lo**	**NW**	**WM**	**NGN**	**Sc**	**So**	**WWU**	**All**	**Excl Lo, Sc**
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
13/14	122,014	92,339	90,874	68,786	72,304	65,935	131,354	75,500	**719,106**	560,832
14/15	116,331	88,124	82,430	62,692	65,531	64,638	132,476	73,109	**685,331**	532,569
15/16	115,760	87,081	82,458	60,661	76,225	66,910	130,381	71,266	**690,742**	536,751
16/17	122,931	92,805	81,319	62,305	67,445	66,045	127,691	69,571	**690,112**	531,262
17/18	114,768	90,432	78,639	59,114	72,445	63,190	124,596	69,811	**672,995**	519,373
18/19	106,440	82,419	70,367	54,463	64,399	57,850	118,233	63,073	**617,244**	476,975
Average	***116,374***	***88,867***	***81,015***	***61,337***	***69,725***	***64,095***	***127,455***	***70,388***	***679,255***	***526,294***

Internals per cust

	EoE	Lo	NW	WM	NGN	Sc	So	WWU	All	Excl Lo, Sc
	%	%	%	%	%	%	%	%	%	%
13/14	3.1%	4.1%	3.4%	3.5%	2.9%	3.7%	3.2%	3.0%	**3.3%**	**3.2%**
14/15	2.9%	3.9%	3.1%	3.2%	2.6%	3.6%	3.3%	2.9%	**3.1%**	**3.0%**
15/16	2.9%	3.8%	3.1%	3.1%	3.0%	3.7%	3.2%	2.8%	**3.2%**	**3.0%**
16/17	3.1%	4.1%	3.0%	3.2%	2.7%	3.6%	3.1%	2.8%	**3.2%**	**3.0%**
17/18	2.9%	4.0%	2.9%	3.0%	2.9%	3.5%	3.0%	2.8%	**3.1%**	**2.9%**
18/19	2.6%	3.6%	2.6%	2.8%	2.5%	3.2%	2.9%	2.5%	**2.8%**	**2.7%**
Average	***2.9%***	***3.9%***	***3.0%***	***3.1%***	***2.8%***	***3.5%***	***3.1%***	***2.8%***	***3.1%***	***3.0%***

The average number of internal PREs per customer in London is 3.9%, and 3.5% in Scotland, as compared to 3.0% elsewhere – with the figures being higher in every year.

Having shown the consistently higher volume of internal PREs - wholly outside GDNs' control - per customer, we need to calculate the relative uplift that would need to be made to the customer number driver to reflect the additional internal PREs, which we do below.

Additional Proportion	Lo	Sc	GDN excl Lo, Sc	Uplift Lo	Uplift Sc
	%	%	%	%	%
13/14	4.1%	3.7%	3.2%	128%	116%
14/15	3.9%	3.6%	3.0%	129%	119%
15/16	3.8%	3.7%	3.0%	127%	122%
16/17	4.1%	3.6%	3.0%	137%	122%
17/18	4.0%	3.5%	2.9%	137%	119%
18/19	3.6%	3.2%	2.7%	136%	118%
Average	***3.9%***	***3.5%***	***3.0%***	***132%***	***119%***

The table shows that customer numbers in London should be uplifted by 32%, and in Scotland by 19%, to reflect the additional number of calls.

Placing these revised customer numbers into an Emergency regression for the 2013/14 to 2018/19 period increases London's allowance by around £2.4m p.a.

We consider that this Regional Factor adjustment needs to be made as it is material using any measure, unique in that it reflects a material asymmetry between two GDNs and the remaining six, outside of company control in that GDNs have no influence over customers' pipework, excluded from DD cost drivers, and not covered by any other DD regional factors.

7. Summary of Company specific claims

From the two preceding sections, we summarise below our revised Regional Factor claims for the RIIOGD2 period per annum, being the twelve originally submitted, restated where appropriate, plus the additional claim arising from the DD's stance on the cost driver for Emergency activity, namely the additional internal PREs per customer.

RIIO-2 Regional Factor claims p.a.	**EoE**	**Lo**	**NW**	**WM**	**Total**
From Business Plan	**£m**	**£m**	**£m**	**£m**	**£m**
Cathodic Protection	1.9		1.5	0.6	**4.0**
Depth of cover	3.6				**3.6**
Parking Bays & TTRO opex		0.4			**0.4**
Repex reinstatement		3.4			**3.4**
Emergency job times		2.5			**2.5**
Plant Hire Repex		2.3			**2.3**
Traffic Management Hire		0.2			**0.2**
London depot rental		0.6			**0.6**
24 hour shift patterns		0.5			**0.5**
Congestion charge		0.2			**0.2**

London Tunnels		0.2			**0.2**
Locksmiths		0.1			**0.1**
	5.5	**10.5**	**1.5**	**0.6**	**18.1**
Ex DD Emergency driver		**2.4**			**2.4**
Revised Total	**5.5**	**12.9**	**1.5**	**0.6**	**20.5**

The above table demonstrates that the cumulative impact of the individual claims for London in particular is very significant and easily meets the appropriate materiality threshold of 0.1% (as well as the 0.5% proposed by Ofgem, which we do not consider to be appropriate for Company Specific Factors in any event). As all (or the majority) of these claims relate to Urbanity, they should properly be considered together as part of the relevant Regional Factor and adjustments made accordingly

Supporting Information – London Challenges

Several of the regional factors we have presented relating to the London network have common cause – fundamentally rooted in the density of people and infrastructure – they often occur simultaneously on streetworks projects. This document is intended to supplement our regional factor claims that specify the logic and evidence basis for each claim, by describing and illustrating common scenarios in which many of the factors can apply and even compound one-another, making it more challenging and resource-intensive to meet customer and stakeholder expectations in London, including the Outer-Met (Tottenham) part of the East of England network.

Cadent's recent tender event for the Construction Management Offices (who will provide the management of most repex and some capex activities to each network) provides a view of how the market prices-in the challenges of managing the complexity London presents. Through this tender the bids for London showed a 62% cost premium for the back-office to support mains replacement activities and a 46% FTE increase, compared to the average of our other three networks. When challenging bidders about the reasons for these premiums, the complexity factors outlined in this paper were cited regularly.

Built environment challenges

By UK standards London is unique in being very densely populated across a large area; other urban environments are much, much smaller. Tall buildings are the most obvious manifestation of the density of people in London, where **1 in 2 people live in a multipleoccupancy building**.

The **density of gas and other**

Figure 1 - Half Londoners live in **utility and communications** *MOBS*

infrastructure is higher in London to support the number of people and associated demand. **Finding space**

for compounds, welfare facilities,

Figure 3 - Site compounds are tight and materials, spoil, plant or customer *sometimes inconvenient* friendly information and facilities is often much more challenging and expensive in London too. The size of the gas infrastructure in

Figure 2 – dense underground infrastructure is common

London is larger to meet the demand from the large and dense population. **Tier 2 & 3 gas mains are the norm** rather than the exception in central London, sometimes uniquely housed within subways, and **governor installations are multiple times larger** in capacity than typical suburban equivalents from almost any other part of the

ways of working in a deep excavation require trench design, support and the associated equipment to be brought to and from the job, carrying extra cost.

country. Where excavations need to fully uncover assets, their sheer size means that large, deep excavations are common. The safe

Figure 4 - Larger assets to meet demand require larger excavations and time to replace

London is a particularly old, historically important, wealthy and protected city. The number of **listed and protected buildings is much greater**, even than in other major UK cities. In connection with this special status, **tourism and public transport options** have been developed more in London than anywhere else. For example: tourist information/ map infrastructure; 'Boris bikes', and; the London Underground all add complexity and infrastructure to London's built environment that our works need to work around. London's dense

Figure 5 - Boris Bikes are an example of additional infrastructure to work around

and busy nature has led to more common use of concrete and other hard-wearing materials in the construction of the build environment.

These take longer to dig through safely and cost more and take longer to recycle and reinstate. Some of London's most wealthy suburbs have customers who have used more expensive materials for driveways or within their homes. Working around those materials or reinstating them to our customers' often exacting standards following works is another more common challenge in London.

NRSWA

There are significant challenges associated with meeting the requirements of **New Roads and Streetworks Act** and associated legislation. In addition to temporary traffic regulation orders, permit schemes and costs of meeting permit conditions, TfL and the London Boroughs have **Lane Rental** programmes (During 19/20 Cadent spent over

£538k on Lane Rental charges), the **Congestion Charging** Scheme, have **more cycle lanes** and infrastructure that we often need to re-route

Figure 5 - Congestion Charging and put back together following works, and increasingly, **very high parking bay suspension charges** (Barking & Dagenham Y8 charges could be £1.7m in this borough alone). Planning and managing these cost areas across the 28 boroughs/ authorities we work with – whose **application of the NRSWA**

regulations varies quite dramatically – is a constant challenge.

Figure 7 - Night working prompted by congestion charges

Figure 8 - Additional planning and TM for large volumes of cyclists

Complex communities

London is complex, active 24/7 and extremely diverse and multicultural by any standards, with pockets of the country's greatest wealth and greatest vulnerability and depravation. This diversity presents challenges associated with effective communications, planning, engagement, customer and community awareness and expectation management. **Over 20% of Londoners do not use English as their first language** compared to less than 10% nationally. Within the 20% is a rich diversity of languages, making it a common challenge for our people

Figure 9 - Unique population density and diversity

and processes to communicate effectively to our customers' satisfaction. This requires more time when communicating, generates re-work and can lead to confusion that undermines customer safety or satisfaction.

Access to properties is critical for much of our work. In densely populated areas – especially multi-occupancy buildings – **we have to access more properties** to complete check and ensure people are safe. For complex reasons including working hours & practices, cultural preferences, communications challenges and issues around customers' perceived safety, **gaining access to properties in London can be a real challenge**. As well as the larger volume of accesses we require, the challenge can lead to slower job times, more re-work/ repeat visits, more 'doublehanded' visits by our staff for their own welfare and safety and more use of bought-in locksmiths services and, in some cases, legal warrants. This complex area slows down work in London, costs money to complete safely and legally, and involves more common repair to forced-entry properties in extreme cases.

Figure 10 - Access to properties is more challenging

Our employees in London develop good skills to help them: navigate the city; communicate with the widest range of people the UK has to offer; assess risk dynamically and solve problems on their feet. The increased challenges they face on a daily basis are compounded by: **longer commuting times** into and out of London, normally without the option to use public transport due to the use of a liveried company vehicle with their tools and equipment on-board (noting that for working time and fatigue assessment purposes, this time is working time); and a **greater number of late or night shifts** due to the 24/7 nature of London and its customers' expectations. The **pay levels in London are higher** than in other networks and the market rightly dictates a premium for the considerable challenges the area poses.

Repex productivity factors

Working with **large numbers of boroughs** (28) with different expectations, customs and practices, priorities and interpretations of the legislation is a major challenge to planning and executing a programme of replacement works. Many of the boroughs require **shorter project lengths** to reduce disruption to road networks, with **challenging / unrealistic permit durations** (tight time scales) that can result in overruns or demobilisation/ remobilisation of a job. The boroughs have a right to specify the traffic management arrangements that they require and these to reduce road network impact requirements can be extensive and complex. Special permit conditions such as **regular spoil removal**; **shorter**

Figure 11 - Shorter projects due to LA intervention

working days (e.g. 10am to 4pm in some areas); **manned traffic**

Figure 15 - Accelerated reinstatement of some **management** *works to get London moving again* **systems** and **accelerated reinstatement post-works** all drive unit costs up, sometimes dramatically. In some cases the provision of alternative bus services for customers impacted by bus route deviations or changes have been required.

Figure 12 - Manned traffic lights as LA permit condiion

Figure 7 - Regular spoil removal as LA permit condition

Figure 6 - Complex traffic management for busy roads

Gas Distribution Questions

GDQ30 – Do you agree with the selected aggregation level, estimation technique and time period for our econometric modelling?

No for the aggregation level and time period but yes for the estimation technique for the following reasons

a) In the context of 8 GDNs and 3 ownership groups, there is no single view of truth, rather a rich picture is needed of both totex and bottom up approaches – but the DD relies on a single approach

b) **The DD's use of a single model rather than multiple approaches is inconsistent with regulatory best practice and precedent including by Ofwat, the CMA, Ofgem at RIIO-1, what Ofgem has proposed for RIIO-ED2 (July 2020) and the Gas Distribution SSMC**

c) The DD approach removes costs from the model, in particular IT capex, LTS and Other capex projects >£0.75m, contributions and growth governors that results in a 'partex' model, introducing bias towards GDNs with more non-load capex, and through their higher allowances, increasing costs for their customers. A true totex model would include all the above and GSOP.

d) The failure to carry out a bottom up approach has had adverse consequences for:

   a. IT costs, where capex and opex must be considered together;

   b. Emergency, where London consistently has more internal PREs per customer; and

   c. Repex, Reinforcement & Connections, where synthetics have been revised counter to engineering logic and a disconnect has emerged with the PCDs.

e) Work from NERA shows that:

   a. more robust models than at DD can change Cadent's DD ranking from the bottom of the GDN league table (positions 5,6,7,8) to the top of the league table (1,2,3,4);

   b. a density driver rather than pre-modelling sparsity and urbanity adjustments is the best fitting model, would rank London top, and provide it with a further £131m – showing that far more pre-modelling Regional Factors are needed for London;

   c. The RESET test is important, as Ofgem stated at ED1, and the failure of the DD model underlines the need to obtain a rich picture of approaches; and

   d. Given the uncertainties, it would be reckless to raise the efficiency bar to the 85th percentile, which would lead to inadequate funding for many GDNs, with median being far more suitable.

f) We agree with the use of the OLS estimation technique because it is less demanding in terms of sample size than the alternatives, and has been widely used in UK regulation

g) Three different time periods should be used for RIIO-GD2:

   a. RIIO-GD1 actuals – 2013/14 to 2019/20;

   b. RIIO-GD2 plans – 2021/22 to 2025/26; and

   c. RIIO-GD1 and RIIO-GD2 – 2013/14 to 2025/26.

h) Due to the DD model's structural, formula and data errors, it is hard to be definitive, but in principle more weight should be placed on the historic data because:

   a. It is more reliable than any forecast, however diligently prepared;

   b. Cadent's Plan was a P40 Plan – we have a less than 50% chance of achieving it; and

   c. The understanding of costs and drivers is reduced compared to the last price control review, as the bottom up models are weaker, which compounds uncertainties over the future.

No, we do not agree with the selected aggregation level, or the time period for the econometric modelling, although we agree with the estimation technique.

Our views on the DD's approach to cost assessment are set out in full in our answer to GDQ26, extracts from which are reproduced below in the response to this question.

1. Aggregation level

The approach to cost assessment as contained in the DD represents a hybrid or "partex" approach, in that it neither represents a totex approach, nor a bottom-up approach, both of which were used by Ofgem at RIIO-GD1. Indeed it is also not a middle-up approach that was considered in RIIO-GD1.

Our response on Aggregation is divided into three sections in our response to this question as follows: a) A single approach

b) Totex approach

c) A different more robust and balanced approach Each is considered in turn below.

a) A single approach

DD contains a single approach to cost assessment over a single time period. The use of any single approach to cost assessment is an error, for the following reasons:

- *The small sample size requires a number of approaches:*

  Given that there are only eight GDNs and three ownership groups, any single approach to cost assessment is likely to be inadequate and flawed. The CMA stated in the 2015 Bristol Water inquiry, paragraph 4.76:

  > "We recognised that no benchmarking analysis or cost assessment method will be perfect, and there will always be vulnerabilities and limitations in any approach. Any method of estimating a company's future expenditure requirements (if it operates and invests efficiently) over the five year price control period is likely to raise significant risks of inaccuracy or other problems."

  The CMA used no fewer than seven models (reduced from ten in their initial findings) to assess the company's base expenditure requirements (para 4.156), plus a targeted review, including engineering analysis (para 3.34) – in a sector with 18 independent comparators. Even after these multiple approaches, the CMA was only sufficiently confident in its results to benchmark using the median level of efficiency, not the Upper Quartile (para 4.245).

  We also note that Ofgem in the SSMD, para 12.128, it decided against using a class 2 Return Adjustment Mechanism for gas distribution, gas transmission and electricity transmission because

  > *"The concentrated ownership structures within the sectors meaning that one company could have material influence over the sector average, and as a*

> *result of this level of concentrated ownership, it may not be possible for a class 2 mechanism to be implemented in a way that is a fair outcome for all companies").*

Ofgem's concerns over the number of comparators apply at least as much to cost assessment as Return Adjustment Mechanisms.

- *Failure to use a bottom-up approach:*

  In particular, and further to the above point, we consider that it is an error not to carry out a bottom-up approach, similar to that in RIIO-GD1, because this would provide a different view to a true totex approach, and insights into cost drivers and regional factors. We note that some of the proposed but discarded bottom-up models currently fail the RESET test, but consider that the use of better drivers and further regional factors could resolve this problem. Nevertheless, it was the relative weakness of the bottom up modelling – as compared to a true totex approach – which led us to propose in our Business Plan that a weight of one third be applied to the bottom up approach. There are still important insights that can be gained from these models, they just need to be weighted appropriately.

  The worth of the bottom-up approach was noted by the CMA in the Bristol Water inquiry, paragraph 4.46(a) as follows:

  > *"Disaggregated models or more granular forms of benchmarking analysis may allow a more accurate estimation of the relationship between expenditure and specific cost drivers and allow a greater number of cost drivers to be taken into consideration."*

  We consider that the DD's failure to carry out a bottom up approach has led to particular weaknesses in the approach to IT costs, Emergency, and Repex, Reinforcement and Connections drivers, as follows:

  In the DD's partex approach, IT capex was excluded from the model and subject to Technical Assessment, but not IT opex. In a true bottom-up approach, we believe that expert assessment of IT & Telecoms costs is desirable, but that this must be on a totex basis – combining both opex and capex – otherwise the work is fatally flawed, given the solution and accounting trade-offs between capex and opex.

  The DD's lack of focus on Emergency costs has led to a failure to address the disproportionate workload arising in London (and also Scotland). The existing Emergency driver, with its use of customer numbers as a proxy for PREs within buildings (which are outside GDNs' control) does not reflect the fact that London and Scotland consistently have more PREs within buildings per customer than other GDNs, as has been discussed several times at CAWG. Due to the DD's failure to address this issue, we have needed to raise an additional Regional Factor claim in our response to GDQ29.

  Repex, Reinforcement and Connections synthetic drivers, where Ofgem's desire to develop more and more detailed synthetic unit costs appears to have amended drivers in a manner inconsistent with engineering logic. Economic / technical rationale was one of the three Model Selection

Criteria Ofgem proposed to use, as stated in the Tools for Cost Assessment consultation of June 2019. However, in these cases it does not appear to have been applied. We also note the disconnect between the PCD for repex and the repex allowances, caused by the lack of a bottom up approach.

In addition, under a bottom-up approach, we agree that there is scope for expert review of major engineering projects with no workload driver, although, as at GD1, the results should be tempered by a recognition of the trade-offs between opex and capex.

- *CEPA noted that additional years' data does not increase the number of comparators:*

CEPA's report from June 2019 (page 23) notes that despite the availability of additional years since GD1, the number of comparators has not changed and so although there are more observations the overall 'between' variance (i.e. the relative performance between GDNs) has not been enhanced to the same degree.

- *It is inconsistent with Ofgem's proposed approach in ED2:*

In the ED2 Sector Methodology Consultation of July 2020, Ofgem's proposed cost assessment toolkit contains multiple approaches:

- totex modelling – where two models from ED1 provided different views and included substantially all controllable costs, unlike the "partex" approach of the DD for GD2;
- disaggregated / Bottom Up modelling;
- expert review; and
- potentially middle up modelling also.

We do not understand the reasons for Ofgem's inconsistency in approach, where it proposes to use a rich picture approach to determine efficient costs for RIIO-ED2, but at precisely the same time seeks to apply an approach to gas distribution which is extremely thin and unreliable. The inconsistent approach between ED2 and GD2 is likely to have severe negative consequences for consumers and networks as it means that there is significantly less confidence in the allowed expenditure set for GDNs as opposed to DNOs (resulting in potential under and overpayment which would not be in the interests of consumers).

- *It is inconsistent with the SSMC for Gas Distribution:*

In the SSMC Ofgem stated its intention to evolve its approach from RIIO-GD1 and use several cost assessment techniques in para 6.51

> *"We propose to use a variety of tools to assess GDNs' cost efficiency in RIIOGD2, including aggregated and disaggregated regression analysis, and technical and engineering assessments."*

Therefore, the use of a single approach which is very different from that of GD1 is not consistent with Ofgem's consultation position as set out in the SSMC.

As we have stated consistently over the course of this price control review, we believe that Ofgem, as shown in electricity distribution in ED1 and ED2, and as for gas distribution at GD1, needs to use a rich picture approach to determine efficient costs, combining insights from a range of different benchmarking techniques. This need is particularly highlighted by the amount of errors and other failings we have identified in respect of Ofgem's single regression model, which we describe briefly in this response, many of which have we have already set out to Ofgem.

We believe that both Totex and bottom-up approaches need to be used. Totex approaches provide value in overcoming trade-offs, between solution choices, capex and opex, accounting policies, organisation structures and cost allocation. Bottom-up approaches provide granularity, improving knowledge of cost drivers and regional factors, which can also feed into Totex approaches. **b) Totex approach**

Totex approaches provide value in overcoming trade-offs, between solution choices, capex and opex, accounting policies, organisation structures and cost allocation. Bottom-up approaches provide granularity, improving knowledge of cost drivers and regional factors, which can also feed into Totex approaches.

The approach to cost assessment as contained in the DD represents a hybrid or "partex" approach, in that it neither represents a totex approach, nor a bottom-up approach, both of which were used by Ofgem at RIIO-GD1. Indeed it is also not a middle-up approach that was considered in RIIO-GD1.

We consider that costs for an activity should only be removed from a totex approach if they meet three criteria:

- activities are truly not comparable between networks;
- no adequate regression workload driver exists; and
- activities have little impact on other costs that are included within the totex regression.

In contrast, the DD's approach to Technical Assessment, as set out in paragraphs 3.139 and 3.140 of the GD Annex, is quite different:

> *"The discrete nature of some investments limits our ability to model costs and benchmark through direct comparison. This may be because an investment is uncommon across networks, lacks historical comparators or has other highly unique characteristics. In these cases we have undertaken a technical assessment."*

We consider the DD's approach to be flawed for two reasons:

- First, because it treats investment and opex differently, allowing spend labelled as investment to fall under Technical Assessment, outside of the model, whereas that labelled as opex cannot.
- Second, because it takes no account of the interaction with spend which is included with the model the GDNs' choices as to how they spend their totex will drive the assessment of efficiency, rather than the total level of spend.

The DD's approach to Technical Assessment had led to the partex approach to modelling, removing many costs from the regression which do not meet our three criteria set out above.

The result, if unaltered, will not only cause an unreasonable set of allowances between GDNs, with some customers paying more than they should, and others less, but it will also damage future customers through the distortion of incentives. In the DD, some types of cost – in particular non-load capex – are favoured over others. This will cause GDNs to strive to minimise some costs, most notably opex, but not capex, leading away from the minimisation of totex, so that customers will (contrary to their interests) pay more than they should – as shown by the chart at the beginning of this response. This represents the very opposite of what the Totex approach introduced in RIIO intended to and successfully achieved.

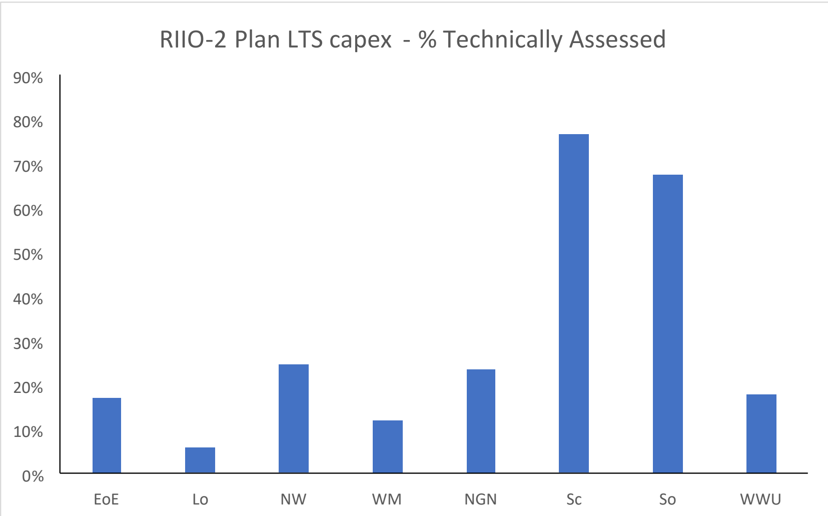
Exclusion of capex projects > £0.75m and IT & Telecoms capex

In respect of the DD approach to capex projects, we fundamentally disagree with Ofgem's approach of excluding all capex projects > £0.75m and IT & Telecoms capex from its partex modelling:

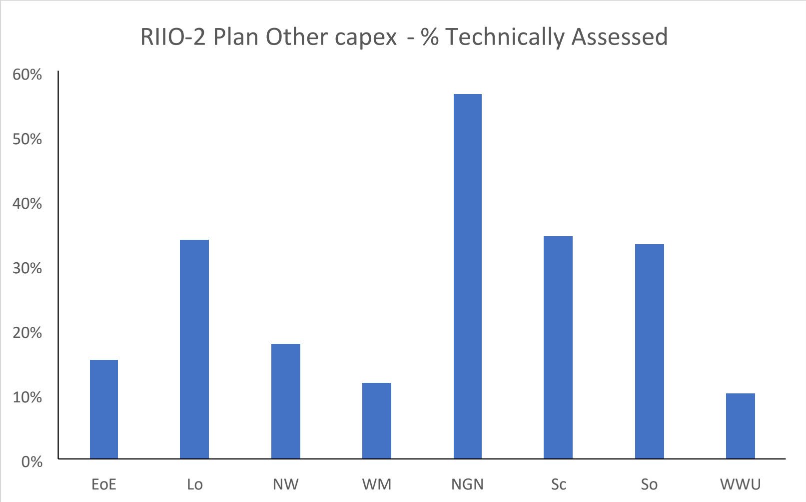
- Under a genuine totex approach, as applied at GD1, only exceptional capex projects – passing the three criteria above – would be excluded from the benchmarking. The only project we are aware of that would fulfil the three criteria for exclusion from a Totex regression are the Thames Tunnel and associated IP project, which has cost around £22m in RIIO-1 with a cost per km around 14 times the norm. The DD approach of removing all capex projects that are > £0.75m is removing a far greater value of costs from Totex benchmarking, and so greatly distorting its results.
- The £0.75m threshold for capex projects is unexplained/justified and therefore arbitrary, which would be inevitable under such an approach. If a value of say, £10m had been applied, this would have led to very different results in the partex model.
- There is a great deal of trade-off between Maintenance costs and capex, in particular LTS capex and also Other capex, not only due to solution choices, but also organisational structures and accounting practices. As stated at CAWG, Cadent's Finance function identified that a further £10m of
Maintenance costs for 2019/20 could be capitalised, which we did not implement as being contrary to how the price control was set. At RIIO-GD1 Ofgem specifically recognised the Maintenance / capex trade-off in its bottom-up approach – it did not need to take any action in its Totex approach, as that approach treated opex and capex the same.
- There are significant trade-offs between IT costs and other costs, in particular for staff. GDNs can choose to have more back office staff and less automated processes or more IT and less automated processes.
- There are many trade-offs between IT capex and IT opex, so that it makes no sense to treat them differently.
    - Capitalisation policies differ between GDNs, so one GDN's capex is another's opex.
    - Even within a GDN, the distinction between IT opex and capex is extremely fine in many cases. For example, if we incur software costs as part of a project, we capitalise these if they are "significant", and not related to data migration, training or research and development. Clearly considerable judgement may be involved in the capitalisation decision. ○ Whether an IT service is provided in-house or as a bought-in service drives whether costs are considered to be capex or opex, with the bought in service being entirely opex.
    - The increasing use of software as a service, for example through cloud computing, acts to increase the opex proportion, although, so GDN choices over how to acquire software services act to drive the balance of IT costs that are labelled as opex rather than capex.

○ In respect of the costs associated with running the national emergency telephone number, Cadent has both capex and opex costs, whereas the other GDNs, who receive a charge from Cadent, will treat that cost entirely as opex.

In addition to the flawed logic, neither have the costs excluded for Technical Assessment been applied evenly between GDNs. The chart and table below show the proportion and value of plan costs which have been subject to Technical Assessment for both LTS, Storage and Entry, and Other capex – with IT capex being the main component of the latter.



LTS, storage, entry	EoE	Lo	NW	WM	NGN	Sc	So	WWU	Total
RIIO-2	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**
Gross	124	118	96	85	83	139	123	74	**843**
TA	-21	-7	-24	-10	-19	-107	-83	-13	**-284**
In partex model	**103**	**112**	**73**	**75**	**64**	**33**	**40**	**61**	**560**



Other CAPEX	EoE	Lo	NW	WM	NGN	Sc	So	WWU	Total
RIIO-2	£m	£m	£m	£m	£m	£m	£m	£m	£m
Gross	135	101	93	66	96	63	105	50	**709**
TA	-21	-34	-17	-8	-54	-22	-35	-5	**-195**
In partex model	**115**	**67**	**77**	**58**	**42**	**41**	**70**	**45**	**514**

From the tables it is clear that 14% of Cadent's LTS spend and 20% of its Other capex spend has been subject to Technical Assessment, as compared to 53% and 37% for the other GDNs respectively.

The effect of the skewed application of Technical Assessment is to bias the benchmarking results in favour of those GDNs with a high proportion of costs subject to Technical Assessment, and against those where it is low. Even if none of the Technical Assessments were subsequently allowed, a GDN with a high value of Technical Assessment will benchmark well in the DD's partex model, and in the case of Scotland does form the benchmark, because so many of the costs for which there is no regression driver are removed from the model.

In particular, as shown above, the DD approach excludes NGN's high cost IT, and SGN's high cost LTS,
Storage and Entry projects, with the result that the three GDNs appear significantly more efficient than Cadent in the model. On this occasion, with Scotland forming the 85th percentile benchmark the result is an unreasonable cost allowance for all other networks, given that the projects excluded are the chosen solutions to the same or similar problems faced by other GDNs where the costs are still within the regression model.

Indeed, there are further compounding issues and bias between networks created by this methodology. As an example, take IT capex projects. On this cost category Cadent is the most cost efficient (lowest average GDN), yet NGN has a Technical Assessment that determines an allowance of £30m - which is 17% above our Plan submission - but the DD removes the £40m Plan cost from the regression modelling. As a result, NGN's inefficient cost of £10m is excluded from the modelling and so has no consequence for NGN, but makes all other GDNs appear less efficient. In addition, although the NGN allowance is above Cadent's Plan level of spend, the DD proposes that Cadent has to apply for a UM in order to spend over £2m per GDN on IT projects. Further details on this issue are provided in response to Core question 18.

A consequence of the flawed logic and execution of this approach is that NGN customers end up paying more than they should, as shown in the chart at the start of this response. This outcome is not in the interests of NGN's customers, and the distortion effect it creates on the efficiency of other networks means that consumers generally will either over- or under-pay for such expenditure.

Exclusion of gas shrinkage costs

In addition to the inclusion of IT capex and projects >£0.75m in modelled costs, as at RIIO-GD1, the costs of shrinkage – the purchase of gas to cover leakage, own use consumption and theft – should be included in a totex model. Although Shrinkage is classed as a non-controllable cost by Ofgem, it is influenceable, hence the incentives at RIIO-1 on gas purchasing and leakage volumes. Cadent has spent tens of millions of pounds managing this cost, through MEG, data loggers and other pressure monitoring equipment, reprofiling pressure reduction equipment, and a team of 12 tasked with keeping the cost down (ultimately to the benefit of consumers). Therefore there is a significant trade-off with other costs that are included in the partex regression.

Exclusion of costs associated with repex stubs

- Furthermore, we disagree that the costs of repex stubs should be removed from the regression for NGN and SGN and assessed separately. Fundamentally, the requirements of the mains replacement programme apply equally to all GDNs. If the HSE is content with the remaining lengths of Tier 1 mains attached to larger mains in some GDNs but not others, this has arisen from how GDNs have carried out the mains replacement programme. Pro-active GDNs have identified the issue, risk assessed options, put management controls (acceptable stub lengths) in place during RIIO-1, and agreed their position with the HSE through approval of their safety case. Those GDNs with which the HSE is content:
- Have already been routinely replacing the lengths described as stubs and left by other GDNs.
- Have incurred higher unit costs because of this work and so appeared less efficient up to now.
- In the RIIO-2 period are still planning to routinely carry out this work – and so planning to incur higher unit costs than others. That is to say the approach followed in RIIO-1 which did not lead to a 'stubs backlog' being created will continue in RIIO-2.

Consequently, in both past and future cost benchmarking, the results are distorted by the fact that some GDNs are routinely carrying out stubs work while others have not. Therefore, in the future cost benchmarking, so that GDNs are treated on a like for like basis, the stubs related costs and workload should not be treated separately to the rest of repex.

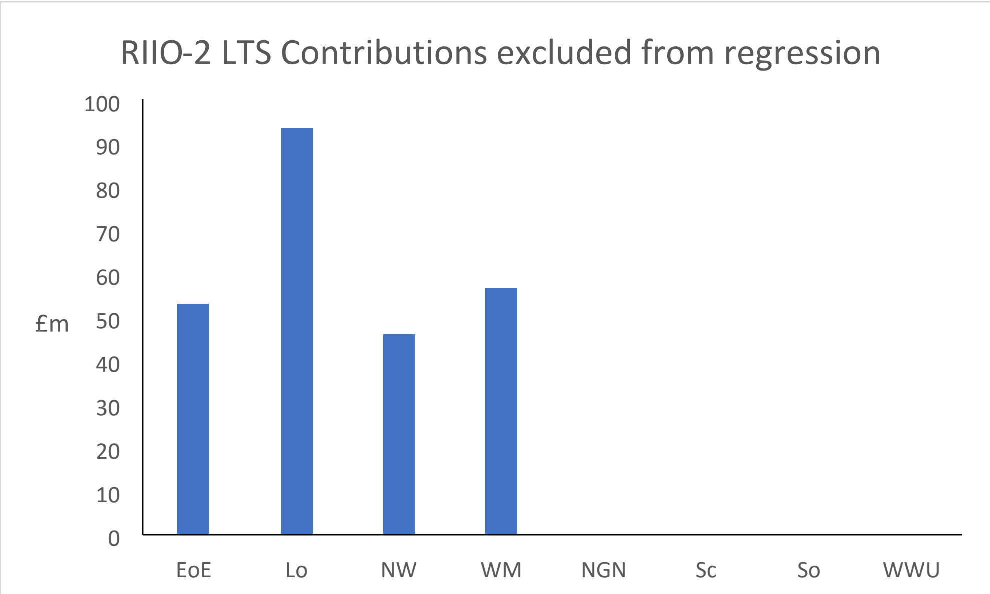
Exclusion of contributions (Net v Gross)

The approach models gross GDN costs against the totex CSV, and having struck the regression, makes a subsequent adjustment to reduce gross calculated allowances by the ratio of net to gross costs in the Business Plan. So if the Business Plan has a net to gross ratio of 0.95 in a 2021/22 for example, the gross modelled allowance for that year is multiplied by that same number to arrive at a net modelled allowance.

We disagree with this approach both in principle and in practice. In principle, efficiency should be assessed by measuring what work is proposed to be done and outputs delivered, against the cost to customers of carrying out that work. Contributions reduce the cost to customers so that they pay less, consequently, consistent with the RIIO-GD1 approach, we are clear that contributions should be included in the totex regression so that it uses net costs to calculate the equation.

Where there is a workload driver in the model, for example for connections, the net approach might not change the regression result greatly, however a net approach would still provide a more complete picture of totex efficiency, as it measures not only how efficient a company may be in carrying out the physical work of a connection, but also how efficient it is in recovering much of the cost of the work.

However, where there is no workload driver in the model, such as for LTS, Storage & Entry, the difference between net and gross costs becomes much more important, presenting an incorrect view of efficiency. In practice, the DD approach of using gross costs makes a substantial difference to the regression result because, in particular for LTS, Storage & Entry, there is a substantial level of contributions in Cadent's plan, but none at all in those of the other GDNs, as shown in the chart below.



Cadent's Plans were reduced by around £250m for contributions to LTS schemes, for example for the Lower Thames Crossing, but none of these contributions have been taken account of in the regression.

While the gross costs of Technically Assessed schemes are removed prior to the regression, the fact that such a low proportion of Cadent's LTS schemes have been subject to Technical Assessment means that the regression shows a greatly distorted, far from robust view.

Exclusion of Growth Governors

While we have not proposed any investment for Growth Governors in GD2, we disagree with the approach Ofgem has taken by excluding Growth Governors from the regression and treating them as non-regressed items. This approach creates bias in the model against Cadent and other GDNs which choose to invest in lower cost alternative solutions.

The table below shows the amounts included in Business Plans by GDNs for Growth Governors over the RIIO-2 period.

Growth Governors Normalisation	RIIO-2 total £m
EoE	0.0
Lo	0.0
NW	0.0
WM	0.0
NGN	4.8
Sc	3.2
So	9.4
WWU	0.0
	17.4

Growth Governors are rarely installed on Cadent's networks as we focus on lower cost pipeline solutions. For example, when faced with a low pressure issue our modelling team will assess a range of options beginning with model testing and adjustments to network pressures, then assessment of network pinch points (locations where laying short lengths of pipe or the installation of valves can materially improve pressures) and finally laying longer lengths of pipe, upsizing existing pipes or governor installation. Installation of governors is generally more expensive and protracted due to the necessity to purchase or lease land for new installation, whereas installation of pipework can quickly resolve customer low pressure issues.

We chose, therefore, not to submit funding for this activity as volumes are low and volatile. By removing Growth Governor funding from the regression model, while leaving the costs of alternative solutions in the regression model, Ofgem is ignoring trade-offs between Growth Governors and alternative solutions. As a result it is artificially lowering the benchmark position, while funding the other GDNs to deliver governor solutions. We consider that Growth Governors are suitable for inclusion in the regression model, and we disagree with their exclusion.

Exclusion of GSOS Payments

Finally, as at RIIO-GD1, we propose that GSOP payments should be added into a totex model, and an efficient level of allowance made. GSOP payments are effectively penalties, however to eliminate all these penalties would cost more than the GSOP payment. **It is also a fact that some of the payments are unavoidable as failure to meet the standard is outside our control**, such as when landlords refuse entry. Thus, we consider it an error that further distorts the modelling outcome (and its reliability) to set allowances that do not account for an efficient level of GSOP payments, which is especially important in London, where GSOP costs are a particular issue, given its high number of customers in MOBs. As a minimum, we need the efficient level of additional GSOS1 costs that London faces to be recognised at FD.

c) A different, more robust and balanced approach

When the DD was published, we were both surprised and concerned at the result of the benchmarking, which was very different to what we had expected. Therefore, we decided to obtain an independent view on the validity and robustness of the DD's approach, and consequently asked NERA to carry out a study for us. Their full report is provided alongside our response.

Their report analysed results from six models, being the DD model with all its errors, plus five different, plausible sets of models:

0) the DD model;
1) the error corrected DD model;
2) the error corrected DD model, with a density driver;
3) the error corrected DD model with elasticity adjusted CSV weights;
4) the error corrected DD model with GDN specific CSV weights; and
5) the error corrected DD model with elasticity adjusted and GDN specific CSV weights.

The DD model - **Model (0)** is that used to calculate RIIO-2 allowances in the DD, as provided to GDNs on July 10th, in support of the publication of the DD.

As Ofgem has acknowledged, the DD modelling contains many errors. **Model 1),** the errors corrected model, seeks to correct those errors which we were aware of as at 21 August 2020 – there are others we have subsequently become aware of, and probably still others of which we may never be aware, which are not addressed here. The errors that NERA have corrected in their modelling are listed in full on page
18 onwards of NERA's report, with the main ones associated with the DD's calculation of MEAV, Southern's repex synthetic, the failure to remove £55m of cost for the bespoke output associated with Cadent's hybrid vehicles, an error in calculating time trends, and the error caused by striking the regression using costs which have been reduced by workload disallowances, but against the original unadjusted workloads.

Model 2), the density driver model, removes the DD's sparsity and urbanity pre-modelling adjustments, and instead uses the error corrected CSV plus a density driver, as in Ofwat's approach at PR14 and PR19. The driver measures density as measured by population per km of main. This model finds the weights between the CSV and density and provides a different view of the need for Regional Factors in London GDN in particular.

Model 3) uses the error corrected CSV with elasticity adjusted weights to take account of the fact that each of the components of the CSV has a different relationship between fixed and variable costs, such that an increase of say 10% in one driver might be expected to increase costs by 10%, whereas for another driver it only be 5%. In contrast the DD CSV assumes a uniform relationship between workload and cost for all activities.

Model 4) uses the error corrected CSV plus company specific CSV weights, based on each GDN's pattern of expenditure across activities. The DD applies a uniform set of weights across the different components of the CSV, based on industry spend, which, in effect imposes a view of what the efficient balance of spend is across activities. NERA show how companies for which the balance of spend is different to the industry average will, purely from this reason, fare poorly if industry average weights are used.

Model 5) combines the approaches of models 3) and 4), reflecting the error corrected CSV plus GDN specific weights and elasticity adjustments by activity.

The results and GDN rankings from the six models are summarised below.

Summary of models - rankings

	Ofgem DD	Ofgem DD model with errors corrected	Error Corrected DD model with density drivers added	Error Corrected DD model with disag-weighted CSV weights	Error Corrected DD model with company weights in CSV	Error Corrected DD model with elasticities and company weights in CSV
Model ref	(0)	(1)	(2)	(3)	(4)	(5)
EoE	7	5	3	3	5	4
Lon	8	8	1	8	2	2
NW	6	2	2	2	3	3
WM	5	6	5	6	1	1
NGN	1	1	4	1	4	5
Sc	2	3	7	5	6	6
So	3	7	8	7	8	8
WWU	4	4	6	4	7	7
Adjusted R2	0.86	0.90	0.98	0.91	0.56	0.60
RESET test	FAIL	FAIL	FAIL	FAIL	PASS	PASS

The results shows that:

- GDN rankings are very different across the five plausible models. Model 5) shows Cadent as ranking 1,2,3,4 as opposed to the DD which showed our GDNs as ranking 5,6,7,8.
- The most statistically robust model are Models 4) and 5) because they pass the RESET test – all other models failing. However, these models also have the worst fit of the data, as measured by the Adjusted R2.
- The model that fits the data best is Model 2) with the density driver, under which London ranks top.

What are the implications of this analysis?

- First, it is clear that there is no single view of truth, and that consequently, a rich picture approach comprising a number of pieces of analysis should be used.
- Second, given that an individual GDN can be anywhere between the most efficient and the least efficient, it would be reckless to benchmark at the 85th percentile. NERA suggest alternatives such as using the median level of efficiency, as used by the CMA in Bristol Water
  2015, or alternatively to apply an efficiency benchmark above median, to the highest modelled cost for each GDN taken from a number of different approaches.
- Third, that at DD, the pre-modelling adjustments for London's Regional Factors are inadequate. Model 2) with the density drivers, has the best fit of any model, with density drivers which are statistically significant at the 99% level, and would result in a cost

allowance for London that is £131m more than Model 1), error corrected DD. Given that we have only requested approximately half that amount - see GDQ29 – it seems likely that we have not identified sufficient Regional and Company Specific Factors for London.

2. Estimation Technique

We support the DD's use of Ordinarily Least Squares as an estimation technique, as it is transparent and less demanding in terms of sample size than the alternatives, which is critical in the context of only eight GDNs and three ownership groups, and has also been widely used in UK regulation.

3. Time period for econometric modelling

The DD benchmarking uses only one time period to determine the efficient level of costs, using time series data for the thirteen years between 2013/14 to 2025/26.

In order to form a rich picture view of efficiency, it is important that more than one time period is used. At both RIIO-GD1 and in the 2015 Bristol water inquiry, two time periods were used.

We consider that three different time periods could be used for RIIO-GD2, because each will provide a different view of efficiency, based on both actual reported and forecast costs and workloads, as summarised below:

- RIIO-GD1 actuals – 2013/14 to 2019/20
- RIIO-GD2 plans – 2021/22 to 2025/26
- RIIO-G1 and RIIO-GD2 – 2013/14 to 2025/26

The DD Gas Distribution Annex, paragraphs 3.65 and 3.66 states that these time periods were considered, but given that the model performance was very similar across the different periods, Ofgem decided to use the thirteen year period to increase the sample size. We have run the regression for the RIIO-GD1 actuals and note that, while the GDN rankings are unchanged, the modelled costs are around 10% higher. While there are on average four years of ongoing efficiency between the two time periods, that is still a substantial difference, and one that needs to be reflected in allowances to provide a balanced view.

In respect of the relative weight to place on the different time periods, it is hard to be definitive because the present modelling is badly impacted by structural, formula and data errors. However, in principle, we believe that more weight should be placed on the historic period because:

- Past figures are, by their nature, more reliable than a forecast - no matter how diligently that forecast has been prepared, the future is always uncertain.
- We have described Cadent's plan as a "P40 Plan" – i.e. we have less than a 50% chance of achieving it. Consequently, to place a disproportionate weight on this Plan seems unwise, especially because, in a true totex model, with errors corrected, we believe that we would affect the benchmark level of efficiency.

- The overall understanding of costs and cost drivers is reduced compared to at RIIO-1, as evidenced by less robust bottom-up models, and this reduced understanding acts to compound the inevitable uncertainties about the future.

Gas Distribution Questions

GDQ31 – Do you believe we should take into consideration revised cost information for the remainder of GD1 including 2019-20 (actuals) and 2020-21 (forecast)?

- We support Ofgem's proposal to take into account revised cost information for the remainder of GD1 including 2019/20 actuals and the 2020/21 forecast.
- We recognise in some cases, Ofgem may require additional information to that provided in the RRP and we welcome early discussion on any additional information requirements.

Yes, we are supportive of updating the cost assessment models with the latest available data, as well as 2020-21 forecasts (where these are available), as long as this is part of a general update and error correction process for the model data. Additionally, it would need to be part of a new consultation on the cost models in October 2020.

We recognise that in some areas, Ofgem will not receive revised forecasts for 2020/21 via the RRP, for example, for separately assessed non-regression items such as Streetworks, and it may be necessary for GDN to provide revised forecasts of 2020/21 on these specific areas. Where there are specific external changes, that affect forecasts, then these should be assessed by separate assessement, for example the potentail impact of COVID-19.

With respect to COVID-19, the impact of the pandemic will be very limited on 2019/20 given lock down in the UK occurred towards the end of March 2020. Additionally, our 2020/21 forecasts have been prepared, as requested, excluding the impact of Covid 19. Therefore, there shouldn't be any limitations of using the forecasts in the RRP.

Gas Distribution Questions

GDQ32 – Do you agree with our selected cost drivers for Opex?

- We do not agree with **Emergency workload driver** for the following reasons:
  - During the CAWG process a better driver was identified - the maximum of the Publicly Reported Errors (PREs) in the last 5 years. This make much better engineering logic as it caters for different external influences (e.g. weather colder in Scotland) and known differences in the proportion of customers requesting emergency call out to their premises (rather than to our assets).
  - The alternative driver provides a slightly better model fit.
  - Ofgem has not provided any rationale for choosing the weaker driver selected.
  - If the CSV is not changed, then Ofgem should add an additional regional factor to account for differences in London. The DD is in error to not have included this and we pointed out the need during CAWG process.
- Cadent are disappointed that the CAWG process failed to address the known weakness of using the **Maintenance MEAV** scale driver.
  - Cadent raised concerns and circulated the Maintenance activities for which there were clear workloads. We do not see evidence that Ofgem has taken account of this information.
  - Within Cadent, EoE has a higher level of maintenance security and safety related work associated with the LTS system after adjusting for size. The scale driver thus disadvantages EoE.
  - The bias extends beyond EoE to all Cadent networks as Ofgem has not accounted for the known inconsistencies in using capital and opex in scale drivers. Again, this disadvantages Cadent as we have a relatively low capex and a relatively high opex. In a bottom-up model this needs to be adjusted for (as was carried out at RIIO-GD1). In Ofgem's RIIO-2 model (which we consider to be a "partex", as opposed to "totex" methodology), the LTS/Other capex Technical Assessment magnifies this bias against Cadent, see response to question 26 for our more detailed comments on the scope of the regression model.
  - Cadent raised the inconsistency between Maintenance, LTS and Other Capex at CAWG. We emphasised the issue of GDN capitalisation policies and by way of example, explained that on review we considered c. £10m p.a. could reasonably be capitalised. We have not seen any evidence of Ofgem addressing this issue at DD.
  - There is an inconsistency between the NARMS framework and the use of Maintenance in the scale drivers. Including Maintenance costs in the scale driver, and hence assessing this cost through the benchmarking process could lead to maintenance costs being disallowed (for example, if a network has a high workload). However, the NARMs methodology commits the network to delivering this workload (for more details see response to Q26 and NARMQ2).
- We also notice the weakness in the use of the **MEAV scale driver** for work management, which is why our Business Plan placed less weight on bottom up models than a true totex approach - unlike to partex approach applied at DD.
- Lastly, the **use of industry average weights to combine CSV categories** will lead to an element of bias against networks that have significant different cost splits, e.g. EoE. (this issue is discussed in more detail in our response to question GDQ26).

Our detailed response follows, where we look at the individual cost categories, followed by an overall response to how the individual CSVs are combined.

1. Emergency CSV

There is evidence that the Emergency CSV is incorrect and that other approaches to modelling costs are more robust.

At CAWG 7 on 13 March 2019, analysis presented to the group showed that the emergency CSV was not a good proxy for publicly reported escapes (PREs). There was also some concern that the customer numbers in the CSV were not consistently reported. The minutes of the meeting reflect that the group recognised there were alternative, superior drivers to using an emergency CSV based on customer numbers. The group recommended using a driver based on PREs given the data was available. The Draft Determination (DD) Step by Step Guide shows maximum PREs over five years were considered as a bottom up model (bottom up model 3a), but the DD does not justify why it was not chosen.

To compare the validity of the choice of Emergency CSV in the top-down regression model, we compared the results of the bottom up modelling which considers both:

- Emergency CSV with 80% customer numbers and 20% external report (model 3)
- Emergency CSV with max PREs over 5 years (model 3a)

The table below shows the results of both models and shows they are comparable in terms of performance. Whilst both models fail the RESET test, they:

- Perform similarly in terms of fit
- Have a statistically significant CSV coefficient at 1% level.

	model 3	model 3a
(R^2)	**0.757**	**0.739**
CSV Coeff.	0.967***	1.047***
t1 Coeff	0.008	0.023**
t2 Coeff	-0.041***	0.002
Constant Coeff.	-10.847***	-9.767***
RESET	FAIL	FAIL

Table 20: Summary of model 3 and model 3a's results

There are two key differences between the models:

- The coefficients in model 3a are larger than model 3 and we estimate would result in higher cost allowances by c.8%
- the coefficients for the time trends perform very differently - the time trend coefficient for t1 (2013-14 to 2018-19 actuals) is only significant in the model 3a with max PREs, whereas t1 is not significant at even the 10% level in model 3. Instead in model 3, t2 (2019/20 to 2025/26 forecasts) is significant at the 1% level. Additionally, the signs for the time trends in model 3 change from

positive to negative, while the signs of the time trend in model 3a stay positive. However, both models show a slow-down in t2[19].

Using Ofgem's principles for cost drivers as a guide we assessed model 3 and model 3a and we concluded on that basis model 3a is more appropriate than model 3 and better aligns with Ofgem's principles for cost drivers. The table below summarises the performance of the models against the principles.

	model 3	model 3a
Economic/engineering sense	Fail	Pass
Be accurately and consistently measurable	Pass	Pass
Relatively stable relationship with costs over time	N/A	N/A
As much relevant information as possible	Fail	Pass
Beyond control of the GDN	Pass	Pass

Table 21: Summary of model 3 and model 3a's performance against Ofgem's principles

a) Economic/Engineering sense:

- Model 3 uses customer numbers as a proxy for the volume of internal emergencies, while external reports is a proxy for no. of external emergencies. While this does describe costs, it doesn't fully reflect the pressures on GDN and analysis presented at CAWG 7 showed that the Emergency CSV was not a good proxy for PREs and in particular discriminated against London and Scotland. As the CSV for model 3 weights the customer numbers element by 80%, this results in the CSV ignoring all regional differences and regional factors would be needed to address the inherent weakness in approach. The graph below, presented by SGN at CAWG 7, illustrates the issues. We have calculated the resulting Regional Factor for London in our response to GDQ29.
- Model 3a provides direct data about the number of publicly reported escapes and therefore proxies are not necessary. It will, therefore, fully reflect the number of escapes a GDN is called to deal with. As such we consider it makes more engineering sense to use model 3a.

[19] We consider the results relating to time trends are likely to influenced by Ofgem's approach to modelling time

trends and therefore should be treated with caution. See GDQ26 for our response on this issue.

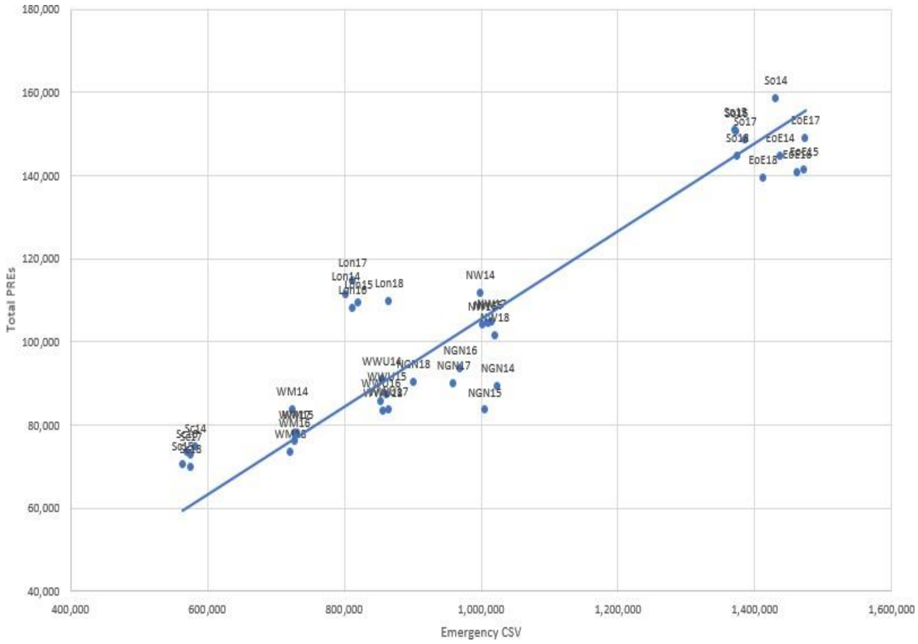


Figure 8: Relationship between Emergency CSV and Total PREs[20]

b) Accurately and consistently measurable:

- We consider both models pass this test.

c) Relatively stable relationship with costs over time:

- We have not recreated model 3 and 3a to assess the stability of the main coefficient over time, however, looking at the time trend coefficients we do question the stability of both models over time. For example, in model 3 the sign on the time trend coefficient changes from positive to negative without explanation and t1 is not significantly different to zero. While t2 also shows a slow down in t2, it is also insignificant at the 10% level. However, we recognise

[20] SGN, CAWG 7 Slides

this issue may be driven by Ofgem's approach to modelling time trends. See our response to GDQ26 for more information.

d) As much relevant information as possible:

- While neither model fully accounts for regional differences, model 3a does take into account that there are differences between GDN in terms of the number of escapes reported by customers. For example, in London and Scotland networks c. 4% of customers request the GDN to attend for internal work (i.e. not the GDN's assets), whilst other networks are all around 3. As explained above, this issue is completely ignored in model 3. If model 3 were to be used, a regional factor would need to be applied to London and Scotland. See our response to GDQ29 for further detail.
- To assess the impact of this, we compared the percentage of customers who report an internal PRE in London and Scotland, to the industry average percentage of customers who report an escape
(excluding London and Scotland). The analysis showed that on average between 2013/14 to

  2018/19, London's rate was 32% higher than the industry average, and Scotland's was 19% higher. We, therefore, consider an uplift of 32% to London's customer numbers would be required to adjust for this difference, and an uplift of 19% to Scotland's customer numbers.

e) Beyond control of the GDN:

- We consider both models pass this test.

Overall, we consider it inappropriate to use an Emergency CSV with customer numbers and external reports rather than PREs. It is unclear how Ofgem has reached its decision to use a model with external reports over PREs given that a model with PREs is superior in terms of meeting Ofgem's cost principles. We, therefore, consider Ofgem's use of an Emergency CSV with reports without appropriate adjustments for regional factors is an error. The need for a regional factor is known and has been raised previously with Ofgem.

Ofgem should reconsider using model 3a, or as a minimum apply regional factors to model 3 to reflect the significant differences between GDNs that are outside their control.

2. Maintenance MEAV

The approach taken to the Maintenance MEAV is not robust as it does not take into account important differences between GDNs which drive costs. For example, it doesn't take into account the impact of differing non-routine workloads (be they included in NARMs or otherwise), or different capitalisation policies between GDN. Indeed, during CAWG process we identified potential for £10m p.a. of our nonroutine maintenance that could reasonably be capitalised and we do capitalise in our statutory accounts but not our regulatory accounts to ensure our regulatory accounts are consistent with the RIIO-GD1 allowances. Both of these mean the maintenance MEAV will not be consistent or comparable between GDNs.

We also disagree with Ofgem's statement in the DD GD Annex, where it states that Maintenance MEAV only includes costs for assets maintained under this activity. While the majority of assets are, this is not the case, Maintenance includes several activities associated with Mains and Services which are not in the Maintenance MEAV. Review of the BPDTs identifies that in fact 18% of RIIO-2 maintenance spend in RIIO-2 is associated with Mains and Services. This may be a further factor behind why the Maintenance MEAV bottom up model does not perform particularly well.

The table below shows the results of the bottom up model for Maintenance MEAV, and shows that overall the level of fit is not particularly strong, and that the coefficient for t1 (the time trend for historic actuals) is not significant, while the coefficient t2 (the time trend for forecasts) is only significant at the 10% level.

	Maintenance MEAV
(R^2)	**0.685**
CSV Coeff.	0.950***
t1 Coeff	-0.002
t2 Coeff	0.019*
Constant Coeff.	-5.100***
RESET	FAIL

Table 22: Summary of Maintenance MEAV model results

During the CAWG process after the December Business Plan submission, we raised the issue of LTS and Other Capex interaction with maintenance expenditure, and that capitalisation policies could significantly impact the efficiency analysis. We re-outlined the RIIO-GD1 adjustment and as an action sent to Ofgem and the Other GDN details of the non-routine activities for which we had specific workload drivers as well as an identification of those activities that our finance team thought we could reasonably capitalise an around an additional £10m in 2018/19 of maintenance costs. Ofgem have not presented any evidence of progressing this issue or how it mitigated this issue in its DD regression modelling.

While this inconsistency of capitalisation differences and trade-offs between genuine opex maintenance or capital investment is managed in a full totex model, in bottom-up modelling it would need some type of adjustment mechanism, as Ofgem applied in RIIO-GD1. In Ofgem's Partex methodology, with significant exclusion of elements of LTS and Other Capex from the regression model, the inconsistent identification and treatment of separately assessed items (given the differing levels in some networks than others) and trade-offs are not addressed. This is leading to increased error in the model and therefore to erroneous disallowances. This is outlined further in response to question 26.

Regarding the non-inclusion of a workload driver for Maintenance, we also bring to the attention of Ofgem the point that much of the non-routine costs within Maintenance has been through the Engineering Justification review by Ofgem and been accepted, by default confirming the workload differences between networks. Looking at East of England, which was ranked 7th in the DD, after adjusting for scale it has more workload than our other networks and the MEAV scale regression default interpretation is that this justified work is treated as a cost inefficiency to that of lower workload networks. This is not the case it is workload driven given demographics of security of supply and safety aspects of the individual systems.   Therefore, it is unreasonable for Ofgem to treat all of this gap to the 85th as inefficiency and disallow it. See our response to GDQ27 for further details.   We also refer to answer to question NARMSQ2 andGDQ26 regards the conflicts this scale driver in the cost methodology with NARMs.

3. MEAV Scale Driver

We generally support the use of MEAV as a scale driver for Work Management, ODA, Business Support, and T&A in the partex model. However, the bottom up model for work management shows that MEAV performs poorly as a cost driver.

	MEAV (model 2)
(R2)	**0.405**
CSV Coeff.	0.745***
t1 Coeff	-0.016
t2 Coeff	-0.046***
Constant Coeff.	-3.909***
RESET	PASS

Table 23: Bottom up cost model results for work management (model 2)

While, the poor fit may be due to industry changes (e.g. as a result of the significant improvements Cadent has made on cost efficiencies since Cadent was formed in 2016 as well as the current on-going transformation programme), the use of MEAV as a scale driver for work management is a known weakness.

In RIIO-GD1 alternative drivers were considered and resulted in the development of MEAV, as it was considered to better represent different scale drivers – rather than narrowly focussing on length of mains or number of customers as used prior to GD1. Despite MEAV being an improvement, it has a number of weaknesses and it is unable to account for:

- differences between companies' organisational structures, for example, where a GDN like NGN outsource maintenance activities, the related work management costs are reported under maintenance rather than work management.
- accounting capitalisation differences and the levels of work management that get attributed to work execution/investment deliverables differ.
- different choices GDNs make between capex versus opex such as choices around more staff versus investments in IT and automation.

These topics were raised at the CAWG meetings, and Ofgem looked at various pooling options which were outlined at CAWGs post plan submission. However, we presume these issues weren't resolved as there is no evidence of their consideration or resolution in the DD and we assume it is one reason why the DD did not include any bottom-up regression models.

These above weaknesses are managed in a full totex model, but are not addressed where significant portions of certain expenditure types are excluded from the model, as in the regression model used at DD.

We are, therefore, only supportive of using MEAV as an opex driver in the absence of a better alternative. Where it is used in the regression model, the DD data errors and inconsistent treatment of separately assessed items between GDN needs to be addressed. Please see our responses to GDQ26 for more information on the errors relating the regression model.

4. Repairs

We support the use of external condition reports as a repair driver, and we consider this a better driver than using number of repairs reported as external condition reports are more outside GDNs' control and less liable to GDN reporting inconsistencies as the relate directly to a customer call. We also note that when comparing number of repairs to the number of reports, there is considerable variance between the number of repairs per report which was not able to be explained at CAWG. We, therefore, consider this variance is likely to at least partly due to reporting inconsistencies between GDN and also different operational practices, both of which are within GDNs' control.

In terms of the cost driver's statistical performance, while the level of fit is acceptable the coefficients for the time trends are not significant at the 10% level and the model fails the RESET test. The table below summarises the results.

(R^2)	**0.776**
CSV Coeff.	0.734***
t1 Coeff	0.002
t2 Coeff	-0.011
Constant Coeff.	-4.464***
RESET	FAIL

Table 24:: Bottom up cost model results for Repairs (model 5)

We consider it likely that this poor model performance is due to the different Network Repair Risk output targets set in RIIO-GD1. During GD1, Cadent has had to work within significantly more challenging Network Repair Risk targets that meant that during peak workload periods we had to complete repairs in materially faster times than other GDNs, an area where NGN is receiving CVP reward for in RIIO-2, despite planned performance being below that which we forecast in RIIO-2. To achieve the standard, Cadent has had to maintain higher resources than other GDN in order to ensure it can respond within the time required. As a result, this led to our Repair costs rising by c.£10m p.a. during the first few years We have adapted processes and introduced more variable rostering to help halve this impact during RIIO-GD1. With the output being removed in RIIO-GD2, our cost efficiency plans include a £5m pa step change improvement moving into RIIO-GD2. We, therefore, support the use of the number of external condition reports as a driver of repair costs.

5. CSV Combination

As part of our review of the DD, we asked NERA to review the DD models and provide their expert regulatory and econometric expertise observations on the model. One aspect that they raised was concern over the combination of individual CSV components in the partex regression model. The concern is that weighting by industry average spend can introduce bias against a network if its expenditure varies materially. East of England with its low repex workload being an example. The alternative is to weight by individual networks. This issue is discussed in more detail in our response to question GDQ26.

Gas Distribution Questions

GDQ33 – What are your views on our proposed approach to the synthetic cost driver for repex?

We disagree with the proposed approach to the synthetic repex cost driver and we have significant concerns with the approach taken to developing detailed unit costs which:

- disregards CEPA advice and framework for the development of the synthetic unit costs;
- in most cases appear to be based on extrapolations rather than actual data;
- appears to be inconsistent with engineering logic.

We have also identified errors within the workloads used in the cost driver (adjusted and unadjusted) for DD.

Given the issues we have identified, we consider it inappropriate to use the proposed updated synthetic repex unit costs. Instead it is more appropriate to use the synthetic unit costs as used at RIIO-GD1.

We would also note that our ability to respond to this questions has been effected by the delay in sharing the models behind the development of its synthetic unit costs. While models were eventually shared on 21 August 2020 (a month after our initial request), these models did not reconcile with the synthetic unit costs used within the Draft Determinations (DD). We raised this issue to Ofgem on 25 August and we did not receive revised models in time for us to take them into account in our response to this question. This has limited our ability to understand how the CEPA framework has been applied to derive the unit costs used at DD, the impact of those rules on the unit costs for example, how the removal of outliers have affected the unit costs.

In addition, we also refer to our answers to GDQ17 and 20 on repex unit costs for the PCDs. Cadent consider that the PCD should be set in accordance with the company-specific allowances, rather than with reference to an adjusted industry average unit cost.

We disagree with the proposed approach to the repex synthetic cost driver as we consider there are serious errors in Ofgem's methodology and in the application of the methodology, which means that the resulting cost driver (and models that use them it) are not fair and unbiased representations of the industry.

We also note that our ability to respond to this question has been effected by Ofgem's delay in sharing the models behind the development of its synthetic unit costs. While models were eventually shared on 21 August 2020 (a month after our initial request for the models), these models did not reconcile with the synthetic unit costs used within the Draft Determinations (DD). We raised this issue to Ofgem on 25 August but we did not receive revised models in time for us to take them into account in our response to this question. This has limited our ability to understand how the CEPA framework has been applied to derive the unit costs used at DD, the impact of those rules on the unit costs, for example, how the removal of outliers have affected the unit costs. We would welcome further engagement with Ofgem on the calculation of the synthetic unit costs.

From our review of the DD, we have the following key issues with the DD approach:

I. in developing synthetic unit costs Ofgem has disregarded CEPA's advice to consider alternative approaches in six areas which do not perform well against CEPA's assessment framework.

II. we are concerned the treatment of outliers is likely to bias the unit costs against networks such as London and East of England, where exogenous factors driver higher unit costs than in other networks.

III. the approach to developing more disaggregated unit costs appears to be based on extrapolations of data, resulting in spurious unit costs for over half of the unit costs that in many cases appear to be counter to engineering logic.

IV. when regressed against repex, the updated synthetic driver does not perform any better than the unit costs used at GD1 and therefore we question the value in trying to disaggregate unit costs to such a level given the issues with the approach.

V. we cannot reconcile the inputs used to calculate the cost driver to those submitted in our business plan or the adjusted workloads in the Cadent Annex.

We discuss each of these issues in turn:

1. Disregarding CEPA's recommendations

On page 4 of the CEPA's "Synthetic Unit Cost Update" report, it recommends *that "Ofgem may want to explore alternative cost assessment approaches for the following mains replacement activity as they do not perform as well against the assessment framework".* These included:

- Replacement of risers to MOBs
- Replacement of pipes with diameter more than 355mm
- Steel mains more than 2 inches in diameter
- Replacement of mains associated with other policy with diameter more than 180mm
- Diversions non-chargeable
- Capitalised replacement
- Non-domestic services

While the DD has taken on board CEPA's recommendation in relation to non-chargeable diversions and replacement of risers to MOBs, it has disregarded CEPA's advice on the other activities without explanation.

The table below summarises CEPA's finding -

Table 1: Summary of CEPA's findings on the synthetic unit cost update

	Variability between GD1 and GD2	Variability over time	GDN variability	Qualitative assessment	Overall assessment
Replacement of risers to MOBs	Excluded due to significant unit cost variability depending on building.				Fail
Replacement of pipes with diameter more than 355mm	Pass	Partially passes	Fail	Fail	Fail
Steel mains more than 2 inches in diameter	Fail	Partial pass	Fail	Fail	Fail
Replacement of mains associated with other policy with diameter more than 180mm	Partial pass depends on diameter band – a pass and a fail	Partial pass	Fail	Partial pass	Fail
Diversions non-chargeable	Pass	Partial pass	Fail	Fail	Fail
Capitalised replacement	Fail (predominantly fails though passes at >250mm)	Fail (though partial pass at >250mm)	Pass (though only partial pass at >250mm)	Fail	Fail
Non-domestic services	Partial pass - depends on type and services associated with relay fail	Fail	Fail	Fail	Fail

Given CEPA's findings, we are concerned that the DD approach disregards their findings and recommendations, without any justification or explanation of how the DD has resolved or mitigated these issues, or why it considers these issues are irrelevant. As a result we consider the synthetic unit costs used at DD are not robust.

We disagree, therefore, with proposals based on synthetic unit costs that would fail the majority of CEPA's criteria. We are particularly concerned about any item that fails the GDN variability criteria and qualitative criteria. As we have seen no evidence to suggest otherwise, we assume these issues continue to exist. We consider that Ofgem made an error when it disregarded CEPA's findings. We invite Ofgem to develop alternative approaches in line with CEPA's recommendations before Final Determinations.

2. Treatment of outliers

We are concerned about how the approach to outliers, unreasonably biases London and the East of England.

In both the CEPA assessment framework and the Step by Step Guide Assessment to Cost Assessment Annex to DD, it is clear that outliers more than 100% away from the industry average unit cost are removed from the calculation. While we understand the concern that a unit cost may be unreasonably skewed by these outliers, we disagree with the blanket removal of all outliers without first considering whether it is appropriate to remove the outlier and whether it creates a bias against particular networks.

For example, where the outliers relate to a large project, it may be appropriate to remove those costs from the sample. However, where the outliers are driven by the predominant characteristics of a network's operating environment, it is not appropriate to remove these unit costs as it will create bias against that network in the cost driver. For example, some of London's unit costs are excluded, but other unit costs are included. But for those unit costs of London that are included, they include identified London regional factors that haven't been adjusted for e.g. streetworks and harsher work conditions. As such those unit costs that are included will influence those diameters. This inconsistency in unit costs will influence the unit cost profile of the diameter band – it is not the unit cost itself that is important in creation of synthetic costs it is the profile. As such the DD approach is not sufficiently robust to be used in determinations.

On larger diameters, most networks have very small volumes, thus excluding London results in a small pool.

Unfortunately, our ability to understand the treatment of outliers in more detail and how this has affected/biased the synthetic cost driver for our networks has been limited by the delay in sharing its synthetic unit cost models with us. We will provide further information where applicable via the CAWG sessions.

3. Development of detailed unit costs

At GD1, the synthetic repex unit costs were set at a simple diameter band level, with no disaggregation for tiers or material types. This provided a simple, transparent approach to the development of the repex synthetic cost driver. Similarly, the unit costs for services were kept simple and only four unit costs were developed.

For RIIO-GD2, a considerable concerted effort has been made to develop more and more disaggregated unit costs and as a result the number of synthetic unit costs for mains has increased from 8 separate unit costs to a hundred. Similarly, the number of unit costs for services has doubled.

As a principle, we are not against more disaggregated synthetic unit costs, as long as they meet the criteria in the CEPA framework and are:

- based on good quality data;
- reflect accepted engineering logic/experience; and
- fairly represent the whole industry and do not create bias against one or more networks.

Where these criteria cannot be met, then specific unit costs (e.g. for tiers and material type) should not be pursued as they will lead to error and bias in the synthetic cost driver and ultimately the regression model.

Ofgem's approach to this more detailed build-up of synthetic costs was challenged by GDNs at CAWG meeting. Cadent is surprised that Ofgem continued to use the approach in the DD. The unit cost data provided in RRPs and hence also BPDTs are themselves heavily derived figures. Networks do not regularly capture actual costs at this detail and so all network companies have a different approach
(Cadent's data rest in part to the RIIO-1 synthetics, but then we make further

approximations/apportionments to obtain the extra detail). Ofgem therefore know that the data fails CEPAs quality criteria.

As we have already highlighted, we are already concerned that the approach to developing synthetic unit costs does not meet the framework criteria. In addition, we are concerned in reaching the detailed level of unit costs used for DD that Ofgem has over relied on methodological work arounds rather than good quality data. This results in a lower confidence in the reliability of the outcome.

For example, pages 11 and 12 of the Step by Step Guide to Cost Assessment describes a high-level approach to applying CEPA's framework:

> *"As a starting point, for all repex and capex (mains reinforcement and connections) activities, we considered the lowest level of disaggregation to which to apply the proposed criteria. First, we ensured a sufficient number of observations (criterion 1) and removed outlier observations (criterion 2). Then, if the calculated synthetic unit cost strongly failed to meet the other selection criteria, we first re-iterated the procedure at a higher level of aggregation (i.e. summing up similar cost activities). If the criteria were still not met, we computed the synthetic unit cost for the activity by applying a scaling factor to the closest activity for which it was possible to compute unit costs within this framework."*

The above approach describes aggregating similar activities where the other selection criteria are not met, and if those criteria are still not met, applying a scaling factor based on the difference in synthetic unit costs used at GD1. From the resulting repex synthetic unit costs, we can only assume that all aggregated synthetic unit costs failed the criteria. While the DD does not explicitly state this, we concluded that this must be the result given over half of the repex mains unit costs appear to have been developed through reliance on the scaling factor approach.

First, we are surprised that higher-levels of aggregation failed given that acceptable unit costs for RIIOGD1 were developed successfully, and as the DD has not explained any issues in this area it is difficult for us to understand further. We consider this a failure in the consultation process, particularly as there were opportunities to engage with GDNs on these issues through the Cost Assessment Working Groups. We are concerned that the lack of transparency around the development of synthetic unit conceals substantial errors including in calculation and methodology.

Second, it is unclear why a scaling factor is more preferable than accepting that it is inappropriate to develop detailed unit costs. Particularly as there isn't a specific need to develop detailed synthetic unit costs for the regression model, and our analysis later in this response shows that the unit costs used at DD do not perform materially better than the unit costs used at RIIO-GD1.

Ultimately, we are concerned that the reliance on a scaling factor based on the percentage cost difference between unit costs at GD1 results in unit costs that are not robust or reflective of the industry, and we consider that there are a number of errors in the assumptions underlying the approach:

- it is an error to assume the difference between the individual synthetic unit costs at GD1 is maintained over time, and Ofgem has not provided evidence to support this assumption; and
- as the synthetic unit costs used at GD1 did not differentiate to the same level of detail as the unit costs used at DD, it is an error to assume that the difference between GD1 unit costs is relevant to GD2 unit costs. For example, the GD1 synthetic unit costs for mains only differentiated

between diameter bands and did not differentiate between pressure tiers or materials, as such the difference in unit costs between the diameter bands is an average of the different materials and pressure tiers. It is, therefore, wrong to assume that the difference between size bands for a specific material and tier will be the same as the average difference between size bands.

From a pragmatic point of view, were this approach limited to addressing a few gaps in detailed synthetic unit costs, where the rest of the unit costs meet the earlier criteria, it might be acceptable. However, from comparing the difference between the unit costs used at GD1 to the difference between the unit costs used at DD, and also the synthetic unit cost models, we have concluded that the DD approach over relies on the scaling factor and it appears the scaling factor approach has been used to develop over 52% of the repex mains unit costs. In addition, we note that all the unit costs for capitalised replacement have been set by pegging to the unit costs for another category without explanation

Ultimately we have concluded that 60% of the synthetic repex unit costs used in DD are not based on direct data and are therefore spurious. Given that companies in the first place will have had to apportion costs in order to complete the business plan data tables to the level of detail required, it is likely that the 40% of synthetic repex unit costs, which are based on business plan data, will also not be reflective of the true cost of delivery.

We also see a similar issue on services, where non-domestic services for relays and transfers have been estimated using the difference between the synthetic unit costs used at GD1 for non-domestic and domestic relays, despite not differentiating between relays and transfers for non-domestic services at GD1. We consider this is an error and we don't believe there is evidence to suggest the scaling factor is appropriate. For example, in our own business plan the unit costs for domestic services are the same as non-domestic services. Additionally the unit cost difference between relays and transfers varies between our networks and part of which is driven by different approaches to allocating costs after work is complete – i.e. the costs of a mains replacement project will be allocated ex-post between mains and services, as well as between the different types of services.

We consider such a reliance on a scaling factor is a methodological error and increases the risk that the resulting unit costs are not fair reflections of the industry average, and that the relationships between size, material and tier are not accurately explained. As a result, the resulting cost driver will be unfairly biased against any GDN whose costs do not reflect the synthetic unit costs.

To add to this, any cost driver developed should make engineering sense, and we are concerned that the unit costs used are inconsistent with our understanding and experience of the cost relationship between different mains types. The table below summarises our concerns.

Table 2: Comments on repex synthetic unit costs

Comments on repex synthetic unit costs	
Tier 1: Cast Iron, Ductile Iron and Steel	The unit costs show: • Ductile Iron (DI) to be cheaper than Cast Iron (CI) • Steel is cheaper than both DI/CI • • This is unexpected and in our experience DI is more expensive than CI, and Steel is more expensive than both DI and CI. It is also unclear whether the Steel unit costs under Tier 1 are meant to be less than or equal to 2" or just Tier 1 steel. If it is less than 2" steel than we are confused why there are unit costs included for the higher diameter bands.
Tier 2A: Cast Iron, Ductile Iron	The unit costs for the Tier 1 elements of this section are cheaper than the Tier 1 unit costs calculated, which appears to be an error. In addition, the unit costs for CI and DI are the same, whereas identified above we expect DI to be more expensive.
Tier 2B: Cast Iron, Ductile Iron	The Tier 1 elements (the first four diameter bands) are cheaper than the unit costs calculated for Tier 1, which appears to be an error. The Tier 1 elements (the first four diameter bands) are more expensive than the respective Tier 2A unit costs, whereas we would expect them to be more expensive. Again the unit costs for CI and DI are the same, whereas in our experience DI is more expensive than CI.
Tier 3: Cast Iron, Ductile Iron	As above the unit costs for CI and DI are the same, whereas in our experience DI is more expensive than CI. It is unclear why and how unit costs have been calculated for the lower diameter bands for Tier 3.
Cast Iron/Ductile Iron > 30m	These costs should represent Tier 1>30m, therefore, it is unclear why there are unit costs for the higher diameter bands.
Steel >2"	The Tier 1 elements (the first four diameter bands) are different to the unit costs calculated for Tier 1 Steel. The Steel unit costs are lower than the CI/DI Tier 3 costs by diameter whereas we would expect them to be more expensive.

The issues we describe above are illustrated in the chart below.

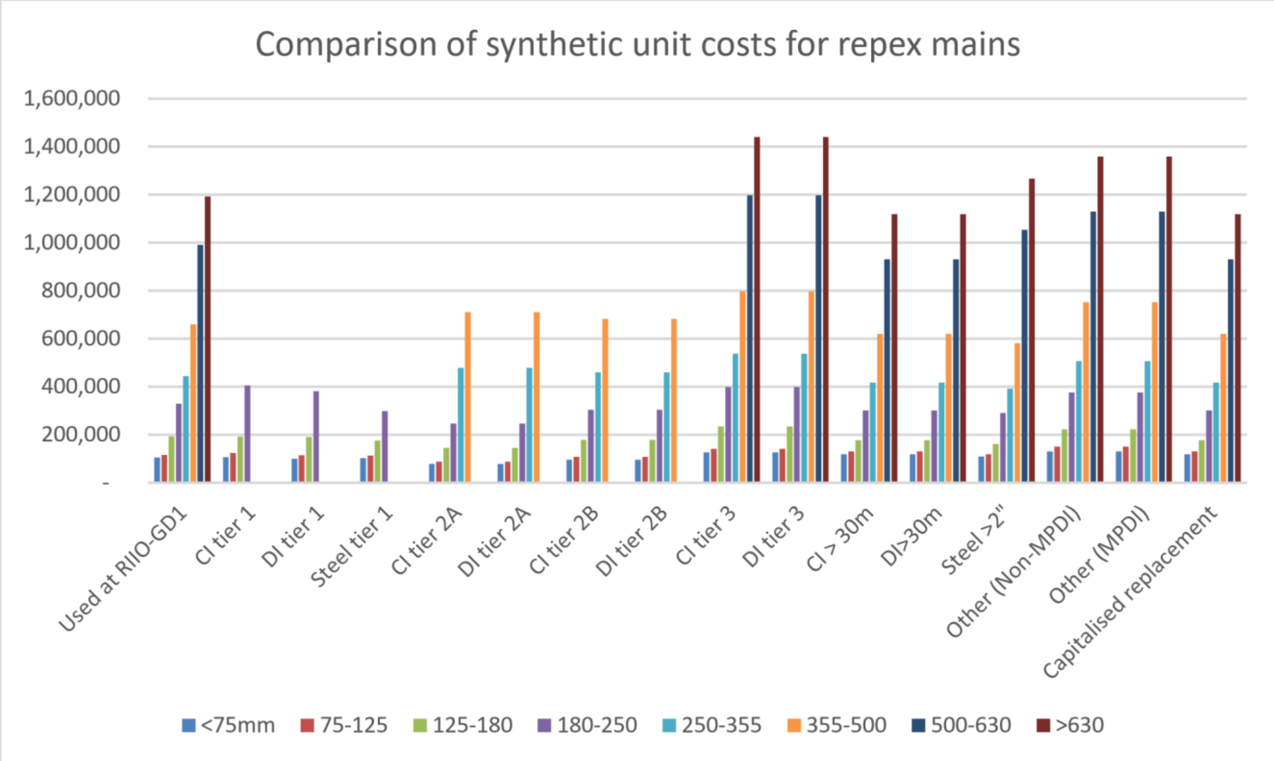


Figure 9: Comparison of repex mains synthetic unit costs used at DD to those used at RIIO-GD1

4. The synthetic driver performs less favourably compared to the unit costs at GD1

As part of our review of the repex synthetic cost driver, we tested the synthetic unit costs used as part of DD against the

- the GD1 synthetic unit costs CEPA developed
- the GD2 synthetic unit costs CEPA developed
- the synthetic unit costs used at GD1 as well as an adjusted version, where uplifts were applied to steel>2" and ductile iron to reflect the higher than average unit costs expected for those types.

To test the different unit costs, we calculated a synthetic cost driver using the different unit costs and regressed them against the normalised repex in the DD normalisation models. The modelling showed that the DD repex synthetic cost driver was only slightly better than using a repex cost driver based on the synthetic unit costs at GD1. The table below summarises the results.

Measure of fit (R^2)	2018/19	2013/14 to 2018/19	RIIO- GD2
Historical GD1 (DD approach)	**0.85**	**0.93**	**0.80**
Updated GD1 (CEPA)	0.83	0.91	0.80

Measure of fit (R^2)	2018/19	2013/14 to 2018/19	RIIO- GD2
Updated GD2 (CEPA)	0.77	0.89	0.80
RIIO GD1	0.85	0.92	0.78
RIIO GD1 - adjustment for Steel & DI	0.85	0.92	0.78

Table 25: Performance of DD synthetic unit costs to alternatives

Given that the level of disaggregation of unit costs employed at DD does not deliver a material improvement in fit, and are based on errors of analysis and methodology. We strongly recommend Ofgem reconsiders its approach including to the appropriateness of removing outliers, and give thorough consideration to using a set of simplified synthetic unit costs such as those used at RIIO-GD1. This will help ensure that all the repex cost drivers are based on actual data, and that this provides a fair reflection of the industry average and does not create bias in the model against individual companies.

5. Errors

We have identified errors in the input files used in the calculation of the repex synthetic unit costs and the synthetic cost driver. They are:

- **Incorrect steel <2" costs and volumes:** the steel <2" costs and volumes have been incorrectly copied across and for all GDNs, the numbers have been moved to the next diameter up. This error is in the calculations for the synthetic unit cost and the synthetic cost driver model and affects all GDN. We raised this error in DDQ_101.
- **Incorrect Services numbers for Southern**: In the sheet "Cal Services Synthetic Cost CAdj", the last row for each GDN, for other domestic relays, usually references 11 cells. However, for Southern, this row (row 85) references over 100 cells, apparently in error, with the result that its repex synthetic for mains and services appears to be overstated by around 37% over the 13 years. Given that repex has a 39% weight in the "totex" CSV, this would be expected to materially impact the benchmarking analysis. We raised this error in DDQ_80.
- **Incorrect allocation of workload reclassified from reinforcement:** In the sheet "Cal Repex Volumes AggAdj", workload for Cadent's Capitalised repex transferred from Reinforcement has been added into the Tier 1 Cast iron 180-250mm work. However, our email dated 5 May which provided the relevant information, showed that it was made up of work in the top two diameter bands, 500630mm and 630mm+, while para 3.26 of the Cadent Annex stated that it should be treated as Tier 3 work. We raised this error in DDQ_82.
- **Using the unadjusted synthetic repex driver in the regression model:** the DD uses the unadjusted repex cost driver in the regression model, despite the model using costs that have been adjusted for workload reductions. By inconsistently regressing lower workload adjusted costs against higher drivers, Ofgem is introducing measurement error into the regression model.

As a result the coefficient on CSV is subject to attenuation bias, creating a downwards bias in the estimated coefficient, and upwards bias in the constant term. The consequence of this bias is to inflate the modelled costs of companies with a lower CSV and reduce the modelled costs of companies with a higher CSV. We, therefore, consider this approach an error21. For Final Determination, Ofgem should use the correctly adjusted repex driver in the CSV used in the regression model.

- **Inconsistencies between the unit costs used in the synthetic cost driver model and those in the model to calculate the synthetic unit cost:** We raised in DDQ_103 that the unit costs in the DD synthetic cost model did not reconcile with those calculated in the unit cost model that Ofgem shared with us on 21 August 2020. The table below summarises the differences. In addition, please note that we still have not been able to identify where the unit costs for FPNES mains and services have been calculated.

Repex synthetic unit costs			(3) Synthetic costs	Jnit cost model	Difference
Tier1	Steel	125_180mm	175,867	166,906	-8,961
Tier1	Steel	180_250mm	298,743	283,520	- 15,223
Tier2A	Cast Iron	75mm	78,538	77,687	-851
Tier2A	Cast Iron	75_125mm	87,328	86,381	-947
Tier2A	Cast Iron	125_180mm	145,368	143,793	-1,576
Tier2A	Cast Iron	180_250mm	246,935	244,258	-2,677
Tier2A	Ductile Iron	75mm	78,538	77,687	-851
Tier2A	Ductile Iron	75_125mm	87,328	86,381	-947
Tier2A	Ductile Iron	125_180mm	145,368	143,793	-1,576
Tier2A	Ductile Iron	180_250mm	246,935	244,258	-2,677
Iron>30m	Cast Iron	75mm	118,853	118,379	-474
Iron>30m	Cast Iron	75_125mm	130,740	127,424	-3,316
Iron>30m	Ductile Iron	75mm	118,853	118,379	-474

Iron>30m	**Ductile Iron**	**75_125mm**	130,740	127,424	-3,316
Steel>2"	**Steel**	**75mm**	108,762	105,708	-3,055
Steel>2"	**Steel**	**125_180mm**	161,910	162,187	277
OtherPolicy(All)	**Any**	**75_125mm**	150,759	151,228	469

[21] See report by NERA: Review of Ofgem's GD2 Draft Determination Cost Assessment

Repex synthetic unit costs			**(3) Synthetic costs**	**Jnit cost model**	**Difference**
OtherPolicy(All)	**Any**	**75_125mm**	150,759	151,228	469
Capitalised Replacement	**Any**	**75mm**	118,853	118,379	-474
Capitalised Replacement	**Any**	**75_125mm**	130,740	127,424	-3,316

Table 24: Summary of differences between synthetic unit costs used in synthetic cost model and the unit cost calculations provided by Ofgem

In addition to the errors identified above our review of the synthetic unit cost model[21] also found differences for other GDN between the values in the RepexNetCosts and RepexVolumes sheets and the numbers in their BPDT. It is unclear whether these have been addressed as part of the SQ process. We have listed below the areas we have found differences. These differences were also raised in DDQ_101.

NGN:

- Associated Relay Domestic costs
- Not Associated Relay Non-domestic costs

Sc, So, and WWU

- Associated Relay Domestic costs
- Associated Relay Non-Domestic costs and volumes
- Associated Transfer Domestic costs and volumes
- Associated Transfer Non-Domestic costs and volumes

Conclusion

Ultimately, given the issues we have identified, the repex synthetic cost driver fails Ofgem's own recently published criteria for a cost driver, which should:

[21] Version received 21 August 2020

- make economic and/or engineering sense.
- be accurately and consistently measurable.
- have a relatively stable relationship with costs over time and incorporate as much relevant information as possible.
- be beyond the control of the network company."[22]

Given the issues we have identified with the repex synthetic unit costs, we consider the repex synthetic cost driver fails the majority of these criteria. We, therefore, consider it inappropriate to use the updated synthetic repex unit costs used in the DD, and instead it is more appropriate to use the synthetic unit costs as used at RIIO-GD1. This will help ensure that all of the repex cost driver is based on actual data, and that it provides a fair reflection of the industry average and does not create bias in the regression model against individual companies.

This is vital to ensuring allowances are set appropriately and are reflective of networks' efficient costs of delivering its licensed activities. This will ensure networks are able to invest in their network, protecting current and future consumers' interests.

In addition, we also refer to our answer to GDQ17 and 20 on repex unit costs for the PCDs. Cadent consider that the PCD should be set in accordance with the company-specific allowances, rather than with reference to an adjusted industry average unit cost.

[22] Ofgem, RIIO-ED2 Sector Methodology Consultation: Annex 2 Keeping bills low for consumers, page 16

Gas Distribution Questions

GDQ35 – Where we have disallowed workloads, should we consider making corresponding adjustments to opex costs? If so, how do you think this could be done?

We agree a corresponding adjustment to opex costs must be made if workload is disallowed. The position as currently set out is erroneous, the draft determination will increase repair activity but has not allowed funding for this work. The decision to disallow workload means we are making fewer long term asset management decisions and therefore will incur short term costs.

A significant reduction in mains renewal workload (PAST and Dynamic Growth) will increase the number of main and service repairs in GD2, leading to an increase in opex costs (and reduced customer benefits).

Our response to GDQ34 sets out a revised repex and opex position for Cadent, this includes reinstating a portion of the excluded workload and increasing opex costs by £11.7m.

In RIIO-2 we forecast that we will need to carry out 6,800km of additional survey activity to monitor PAST mains before they are renewed or to allow for investment deferral. The annual additional opex spend associated with these surveys is set out below. In total, we are proposing to spend £0.7m over RIIO-2.

£m (18/19 constant)	2021/22	2022/23	2023/24	2024/25	2025/26	RIIO-2 Total
EoE	£0.05	£0.05	£0.04	£0.04	£0.04	£0.22
Lon	£0.08	£0.07	£0.07	£0.06	£0.06	£0.33
NW	£0.01	£0.01	£0.01	£0.01	£0.01	£0.05
WM	£0.02	£0.02	£0.02	£0.01	£0.01	£0.08
Cadent	£0.16	£0.15	£0.14	£0.12	£0.11	£0.69

Table 26: Additional opex spend for surveys

From the survey programme we will carry out on the PAST mains, we can expect to identify an additional 4,400 leak, above those we would otherwise have repaired. This will lead to an increase in repairs and opex spend, note that the work now excluded is predominantly large diameter and therefore the unit costs for repair are reflective of this. In the table below, we detail the additional cost over RIIO-2 of repair we would expect by network.

£m (18/19 constant)	2021/22	2022/23	2023/24	2024/25	2025/26	RIIO-2 Total
EoE	£0.4	£0.4	£0.4	£0.3	£0.3	**£1.9**
Lon	£1.9	£1.7	£1.6	£1.4	£1.2	**£7.8**
NW	£0.1	£0.1	£0.1	£0.1	£0.1	**£0.6**

WM	£0.2	£0.1	£0.1	£0.1	£0.1	**£0.7**
Cadent	**£2.6**	**£2.4**	**£2.2**	**£2.0**	**£1.8**	**£11.0**

Table 27: Additional opex costs for repair by network

Gas Distribution Questions

GDQ36 – What are your views on our proposed approach to the synthetic cost driver for capex?

Executive Summary

We **disagree** with the DD approach to the synthetic capex cost driver and we have concerns with the approach taken to developing detailed unit costs which:

i. disregards CEPA's advice to consider alternative approaches for reinforcement and connections synthetic unit costs as they do not perform well against CEPA's assessment framework. ii. is likely to result in bias against networks such as London bias due to the treatment of outliers.

iii. in some cases appears to be based on extrapolations of data rather than actual GD1 data.

In addition, we are concerned that the synthetic cost driver does not reflect the uplifts made to capex to bring our connections and reinforcement numbers in line with a central case. We raised this issue via a DDQ (see CADENT_DDQ_59), and which Ofgem has accepted is an error and indicated will be corrected for final determinations.

We would also note that our ability to respond to this questions has been effected by Ofgem's delay in sharing the models behind the development of its synthetic unit costs. While models were eventually shared on 21 August 2020 (a month after our initial request for the models), these models did not reconcile with the synthetic unit costs used within the Draft Determinations (DD). We raised this issue to Ofgem on 25 August and we did not receive revised models in time for us to take them into account in our response to this question.

We disagree with the proposed approach to the capex synthetic cost driver as we are concerned there are errors in Ofgem's methodology and application of the methodology, which means we cannot have confidence that the resulting cost drivers are fair and unbiased representations of the industry.

We also note that our ability to respond to this questions has been affected by Ofgem's delay in sharing the models behind the development of its synthetic unit costs. While models were eventually shared on 21 August 2020 (a month after our initial request for the models), these models did not reconcile with the synthetic unit costs used within the Draft Determinations (DD). We raised this issue to Ofgem on 25 August and we did not receive revised models in time for us to take them into account in our response to this question. This has limited our ability to understand how the CEPA rules have been applied to derive the unit costs used at DD, including how removal of outliers have affected the unit costs.

We have the following key issues with Ofgem's approach:

I. in developing synthetic unit costs it has disregarded CEPA's advice to consider alternative approaches as neither connections nor reinforcements perform well against CEPA's assessment framework.

II. the treatment of outliers is likely to bias the unit costs against networks such as London and East of England, where exogenous factors driver higher unit costs than in other networks.

III. the aggregation and scaling factors - we are concerned that to develop synthetic unit costs for connections and reinforcements over relies on methodological work arounds rather than good quality data.

IV. the workloads used in the synthetic driver and adjusted synthetic driver do not reflect the uplifts Ofgem have made to totex for connections and reinforcement expenditure

We discuss each of these issues in turn:

1. Disregarding CEPA's recommendations

CEPA's "Synthetic Unit Cost Update" report recommends that Ofgem explores alternative cost assessment approaches for reinforcement activity and connections activity as neither perform well against the assessment framework, due to significant unit cost variability between GDNs and over time. In addition, in the case of reinforcement, CEPA identified many data anomalies that it considered difficult to explain. While the DD has taken on board CEPA's advice in other areas e.g. replacement of risers to MOBs, it has disregarded CEPA's advice on connections and reinforcement without explanation.

The table below summarises CEPA's findings.

	Variability between GD1 and GD2	**Variability over time**	**GDN variability**	**Qualitative assessment**	**Overall assessment**
Reinforcement: mains ≤180mm in diameter	Pass	Partial Pass	Fail	Fail	Fail
Reinforcement: mains >180mm in diameter	Pass	Partial Pass	Partial Pass	Fail	Fail
Connections: mains ≤180mm in diameter	Pass	Partial Pass	Fail	Fail	Fail
Connections: mains >180mm in diameter	CEPA did not test*				
Connections: all services	Pass	Pass	Fail	Fail	Fail

Table 28: Summary of CEPA's findings on the synthetic unit cost update

**it is not clear from the CEPA report whether this item was tested, and it does not provide any results on this item. Ofgem has not commented on this in its DD.*

We are concerned that the Draft Determination (DD) approach disregards CEPA's findings and recommendations, without any justification or explanation of how the DD has resolved or mitigated these issues, or why it considers these issues are irrelevant.

As a minimum, we were surprised that the draft determinations used synthetic unit costs that fail the majority of CEPA's criteria, and in particular, we consider it wholly inappropriate to use any item that fails the GDN variability criteria and qualitative criteria. As we have seen no evidence to suggest otherwise, we assume these issues continue to exist. As such we consider disregarding CEPA's findings a significant error in methodology and we ask Ofgem to develop alternative approaches in line with CEPA's recommendations before Final Determinations.

2. Treatment of outliers

As for the development of the repex synthetic unit costs (see GDQ 33), we are concerned about how the approach to outliers, could bias the model against London and the East of England. In both the CEPA assessment framework and the Step by Step Guide Assessment to Cost Assessment Annex to DD, it is clear that outliers more than 100% away from the industry average unit cost are removed from the calculation. While we understand the concern that a unit cost may be unreasonably skewed by these outliers, we disagree with the blanket removal of all outliers without first considering whether it is appropriate to remove the outlier and whether it creates a bias against particular networks in the regression model.

Given the nature of reinforcement and connection activity, we would expect significant differences in unit costs between GDN. For example:

- they are lower volume activities which tend to be more bespoke in nature meaning unit costs between projects and between GDN may not be comparable;
- as well as job characteristics (such as scale, complexity and demand requirements affecting unit costs), unit costs are also likely to vary due to regional characteristics and other exogenous factors such as Streetworks costs which vary significantly across UK; and
- level of contributions will also affect the unit costs if costs are looked at on a net basis.

Removing outliers without considering these factors will result in a synthetic unit cost that is not reflective of the industry, and will create bias in the model against GDNs with higher unit costs.

Some of these outliers could be addressed by first normalising the costs before calculating the synthetic unit costs, and from the Step By Step Guide to Cost Assessment, it appears adjustments were made for regional pay and productivity differences but other items have not been adjusted for, such as Streetworks which are likely to influence variability in unit costs between GDN (as well as over time). However, we consider there are still likely to be issues remaining due to the variability in connections and reinforcement activity as identified above.

Unfortunately, our ability to understand the treatment of outliers in more detail and how this has affected/biased the synthetic cost driver for our networks has been limited by Ofgem's delay in

sharing its correct synthetic unit cost models with us. We will provide further information as appropriate via
CAWG.

3. Use of aggregation and scaling factors

We are concerned that the approach to developing the DD synthetic unit costs for connections and reinforcements has relied on methodological workarounds rather than good quality data. As a result we are concerned that the resulting unit costs are not a fair reflection of the industry average costs and may inadvertently introduce error into the regression model.

Specifically, we are concerned about the approach to aggregation and scaling factors, and pages 11 and 12 of the DD Step by Step Guide to Cost Assessment describes a high-level approach to applying CEPA's framework:

> *"As a starting point, for all repex and capex (mains reinforcement and connections) activities, we considered the lowest level of disaggregation to which to apply the proposed criteria. First, we ensured a sufficient number of observations (criterion 1) and removed outlier observations (criterion 2). Then, if the calculated synthetic unit cost strongly failed to meet the other selection criteria, we first re-iterated the procedure at a higher level of aggregation (i.e. summing up similar cost activities). If the criteria were still not met, we computed the synthetic unit cost for the activity by applying a scaling factor to the closest activity for which it was possible to compute unit costs within this framework."*

The above approach describes aggregating similar activities where the other selection criteria are not met, and if those criteria still do not apply, a scaling factor based on the difference in synthetic unit costs used at GD1.

As we explain above, we have not been provided with the final DD unit cost model and therefore it is difficult to understand to what extent the scaling factor has been relied on to develop synthetic unit costs for connections and reinforcement, however, from a high-level review of the unit costs, it appears that for connection unit costs, a significant proportion of the unit costs may have been developed relying on a scaling factor, for example, it appears:

- the unit costs for mains >180mm (for new housing, existing housing and FPNES) have been calculated by applying a 29% uplift to the unit costs for mains ≤180mm.
- the unit costs for non-domestic services have been calculated by applying a 300% uplift to domestic services, which is also the difference between unit costs for new housing services and non-domestic services used at GD1.
- The unit costs for existing and new housing services have been calculated with reference to GD1 mains (please see later in our response for errors we have identified in this approach).

If this is the case, half of the synthetic unit costs for connections have been calculated by using a scaling factor, without explanation of why that scaling factor is appropriate. It is also unclear why a scaling factor is a more preferable than accepting that it is inappropriate to develop detailed unit costs and as the DD has not explained any issues in this area it is difficult for us to understand further. We are surprised that this issue has not been the subject of consultation process, particularly as there were opportunities to engage with GDNs on these issues through the Cost Assessment Working Groups. We are concerned that the lack of transparency around the development of synthetic unit conceals substantial errors including in calculation and methodology.

With respect to aggregation, the updated synthetic unit costs for connections are different to those used at GD1, and the DD (unlike RIIO-GD1):

- does not use separate unit costs for new housing and existing housing connections; and
- uses specific unit costs for FPNES.

The inability to develop separate robust synthetic unit costs for new and existing houses raises questions about the quality of the data being used and whether synthetic unit costs should be developed for connections at all. It also highlights the need the develop bottom up cost models to review the accuracy of cost drivers and understand regional factors. Unfortunately, our ability to understand this issue in more detail and has been limited by Ofgem's delay in sharing the correct synthetic unit cost models with us.

4. Errors

We have identified a number errors and inconsistencies in the development of the synthetic capex driver. These are detailed below.

a) Inconsistencies between the unit costs used in the synthetic cost driver model and those in the model to calculate the synthetic unit cost:

We raised in DDQ_103 that the unit costs in the DD synthetic cost model did not reconcile with those calculated in the unit cost model that Ofgem shared with us on 21 August 2020. The table below summarises the differences. In addition, please note that we still have not been able to identify where the unit costs for FPNES mains and services have been calculated.

Capex synthetic unit costs	(3) Synthetic costs	Unit cost model	Difference
Reinforcement General & Specific <=180mm	273,464	267,491	- 5,973
Reinforcement General & Specific >180mm	393,352	381,306	- 12,045
New Housing Mains <=180mm	112,343	81,305	- 31,038
New Housing Mains >180mm	144,922	136,474	- 8,448
New Housing Services	645	645*	-
Existing Housing Mains <=180mm	112,343	81,305	- 31,038
Existing Housing Mains>180mm	144,922	136,474	- 8,448
Existing Housing Services	645	645*	-
Non-Domestic Mains <=180mm	135,705	130,836	- 4,868
Non-Domestic Mains >180mm	135,705	28,879,001	28,743,296
Non-Domestic Services	1,936	1936*	-
FPNES Mains <=180mm	168,849	166,010	- 2,839
FPNES Mains >180mm	217,815	not in model	-
FPNES Services	1,311	not in model	-

***Calculations for services were found in the repex synthetic unit cost model – see below for issues relating to the calculation of unit costs for services*

Table 29: Summary of differences between synthetic unit costs used in synthetic cost model and the unit cost calculations provided by Ofgem

b) Inconsistencies in the calculation of unit costs for services:

Unit costs for new, existing and non-domestic services have been calculated relying on a scaling factor based on the differences between mains and services synthetic unit costs, however, we have identified several errors and inconsistencies in the calculations:

- the scaling factors are applied to unit costs we do not recognise and that are not used in the synthetic cost model. Were the factors applied to the unit costs used in the DD model, the services unit costs would be significantly higher.
- the scaling factor for new housing has been applied to existing housing, although there is a different scaling factor for existing housing.
- the non-domestic services unit cost has been calculated with reference to new housing services, rather than non-domestic mains, and it is unclear why Ofgem has taken a different approach to nondomestic services.
- there is also an inconsistency in how the scaling factors for new housing and existing housing have been calculated. New housing is calculated with reference to ≤180mm mains, while existing

housing is calculated with reference to >180mm mains. This would not be significant, except the scaling factor calculated for new housing using ≤180mm is then applied to a unit cost for >180mm mains.

The tables below show the calculation underlying the synthetic unit costs for services used at DD (including the mains unit costs that Ofgem used to calculate the services unit costs which differ to the unit costs used at DD), and shows a corrected view of services based on DD synthetic unit costs. Please note the difference in the mains unit costs used to calculate unit costs for services to the synthetic unit costs used in the DD synthetic capex driver.

Connections		RIIO-GD1 (09/10 prices)	Scaling factor based on RIIO-GD1	Unit costs used to calculate services	Calculated synthetic unit cost (used at DD)
New Housing Mains <=180mm	(£/km)	94,973		85,064	
New Housing Mains >180mm	(£/km)	122,906		109,732	
New Housing Services	No.	559	-99.41%		645.48
Existing Housing Mains <=180mm	(£/km)	122,906		85,064	
Existing Housing Mains>180mm	(£/km)	156,426		109,732	
Existing Housing Services	No.	1,006	-99.36%		645.48
Non-Domestic Mains <=180mm	(£/km)	156,426		140,105	
Non-Domestic Mains >180mm	(£/km)	156,426		140,105	
Non-Domestic Services	No.	1,676	200%		1,936.45

Table 30: Summary of Ofgem's approach to calculating the services unit costs used in the DD synthetic capex driver

Connections		RIIO-GD1 (09/10 prices)	Scaling factor based on RIIO-GD1	Mains synthetic unit costs (Used at DD)	Calculated synthetic unit cost (used at DD)
New Housing Mains <=180mm	(£/km)	94,973		112,343	
New Housing Mains >180mm	(£/km)	122,906		144,922	
New Housing Services	No.	559	-99.55%		658.74
Existing Housing Mains <=180mm	(£/km)	122,906		112,343	

Existing Housing Mains>180mm	**(£/km)**	156,426		144,922	
Existing Housing Services	**No.**	1,006	-99.36%		931.64
Non-Domestic Mains <=180mm	**(£/km)**	156,426		135,705	
Non-Domestic Mains >180mm	**(£/km)**	156,426		135,705	
Non-Domestic Services	**No.**	1,676	200%		1,976.21

Table 31: A revised view of the services unit costs based on the mains synthetic unit costs used at DD

c) Reflecting the central case for connections and reinforcement in the synthetic cost driver:

Neither the adjusted nor unadjusted synthetic capex driver reflects the central case for connections and reinforcement. As the costs in the regression model were uplifted for connections and reinforcement to reflect the central case, the synthetic driver also needs to reflect the increased workloads. Failure to address this will reduce the regression model's ability to explain costs and will increase error in the model and will result in cost allowances that are too low for Cadent.

d) Using the unadjusted synthetic capex driver in the regression model:

The DD uses the unadjusted repex cost driver in the regression model. By inconsistently regressing lower workload adjusted costs against higher drivers, Ofgem is introducing measurement error into the regression model. As a result, the coefficient on CSV is subject to attentuation bias, creating a downwards bias in the estimated coefficient, and upwards bias in the constant term. The consequence of this bias is to inflate the modelled costs of companies with a lower CSV and reduce the modelled csots of companies with a higher CSV. We, therefore, consider this approach an error[23]. For Final

Determination, Ofgem should use the correctly adjusted repex driver in the CSV used in the regression model.

Conclusion

CEPA identified issues with the synthetic unit costs for connections and reinforcements. We have also raised about Ofgem's approach to developing synthetic unit costs including the apparent:

- treatment of outliers and failure to normalise costs to address variances between GDN,
- use of scaling factors to be able to calculate certain categories of unit costs; and
- other errors in the calculation.

We consider it inappropriate to use the updated synthetic capex unit costs in DD and FD. We consider there are two clear options to calculate the synthetic capex driver for final determinations:

- use the synthetic capex unit costs as used at RIIO-GD1; or
- test synthetic capex unit costs using normalised capex.

[23] See report by NERA: Review of Ofgem's GD2 Draft Detrmination Cost Assessment

As part of our review of the synthetic capex driver, we tested the synthetic unit costs used at RIIO-GD1 and also developed a set of normalised synthetic capex unit costs. Using these unit costs, we calculated alternative versions of the synthetic capex driver and regressed them against the normalised capex in the draft determination normalisation models.

The table below shows the results of the modelling and shows that the DD synthetic capex cost driver was only slightly better than using a capex cost driver based on the synthetic unit costs at GD1, and it performed worse than using normalised unit costs.

Measure of fit (R^2)	2018/19	2013/14 to 2018/19	RIIO- GD2
Historical GD1 (DD approach)	0.93	0.95	0.96
RIIO GD1	0.90	0.95	0.94
Normalised (Cadent test driver)	0.95	0.99	0.98

Table 32: Comparison of performance of alternative synthetic capex unit costs

Given the results of our modelling, Ofgem should review how it has calculated the capex synthetic unit costs and ensure costs are first normalised for regional factors and other items such as Streetworks. If these unit costs still fail the CEPA framework, we consider it inappropriate to use an updated set of synthetic capex unit costs and instead the RIIO-GD1 unit costs should be used to calculate the synthetic capex driver. Failure to do so is likely to increase the level of error in the model and bias it against some networks, resulting in modelled costs that are too low.

In addition, we also refer to our responses to Ofgem's proposals on capex PCDs, and uncertainty mechanisms (GDQ22, 23 and 29). We consider that any PCDs or uncertainty mechanims that are set, should be set in accordance with the company-specific allowances, rather than with reference to an adjusted industry average unit cost.

Gas Distribution Questions

GDQ37 – What are you views on our proposed capex adjustments?

For Cadent, Ofgem have made no adjustments to our base capex costs or volumes for reinforcements or connections under this approach.

However, please see response to GDQ26 in regards to the overall 'partex' approach and the bias this creates.

Gas Distribution Questions

GDQ38 – Do you agree with our assessment of non-regression costs and our proposed adjustments?

No, we have significant concerns with Ofgem's proposed approach to assessment of the non-regression cost items, in particular, the proposed adjustments to MOBs, Streetworks, Smart Metering and Growth Governors. We have identified a number of issues with the DD approach for each of these items, and which are listed below.

MOBs:

- We do not agree with Ofgem's adjustment to MOBs. The allowance takes no account of the safety related work we need to do in RIIO-GD2. The DD is proposing the removal of safety critical investment from High Rise Buildings, at a time when Cadent, government and the HSE are focused on improving the safety of these assets. The DD also ignores customer support and Safety and Reliability are our customers' top priorities.
- Additionally, we have identified six errors in Ofgem's calculations and methodology.

Streetworks:

- *Use of a four-year annual average without reference to any drivers* is inappropriate as it ignores the underlying increase trend from external pressures (as well as uplifts Ofgem has made to connections and reinforcements for the central case). In addition, the choice of four years used for the average is incorrect for the same reason.
- *Disallowing fines and penalties* is inconsistent with the understood logic that allowing an efficient level of fines and penalties, which would be allowed in a competitive market, is in customers' best interests. It is also inconsistent with the approach taken at previous price controls.
- *Disallowing lane rental avoidance charges:* these are costs we incur to avoid/minimise the number of days lane rental we require to deliver jobs, and therefore to minimise Streetworks costs. It is an error to not allow avoidance charges, while allowing lane rental charges.
- *Errors:* We have identified several errors in the DD, as well as an error in the submission we provided in March 2020. All of the errors we have identified benefitted Cadent at the DD, and we have provided more information on these in our detailed response below.

Smart metering:

- There is an error in Ofgem's analysis of our business plan proposal. This has resulted in a mistaken conclusion that we assumed a 3% intervention rate in our business plan, and then reduced our plan cost by 17% to reflect a reduction in the intervention rate to 2.5%. However, our business plan was based on an average 2.3% intervention rate (with small variations in that rate between our networks). It is incorrect to apply a downwards adjustment to our proposed costs and workloads, instead, we consider Ofgem should have uplifted them to 2.5% consistent with its approach to other non-regression items and regression modelled costs.

Growth Governors:

- While we have not proposed any investment for Growth Governors in GD2, we disagree with the approach Ofgem has taken to Growth Governors which excludes their cost from the regression model while including the costs of alternative solutions. This approach reduces the ability of networks to manage trade-offs and creates bias in the model against companies which invest in alternative solutions.

Diversions:

- We agree with Ofgem's approach to basing allowances on the GD1 historic run rate. Our business plan submission was based on 80% of the historic workload and Ofgem has accepted this in full but not uplifted our allowances to the historical run rate. We believe this is an error, and Ofgem should uplifted our allowances consistent with its approach to other areas (e.g. Growth Governors, regression modelled costs, connections etc.).

As highlighted above in our headline response, we disagree with the DD's proposed approach to the assessment of MOBs, Streetworks, Smart Metering, Growth Governors and Diversions. We address each of these items below in detail.

In addition to the issues we raise below, there is an issue which is common to all non-regression modelled items which needs to be addressed. As part of the Draft Determination (DD) approach to calculating the implicit adjustment, Ofgem applies the scalar factor derived from the regression model to non-regression modelled costs. This is inappropriate for two reasons:

- First, it amounts to double counting the efficiency challenge – these items have already received significant efficiency challenges (for example, as much as 20% in London) therefore it is double counting to apply a further challenge based on the regression model results; and
- Second, it is inconsistent with Ofgem's DD methodology – Ofgem has deemed the separate assessment items inappropriate to include in the regression model, therefore, it is inconsistent and an error to assume that the efficiency results of the regression model can be applied to these items.

As such, we consider it an error to apply the efficiency challenge derived from the regression model to the non-regression items. See GDQ41 for our more detailed response to this issue.

1. Multiple Occupancy Buildings:

The DD is proposing the removal of safety critical investment from High Rise Buildings, at a time when the government, the HSE and the gas industry are focused on improving the safety of these assets. We are proposing significant increases in work in RIIO-GD2 to improve safety and performance for our MOBs customers, reflecting the changing societal risk thresholds. The DD also raises concerns about our ability to increase resources to deliver the plan. The DD cuts £34.6m from Cadent's proposed Maintenance Budget for Multiple Occupancy Buildings (MOBs). This results in cuts to key maintenance activities in North London of 10,300 Pipeline Isolation Valves (PIVs), 22,500 Network Diagrams that isolates and identifies the pipes in a building needed in an emergency, and 4,900 brackets that reduces deterioration and future interruptions for customers. The DD analysis that supports this reduction is flawed because it takes no account of the work that needs to be done in RIIO-GD2, instead it joins cost and volume factors that are independent to each other to create a relationship that is not reflective of reality. Ofgem has also accepted that it contains errors through the DD Question process. More fundamentally the reduction removes funding which is essential to keep our customers safe and which we are mobilising to deliver.

a) Errors in the Ofgem Approach

The Table below is taken from Table 43 in the Cadent Annex, with the addition of the Cadent submitted costs and percentage change columns.

Network	Costs (gross)	

	Cadent submitted costs £m	Submitted (input) [Ofgem modified] £m	Modelled (output) £m	Change from Cadent submitted
MOBs maintenance				
East of England	16.4	16.2	13.8	-16%
London	60.3	59.3	26.3	**-56%**
North West	13.9	13.7	11.7	-16%
West Midlands	8.0	7.9	12.1	+51%
Cadent	**98.6**	**97.0**	**64.0**	**-35%**

Table 33: Allowed MOBs maintenance costs versus submitted

The analysis which Ofgem has conducted to compare past and predicted costs based on a ratio of historic MOBs Repex workloads to MOBs Maintenance spend by networks is flawed as it takes no account of the work we need to deliver in RIIO-GD2. It results in additional work beyond that requested being added to our West Midlands network and significant work volumes being removed from the network with the largest asset base of MOBs – North London. The analysis is not credible, particularly in light of the Grenfell tragedy and when there is safety critical work (identified from surveys) that we must deliver.

We have undertaken analysis with the most recent 2020 data available to re-check the plan submitted in December 2019. The analysis reinforces our December plan and strengthens the importance of this funding for these maintenance works that follow-on from our survey results.

Error 1

In the DD, Ofgem stated that we had submitted £97m for MOBs. This is not the figure we supplied in December BPDT (£98.6m). Ofgem has, in error, made an adjustment £1.6m to Cadent's BPDT figures. This error was acknowledged in response to CADENT_DDQ_23 and when corrected will return £1.6m back into the plan.

Error 2

Unrepresentative data from the early years of RIIO-GD1 have been included in the calculation of the adjustment figures.

Following engagement with the HSE at the mid-point of RIIO-1, the industry has undergone a step change in its management of MOBs and as such workloads prior to this should be adjusted to reflect this change. Using spend data from 2018 onwards is more representative of the expenditure today, but even that is likely to understate the amount of work required in RIIO-GD2 due to the lag between increased inspection and increased work delivery.

Error 3

Failure to make adjustments for London's MOBs asset population and associated volume of maintenance works. North London has more MOBs customers than any other UK GDN, and likewise it has more than in all of Cadent's other networks combined. Appropriately scaled adjustments must be carefully applied during assessment, when one network is clearly such an outlier.

Error 4

The adjustments that Ofgem has made are based on the mapping of historic maintenance expenditure (investment on risers) to buildings maintenance investment (investment in the environment around the riser). These are different work activities. This latter workload arises from increased surveys conducted since 2018 that are required to achieve compliance and meet the standards expected by the HSE.

To illustrate the impact of Errors 3 and 4, a comparison table of Cadent's proposal and Ofgem's DD is below:

		EoE	Lon	NW	WM
No. of MOBs Customers		79,022	288,183	69,628	51,729
Cadent December Position	£ spend / MOB customer	£208	£209	£200	£154*
Ofgem Draft Determination	£ spend / MOB customer	£175	£91	£168	£234
% change vs. submitted proposal		-16%	-56%	-16%	+52%

Table 34: Comparison of Cadent's Business Plan to DD

* Given the MOB survey results, in RIIO-GD2 the West Midlands network has lower maintenance activity workloads identified, translating into a corresponding lower spend per customer than the other Cadent networks. West Midlands unit costs for each maintenance activity are comparable to other Cadent networks.

Error 5

The analysis conducted is not grounded in the delivery of a safe service. A mechanistic approach to removing workload based on broad-brush comparisons is not consistent with Ofgem's duty to fund our activities, aligned with the Utilities Act and Energy Act for the interests of poor, chronically sick, old and disabled customers. The adjustments made are disproportionate to the need, providing inadequate funds to complete work in London, while providing more funding than work identified in the West Midlands.

Despite reductions in allowances there is work we must continue to do:

- Inspections in HRB and MRB to understand current condition and identify any severe corrosion

- Severe Corrosion Interventions, to remove deterioration found, protecting customers and the public

Based on our inspection data, we forecast that London needs 58% of all Cadent's Inspection and Severe Corrosion intervention spend in RIIO-GD2 and therefore the DD reduction leave us with a disproportionately small remaining budget to conduct the remaining follow-on maintenance jobs in London. Given a reduction of the scale proposed in the DD it will simply not be possible to deliver Cadent's submitted plan outputs. Further details on these workload ouputs are provided in supporting information at the back of this question response.

Ofgem has ignored their independent engineering review

We note that Ofgem has ignored the recommendations of its advisers in this area, who suggested a materially smaller reduction in the allowance for MOBs fault repairs.

b) We are putting in place resources to deliver the plan

In our response to CADENT_SQ_ENG_65 we have outlined our risk mitigation strategy of resourcing of labour and setting out the associated cost to deliver the volumes of fault fixing work.

We:

- Have undertaken a tender exercise in Autumn 2019 (giving cost confidence to our submission)
- Are putting the contractors to work in 2020
- Are growing our supply chain and
- Are developing processes and systems that support these new work streams.

We have conducted a step-up in work activity:

- In the North West we have started a trial of conducting MOB remedial works in June 2020, rectifying PIV related issues and installing Marker plates. We are looking to expand this trial further, conducting the installation of pipe supports where requirement has been identified from surveys and then the remaining elements of MOBs maintenance thereafter.

Additionally, we are progressing the tender process for works in London ensuring that a procurement framework is in place with contracts awarded to suppliers for MOBs repair activities during Autumn 2020.

We have a proven track record of increasing delivery. We have undertaken a four-fold increase in MOBs maintenance in London in RIIO-GD1 between years 2018/19 and 2019/20 to meet the need of conducting detailed inspections, repairs and improvements, as shown in our submitted business plan data tables.

To expand into conducting improvements in these MOBs that we have identified through surveys, we need to increase our resources once more at the start of RIIO-GD2. Thus, for **RIIO-GD2 only a twofold increase** is required, with subsequent small rises in required resources and associated spend during the RIIO-GD2 period.

c) The work is needed - Why our RIIO-GD2 proposals are significantly different than RIIO-GD1

The inspections undertaken in the latter years of RIIO-GD1 (which are greater in detail than previously) have identified a larger consequential workload of minor interventions required to bring these assets up to standard. There is an expectation by the HSE that we will complete the identified work by the end of RIIO-GD2 as stated in section 4.1.1 of Appendix 9.04 to our Business Plan.

The HSE have made MOB related safety a priority area for all GDNs. We must undertake this work to keep our customers safe. If not undertaken, then the HSE have shown that they are willing to prosecute for MOBs non-compliance. Close working with the HSE provides assurance that these work volumes are required.

On this basis it is not appropriate to apply historic spend ratios between different MOBs works to RIIOGD2 – the world is different now, with different realities and additional requirements that drive us to resolve additional faults which will ensure we deliver to the new standard we are holding ourselves to along with what our customers and the HSE expect.

d) Customer support

From the customer engagement we have undertaken, Safety and Reliability were the top priorities for customers and the public. During joint GDN engagement it was made clear that proactive checking of pipes to allow issues to be flagged and intervened in advance of failure were key messages.

This maintenance work will support these safety and reliability needs by, for example, improving isolation provision, asset understanding with diagrams and communication through appropriate signage.

The DD proposals seriously limit our ability to conduct our planned maintenance programme and therefore increases the number of reactive repairs we must carry out, this is not in line with customer needs and expectations.

e) Summary

With the DD proposals London customers will be treated differently to other networks – with a lower level of service and safety than MOBs customers in Cadent's other networks (EoE, NW & WM).

We have faults identified through surveys that we are required to fix / resolve. We will only be able to intervene on 40% of faults found in London if the DD position is fixed or complete the work unfunded presenting yet more asymmetric downside risk.

London is the network where we have our biggest need, yet the cost allowance has been disproportionately reduced through an approach that doesn't seem to align to these needs and therefore gives an increase to West Midlands.

London customers will be exposed to risks which would have been resolved in our other networks and it is not reasonable for us to expect our MOBs customers or the HSE to be satisfied with this.

If we are not adequately funded for the work in London, then Ofgem is failing in its duty fund our obligations to protect the public from the dangers arising from inadequate maintenance of MOBs, which we are legally obliged to carry out. . Our work managing MOBs assets is critical to protecting the public from danger, in addition to supporting local authorities and emergency services.

2. Streetworks

- We disagree with Ofgem's proposed approach to Streetworks costs. There are four key issues with the approach:
- The use of a 4 year annual average to set allowed costs for GD2 without any reference to scale changes i.e. permit numbers and the number of new permit schemes introduced before the end of GD1. Additionally, the years chosen result in a low cost allowance that is not representative of current or future efficient costs.
- Disallowance of all penalties and charges – setting higher expectations for GDN than for an efficient company, and which creates perverse incentives for GDN resulting in higher costs for customers.
- Disallowance of costs to avoid lane rental charges, despite those costs being considerably lower than lane rental charges. This approach creates perverse incentives for GDN and will result in higher costs for customers.
- We have also identified three errors in the DD, and which we explain below.

a) Use of 4 year average to set allowed costs for GD2:

While we agree with the DD approach to assessing GDNs separately, which ensures regional differences are reflected in cost allowances, we do not agree with Ofgem's proposed approach to using a 4 year average as the basis for determining allowed costs. We have two primary issues with this approach:

i. The approach does not consider the impact of key drivers on costs.

Ofgem has determined GD2 costs based on a four-year average of the annual costs between 2016/17 and 2019/20, without reference to any cost drivers. In addition, Ofgem's assessment of Streetworks costs shows three possible annual averages were considered and that the average that that generated the lowest GD2 costs was chosen, without any considering the appropriateness of any of the averages. We were surprised with this approach, given the Business Plan Data Table required costs and workloads to a greater level of detail than currently in the RRP. For each cost item, we developed specific costs and workload forecasts at an opex, capex and repex level which have been ignored without justification being provided by Ofgem.

As we explained in our March 2020 revised Streetworks submission, there are a number of drivers of Streetworks, and our March 2020 supplementary document explained for each cost item what the drivers were, the basis of the unit cost that was used and why we considered our approach appropriate. Without looking at the costs and workloads at this level, it is not possible to set a cost for GD2 that is representative of the efficient cost to deliver that work. As such, the DD's approach to modelling the efficient cost of Streetworks is flawed.

Basing the GD2 costs solely on an annual average figure without reference to these cost drivers, results in GD2 allowances that are below the efficient level costs that a GDN could reasonably deliver in GD2. In addition, Ofgem's proposed uncertainty mechanism for Streetworks does not provide any protection from increases in costs above the level allowed in the DD, as it only provides protection for new requirements introduced in GD2. Therefore an increase in costs, for example, due to new permit schemes introduced in the last year of GD1 won't be covered.

To illustrate this issue, the following three tables provide a simple comparison of:

- our actual 2019/20 Streetworks costs to our forecast costs at the end of GD1 and the average annual forecast costs in GD2[25];
- the number of HA operating permit schemes underlying our Streetworks costs and forecasts to those within the averages considered in the DD separate assessment model; and
- permit numbers underlying our Streetworks costs and forecasts to those within the averages considered in the DD separate assessment model.

The first table below shows that in all but two cases, the averages considered at DD are below the current costs incurred in 2019/20. They are also, in all but three cases, below the GD2 forecasts, which are already lower than our 2019/20 actuals. This is unsurprising given that the

[25] Note, the 2019/20 costs are taken from the 2019/20 RRP. In addition our forecast costs are slightly different to those provided in March 2020 as we have amended an error relating to Parking Bays that we have since found. We explain this error later in this section.

DD's averages do not take into account any cost drivers such as the increase in the number of permits due to HAs introducing new permit schemes in our network.

				Ofgem's choice of averages		
costs	Actual 2019/20	Forecast 2020/21	GD2 average	2016/17-2019/20 (used for DD)	2017/18-2019/20	2017/18-20/21
EoE	10,965	15,703	12,200	9,261	10,454	11,767
Lon	14,077	18,883	15,235	12,620	13,396	14,768
NW	5,588	6,585	4,595	4,382	4,699	5,170
WM	3,907	4,241	3,410	2,875	3,228	3,481

Table 35: Comparison of annual average costs compared to the averages Ofgem considered as part of its DD analysis

Note: As highlighted earlier, we based our GD2 forecasts on the base case for connections and reinforcements, as such our permits forecasts for GD2 are not representative of the central case and are therefore too low. Consistent with elsewhere in Ofgem's determination, allowances should be based on Ofgem's view of efficient costs and workloads on the central case. For example, we estimate that amending our Streetworks forecasts for the connections central case would increase GD2 Streetworks costs in total by c.£9m across the four networks. This equates to increases in costs of 6% for EoE, 4% for Lon, 3% for NW, and 5% for WM.

The second table below shows that all of the averages considered are based on a situation where there were fewer HA operating permit schemes than are currently operating permit schemes and significantly lower than the number of HA that will be operating permit schemes by the end of GD1, by when all HA in our network will be operating permit schemes. As such, the DD's averages are not representative of our current operating environment, let alone the operating environment we will certainly be operating under in GD2. The DD's proposed

Streetworks uncertainty mechanism does not address this, as it is almost certain that all HA within our networks will be operating permit schemes before the start of GD2 and therefore we will be unable to trigger a reopener.

				Ofgem's choice of DD averages		
no. of HA	Actual 2019/20	Forecast 2020/21	GD2 average	2016/17-2019/20 (used for DD)	2017/18-2019/20	2017/18-20/21
EoE	26	30	30	25	25	26
Lon	34	34	34	33	34	34
NW	23	23	23	21	22	22
WM	10	14	14	7	7	9

Table 36: Comparison of the number of HA operating permit scheme

To add to this, the next table below compares permit numbers to those underlying our Streetworks costs and forecasts to those within the averages considered in the DD separate assessment model. It shows that the averages considered are not representative of current operating conditions, and in most cases not representative of the operating conditions in GD2.

Even in the case of London, which has been fully permitted since 2018/19, Ofgem's choice of average does not fully represent its operating conditions, and the average number of HA operating permit schemes between 2016/17 and 2019/20 is lower than the number operating in 2018/19.

As we explained in our March 2020 Streetworks Supplementary Document, our permit volume forecasts are based on:

- changes in opex, capex and repex workloads;
- the increase in the number of HA operating permit schemes by the end of GD1, when we expect to be fully permitted; and
- the decrease in average project mains replacement length.

Therefore, we consider our permit forecasts to be a fair representation of the number of permits we will receive and work under in GD2.

				Ofgem's choice of DD averages		
no. of permits	Actual 2019/20	Forecast 2020/21	GD2 average	2016/17-2019/20 (used for DD)	2017/18-2019/20	2017/18-20/21
EoE	19,557	25,003	20,301	17,198	18,658	20,244
Lon	15,693	16,789	14,523	16,261	15,569	15,874

NW	19,081*	24,335	19,448	17,783	17,724	19,377
WM	5,711 *	8,014	7,289	4,377	4,451	5,342

Table 37: Comparison of number of permits

Note:

- The number of permits in 19/20 in NW and WM are not representative of 23 and 10 HA (respectively) operating in the year. In NW, one HA introduced a permit scheme in February 2020 so the permits do not represent a full year of that HA operating. Similarly, in WM 3 HAs introduced permit schemes in May and June 2019.
- As highlighted earlier, we based our GD2 forecasts on the base case for connections and reinforcements, as such our permits forecasts for GD2 are not representative of the central case and are therefore too low. Consistent with elsewhere in Ofgem's determination, the allowed Streetworks costs should be based on Ofgem's view of efficient costs and workloads on the central case.

As the tables above show, setting GD2 costs based on a simple annual average with no regard to drivers is inappropriate, and that none of the averages considered in the assessment take into account changes in scale. Basing the GD2 costs solely on an annual average figure without reference to these cost drivers, results in GD2 allowances that are below the efficient level costs that a GDN could reasonably deliver in GD2. In addition, Ofgem's proposed uncertainty mechanism for Streetworks does not provide any protection from increases in costs above the level allowed in DD as it only provides protection for new requirements introduced in GD2. Therefore an increase in costs due to shorter project lengths or new permit schemes introduced in the last year of GD1 won't be covered.

For final determinations, Streetworks allowed costs should be based on our forecast volumes. Our March 2020 Streetworks supplementary document set out our approach to forecasting different Streetworks Volumes by different cost items and at an opex, capex, repex level to reflect the different nature of Streetworks for different type of work. We have summarised our approach in the table below, and we consider our approach provides a rational and fair forecast of Streetworks volumes, which should then be used with unit costs to set efficient GD2 allowances. More information is available in the Streetworks supplementary document we provided to Ofgem in March 2020.

	Approach to Forecasting Streetworks Volumes	Reference to March 2020 Streetworks supplementary document
Permit numbers	Based on 2018/19 permit to workloads ratio and forecast using forecast GD2 workloads (condition reports, connections and mains decommissioned). Forecast repex permits adjusted to reflect on average shorter project lengths in GD2 will drive increased permit numbers. Note, forecast each type of permit separately.	Page 5
Chargeable variations	Based on 2013/14 to 2018/19 average number of variations to permits and forecast number of permits	Page 6

Traffic Orders & Notices (TTRO/TTRN)	Based on the number of 2018/19 TTRO/TTRN and assumed the volume will change in line with forecast permit numbers	Page 6
Lane Rental & Avoidance costs	**No. of days incurred lane rental charges:** Assumed number of days we incur lane rental fees is likely to change proportionally to permit volumes, as those forecasts take into account changes in workload and shorter project lengths. **Days avoided lane rental**: number of days we can avoid lane rental depends on the opportunity and that it is economic to spend money to avoid lane rental charges. As such, used the 2015/16 to 2019/20 average number of days avoided per job, and multiplied by our forecast number of lane rental jobs.	Page 7-8
Inspections	Number of inspections not driven by permits but workload, and take place at same rate in areas without permit schemes. As such for each type of inspection, developed specific forecast based on 2018/19 number of inspections to workload.	Page 9
Suspensions & Switch-outs	Do not have number of parking bay suspensions or number of individual switch outs, therefore forecast each item on the basis of 2018/19 number of work orders and assumed will change in line with forecast permit numbers.	Page 10
	Approach to Forecasting Streetworks Volumes	**Reference to March 2020 Streetworks supplementary document**

Charges/ Penalties	**NRSWA Fixed Penalty Notices (FPN):** as not related to permits, forecast on 2018/19 ratio of NRSWA FPN to workload and multiplied by forecast GD2 workloads. **TMA Fixed Penalty Notices (FPN):** these FPN solely related to permits, therefore used 2018/19 ratio of TMA FPN to permits and multiplied by forecast permit numbers. **S74 Overstay Charges:** these charges are not specific to permits and can be incurred for work under NRSWA notices. Therefore forecast GD2 workloads based on 2018/19 ratio of s74 Overstay Charges to workloads. For all three types of charges, we assumed a 1% per annum improvement in number of charges from 2019/20 to the end of GD2.	Page 12
TMA Administration costs	Did not forecast specific administration workloads, but as administration costs are solely costs of operating under permit schemes, we used number of permits as a cost driver.	Page 15
TMA Condition related productivity costs	Did not forecast number of conditions, but as these costs are solely costs of operating under permit scheme, used number of permits and length of main decommissioned as cost drivers. Specifically, used permit numbers as driver for opex and capex forecasts. For repex, used both km decommissioned and permit numbers to reflect that both can drive the number of conditions and costs.	Page 15

Table 38: Summary of Approach to Forecasting Streetworks Volumes

In addition to basing forecast Streetworks allowances on our forecasts, an adjustment will be need to be made to our forecasts so that they reflect the central case for reinforcements and connections as our March 2020 submission was based on the base cases in our December Business Plan. As such our March 2020 permits forecasts for GD2 are not representative of the central case and are therefore too low. Consistent with elsewhere in Ofgem's determination, the allowed Streetworks costs should be based on Ofgem's view of efficient costs and workloads on the central case.

ii. The 2016/17 to 2019/20 average is not representative of current or future efficient costs

As discussed above, we disagree with using a simple annual average to set future Streetworks costs without any consideration of cost drivers. In addition, we also disagree with Ofgem's choice of years to form the average as those years do not provide a fair representation of efficient GD2 unit costs. However, we are supportive of the approach of using GDN specific averages, which ensures different characteristics between GDN are recognised and reflected in GD2 costs, and which would otherwise be difficult to control for e.g. scale of fees varying significantly between HA, complexity of permit conditions etc.

Overall, it is difficult to compare unit costs at a total Streetworks level, as many of the components have different factors driving the unit costs, which are not reflected in inflation and are not related to inefficiency. As such it is inappropriate to look at annual Streetworks unit costs as a method of determining efficient Streetworks costs.

For example, taking just the average unit costs of permits, the unit cost can vary each year due to:

- the mix of different permit types each year – with more major permits driving up unit costs, and
- the cost of different permits varying between HA, though in our experience, new permits schemes that are introduced are now more usually closer to the maximum allowed fee than permit schemes introduced earlier in GD1, driving up unit costs.

Similarly, the unit costs can increase due to:

- HAs regularly updating their costs of parking bay suspensions and switch-outs to allow them to recover their actual costs and advertising fees;
- TfL changing its fee structure for lane rental charges: TfL last revised its lane rental charges in 2012, and confirmed in March 2020 that it will apply to the DfT to amend its lane rental scheme again, which will increase the fees driving up unit costs (see table below);
- uplifts in unit costs of contractors to deliver the work e.g. due to increased labour costs as well as increasing complexity of permits and number of conditions; and
- changes in the mix of opex, capex and repex work as each different type of work has different unit costs reflecting the different characteristics of the jobs.

	Current		Proposed scheme	
Charge band	**Daily charge**	**Split of TfL lane rental coverage**	**Daily charge**	**Split of TfL lane rental coverage**
High	£2,500	39%	£2,500	15%
Medium	-	-	£1,500	30%
Low	£800	61%	£1,000	55%
% of TfL network covered by lane rental scheme	56%		72%	
Footway charge	-	-	£350	2%

Table 39: Summary of TfL lane rental charges under the current scheme, and the new scheme

As such using an average with years prior to 2018/19 results in lower unit costs for reasons other than efficiency. For these reasons, we developed our forecasts for each streetworks activity at an opex, capex, repex specific unit costs based on 2018/19 unit costs, as we considered this a fair and pragmatic basis of forecasting the future and considered it was a conservative estimate as it did not require us to forecast possible future increases in unit costs e.g. due to

- changes to the lane rental charging structure (which we did not take into account as we considered it too soon to understand the impact on unit costs, despite the change being almost certain – note we did take account of the expansion of the rental scheme coverage from 56% to 72% of the TfL network);
- changes to other fee structures such as to maximum permit fees and inspection fees, that could take place due to changes in Government guidance or legislation;
- costs increasing above inflation e.g. costs such as parking bay costs where HA are entitled to recover their costs and the costs of advertising.

In addition, where we thought it was likely that unit costs would remain flat in nominal terms over GD2 (e.g. permit fees, FPN, sample inspection fees), we deflated the costs to reflect this despite the fact that these costs could increase in GD2 as a result of new guidance or legislation from Government.

As such we consider our GD2 Streetworks forecasts are a fair view of efficient costs for each of our networks, and take a conservative view of future unit costs. We therefore consider Ofgem should accept our costs forecasts in full.

b) Disallowing all penalties and fines:
Ofgem has disallowed all costs relating to penalties as it considers that these costs are "within GDN's control and are levied by HAs due to failure by a GDN or its contractors to comply with agreed permit conditions, These conditions are in place to ensure sites are managed safely and effectively and there must be a strong incentive on GDNs to comply with these requirements."

While we agree that penalties such as fixed penalty notices (FPN) under the New Roads and Street Works Act 1991 (NRSWA) and the Traffic Management Act 2004 (TMA) and s74 overstay charges are largely within GDNs' control, the DD's proposal to disallow all costs associated with penalties is an error and does not reflect the complex operating environments that GDNs face and that it is neither efficient nor practical to reduce penalties to zero. As a result by disallowing all costs associated with penalties, the DD has set efficient costs beyond the frontier.

Ofgem recognised this at RIIO-GD1 and allowed an efficient level of penalties and fines as it saw:

> *"that there is an efficient level of penalties and GDNs would incur disproportionate costs, which would ultimately be passed to the customer, if they were to achieve zero penalties."*[24]

Therefore, consistent with Ofgem's previous approach at price controls, an efficient level of penalties should be included in totex allowances, and also in the Totex Incentive Mechanisms when incurred, for the following reasons:

[24] Ofgem, RIIO-GD1:Initial Proposals – Supporting document – Cost efficiency page 27

- First, an efficient level of penalties (FPN and s74 overstay charges) would be allowed in a competitive market. Ofgem regulates revenues, using price controls, so that prices charged by monopoly energy networks are set to recover an efficient level of cost and no more. In a fully competitive environment, an efficient level of all costs, including those relating to unavoidable failings or shortcomings, would be included within prices.
- Second, the efficient level of penalties is greater than zero. No business, regulated or unregulated, operates perfectly with no shortcomings. As would be expected, all energy networks incur a level of penalties, consequently, the efficient level must be above zero. The alternative approach would be to fund licensees to have sufficient resources to never incur a penalty. This would be economically incoherent as customers would pay excessive sums for such a service.
- Third, treating penalties differently to other costs encourages GDNs to act inefficiently. One of the strengths of Ofgem's RIIO approach has been the equalisation of incentives across different categories of expenditure, encouraging GDNs to adopt the lowest cost solutions. In RIIO2, if penalties are made entirely for the account of shareholders, with a maximum incentive of 50% on other costs, GDNs will be incentivised to spend up to £100 in other costs to avoid a penalty of £50, which is not efficient, and undermines the RIIO approach. Additionally, our business plan was prepared on the basis of an efficient level of penalties being allowed, if they are not allowed our plan will need to be uplifted to reflect the increased expenditure we will incur in avoiding them completely.
- Fourth, because the efficient level of penalties is greater in some networks than others, not allowing them penalises some networks more than others. For example, in the case of TMA FPN - we note that the provisions of the TMA 2004 only apply in England and not in Wales or Scotland. Consequently, not allowing TMA FPNs disproportionately affects those GDNs operating in England, rather than Scotland or Wales.

Based on the above reasons we believe a fair and proportionate approach would allow an efficient level of fines and penalties determined with reference to other GDNs. We, therefore, support Ofgem setting an efficient level of penalties based on the industry average, and where necessary making adjustments to recognise network characteristics outside of the GDNs control. We consider this consistent with the approach taken at RIIO-GD1. Due to differences between NRSWA and TMA FPN, and also between FPN and s74 Overstay charges, an efficient level needs to be determined separately for each type of penalty. In addition, analysis on penalties will need to recognise:

- Scotland is subject to a completely separate penalty regime e.g. it only incurs FPN under the Road Works (Fixed Penalty) (Scotland) Regulations, which while similar to the NRSWA FPN covers fewer offences, and is not subject to the TMA 2004 or s74 Overstay Charges.
- For TMA FPN, the level of permit schemes in effect in each country differs and for example Wales and Scotland do not have any permit schemes.

Penalty/ Fines	Efficient unit cost	Efficient volume
NRSWA FPN	Set at industry average cost per FPN for 2019/20 Note may be higher than £80 early payment fee due to GDN challenging FPN, which is in customers' best interests.	Use industry average number of FPN to number of NRSWA notices and permits for 2019/20. Uplift using each GDN's GD2 forecasts of notices & permits
TMA FPN	Set at industry average cost per FPN for 2019/20 Note, the efficient unit cost will be higher than £80 early payment fee due to: FPN for working without a permit incurring fines of £500 (£300 when paid early). In addition, GDNs challenge FPN and therefore are not always able to pay early. We consider it in customers' best interests that we challenge FPN where it is appropriate to do so. For example, in 2018/19 we challenged 13% of the FPN received. About 40% of the FPNs challenged were withdrawn. Where we challenged and did not succeed, c. 7-10% resulted in missing the early repayment price. After taking into account that in some cases challenging resulted in missing the early payment price, at a Cadent level,in 2018/19 we estimate that we saved c. £85k through challenging FPNs.	Use industry average number of FPN to number of permits in 2019/20 Uplift using each GDN's GD2 forecasts for permits
S74 Overstay Charges	Should be treated separately to other FPN as under different powers with completely different charging structure. HAs have significant discretion in determining appropriate fines within the maximum charging structure, which can allow charges of up to £10k per day. In addition, can waive and reduce charges as they see fit. As a minimum should allow an efficient level of £ per overstay notice based on industry average. Though this won't address differences between HAs.	Use industry average number of s74 Charges to number of NRSWA notices and permits for 2019/20. Uplift using each GDN's GD2 forecasts of notices and permits.

Table 40: Proposed approach to setting the efficient level of penalties and fines

Note, when setting the level of efficient charge and efficient volumes it will be important to correct for any differences between the RRP and BPDT and that all GDNs provided information on a consistent basis. In our own review of fines and penalties, we found significant differences between the data reported in the RRP and BPDT which would have a material impact on any efficiency analysis, for example:

- For number of s74 Overstay Charges, NGN appears to have reported the number of days that incurred a charge in the RRP and BPDT, rather than the number of charges received. All other GDNs appear to have reported the number of charges.
- Southern's number of NRSWA notices is three times higher in the BPDT than in the RRP.
- NGN's number of NRSWA FPN is significantly lower in the BPDT than that reported in the RRP.
- For several NGN and SGN there are differences in the number of permits and notices reported in the RRP to those reported in the business plan tables.

c) Disallowing lane rental avoidance charges:

We incur avoidance costs to avoid/minimise the number of days we incur lane rental charges. Lane rental charges are expensive, currently the only HA within our networks operating a lane rental scheme is Transport for London (TfL) in our London network, which charges between £800 and £2,500 a day for lane rental. We, therefore, proactively look for opportunities to reduce the number of days we incur lane rental charges where it is economic to do so, for example, by employing different shift patterns, using fast drying cement etc.

At the moment, TfL's lane rental scheme covers 56% of its network and the table below summarises the current charging structure and also sets out changes to the lane rental scheme which we expect TfL will bring into effect before the start of GD2. The earlier table summarising lane rental charges shows that both the average cost of lane rental will increase in GD2, as well as the number of days we are likely to incur charges due to TfL expanding the scheme to cover 72% of its network.

In our March 2020 Streetworks submission, we forecast in total c.£400k (£69k p.a.) of avoidance costs in GD2 based on an estimate of avoiding 283 days lane rental each year. This assumed that we could avoid approximately 15% of the number of lane rental days that we would otherwise incur if we did nothing. As a result of including avoidance costs, our forecasts for lane rental costs were c.£2m lower than they would have otherwise been.

Looking at our GD1 experience between 2013/14 to 2018/19, we spent c. £600k to avoid 2007 days in lane rental fees. Over that period, on average it cost £297 per day of lane rental avoided, compared to the average cost of £1462 per day of lane rental charges. This resulted in us avoiding c.£3.2m of lane rental charges, which customers benefited from through the TIM. This demonstrates that our proposed avoidance costs are efficient and in customers' best interests.

Additionally, Ofgem should allow avoidance costs as not to do so unfairly penalises us compared to other GDN who either do not have lane rental schemes in their area, or in the case of SGN, the lane rental charges are significantly lower and there is perhaps not the same economic case for trying to avoid charges.

Finally, if Ofgem continues to disallow avoidance costs, it will need to uplift our forecast lane rental costs by c. £10.5m over RIIO-GD2 in order to recognise that our lane rental costs are lower than they otherwise would have been had we known avoidance costs were disallowed, and to treat us on an equivalent basis with other GDNs. These higher costs would also need to be reflected in the unit costs used for uncertainty mechanisms and PCDs.

d) Errors

We have identified three errors in the DD, one is an error that we identified in our March 2020 submission, and the other two are errors we have identified in the DD calculations. All three errors have benefited Cadent and we have identified them as part of our fair and transparent approach to reviewing DD. We explain each of the errors below:

i. Administration costs within our March 2020 submission:

Our review of the DD as well as our 2019/20 actual costs has identified an error in the administration costs we submitted to Ofgem in response to SQ_CA_27, which requested GD1 and GD2 cost information for administration and condition-related productivity costs. The GD1 administration costs included in that return were based on the costs we had reported in the RRP, and the forecast costs were based on our forecast of permit numbers for GD2 and the 2018/19 administration cost per permit as reported in the RRP.

At the time, we were unaware that in 2017/18 and 2018/19, EoE and Lon included parking bay suspension costs under field related administration costs. They have also continued this approach for the 2019/20 RRP. As a result, our response to SQ_CA_27 resulted in a double count of parking bay costs, as we also separately identified all parking bay costs in the streetworks business plan data table
(March 2020 version). The table below shows in 2018/19 prices the value of the parking bay suspensions included under administration costs for EoE and Lon

(£m, 2018/19 prices)	2016/17	2017/18	2018/19
EoE	-	0.064	0.166
Lon	-	1.660	3.222
Total	**-**	**1.724**	**3.388**

Table 41: Value of parking bay suspensions included under administration costs in the RRP

As the forecast admin costs in our response to SQ_CA_27 were based on the 2018/19 unit cost (administration cost per permit), we have reforecast the administration costs for EoE and Lon. The tables below provides the revised administration costs which addresses the double count and compares them to the costs submitted in March 2020. The numbers below have also been updated to reflect 2019/20 actuals. Please note as the issue only arises from 2017/18 onwards, therefore, the tables below only show revised administration costs for 2017/18 to 2025/26.

(£m, 2018/19 prices)	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
EoE revised	2.766	2.934	3.490	4.357	3.270	3.292	3.328	3.310	3.284
EoE (SQ_CA_27)	2.830	3.100	4.050	4.571	3.406	3.427	3.463	3.443	3.416
Difference	**(0.064)**	**(0.166)**	**(0.561)**	**(0.214)**	**(0.136)**	**(0.135)**	**(0.135)**	**(0.134)**	**(0.132)**

Table 10: Revised Administration costs - EoE

(£m, 2018/19 prices)	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Lon revised	2.113	2.058	1.973	2.490	1.929	1.980	2.050	2.049	2.038
Lon (SQ_CA_27)	3.773	5.280	6.603	6.393	4.956	5.088	5.268	5.266	5.238
Difference	**(1.660)**	**(3.222)**	**(4.630)**	**(3.904)**	**(3.027)**	**(3.108)**	**(3.218)**	**(3.217)**	**(3.200)**

Table 42: Revised Administration costs - Lon

ii. Ofgem's streetworks assessment for WM – incorrectly using data from NW

In its cost model spreadsheet, Ofgem is picking up the wrong lines for capex and repex productivity costs for WM – instead it is picking up productivity costs for NW. This error is in sheet: "Cal_SQs", rows 122 and 123 columns AA-AK. The cells should be picking up row 118 but are instead picking up row 88 (NW's productivity costs].Overall, it makes Ofgem's view of submitted GD1 costs too high by c.£2.596m and GD2 costs for WM too low by £1.314m.

However, due to Ofgem's approach of using the 2016-17 to 2019-20 average to set allowed GD2 costs, the impact is that the DD allowance is £0.22m higher per annum in GD2 than Ofgem intended.

iii. Charges and penalties:

Ofgem is disallowing all charges and penalties. While we disagree with this approach (see above for our detailed response to this issue), we want to highlight an error in the calculations for the exclusion of charges and penalties.

The "Cal_Charges&Penalties" sheet in the Streetworks model incorrectly has charges and penalties costs from our December Business Plan submission rather than the revised numbers we provided in March 2020. This is unexpected given Ofgem has used the March submission data elsewhere in its analysis. The charges and penalties in the Streetworks table in the December Business Plan submission were not in line with the RRP and were lower.

As a result of this error, based on the DD's proposed methodology, it has removed too few costs. We estimate the impact of this error is that DD allowed costs are on average higher by £188k per annum across the four networks than if Ofgem had used the March submission. The table below shows the impacts by network.

Charges, penalties and avoidance costs (£m, 2018/19 prices)	Ofgem's view of submitted costs: 4 year average	March submission: 4 year average	Impact on annual GD2 allowance	GD2 5 year impact
EoE	1.108	1.150	-0.042	-0.209
Lon	1.400	1.440	-0.040	-0.199
NW	0.769	0.857	-0.087	-0.437
WM	1.050	1.069	-0.019	-0.096
Total	**4.328**	**4.516**	**-0.188**	**-0.940**

Table 43: Impact of error in exclusion of charges and penalties

3. Smart Metering

We disagree with the adjustments made to our smart metering costs in DD and we have identified a significant error in Ofgem's analysis of our business plan.

The DD states that our metering costs were based on forecast intervention rate of 3%, and it has reduced our proposed costs by 17% to reflect a 2.5% intervention rate, which it considers to be more appropriate. However, Ofgem's analysis is incorrect and our forecast metering costs are based on an average 2.3% intervention rate as stated on page 10 Appendix 09.38 (Controllable Opex Costs) to our December Business plan, which stated "*The rate of our intervention at SMART meter requests has been forecast at 2.3% on the basis that we have established effective controls to reduce interventions and 2.3% is the average intervention rate from 2018/19*".

The table below shows the forecast volume of meter interventions by network underlying our December Business Plan compared to the estimated number of meter fits in our networks, and the network specific intervention rate. It is clear from the table that our business plan was not based on a 3% intervention rate.

	EoE		Lon		NW		WM	
	Forecast meter installations	Forecast meter interventions	Forecast meter installations	Forecast meter interventions	Forecast meter installations	Forecast meter interventions	Forecast meter installations	Forecast meter interventions
2020/21	624,125	11,506	397,675	8,452	372,666	9,103	274,164	6,837
2021/22	664,125	15,338	417,675	9,902	392,666	10,619	294,164	8,372
2022/23	704,125	14,672	437,675	9,852	412,666	10,634	314,164	8,407
2023/24	584,125	12,172	377,675	8,502	352,666	9,088	254,164	6,802

2024/25	116,162	2,420	88,297	1,988	79,471	2,048	44,705	1,196
2025/26	56,162	1,170	58,297	1,312	49,471	1,275	14,705	394
Total	**2,748,825**	**57,278**	**1,777,293**	**40,008**	**1,659,607**	**42,767**	**1,196,066**	**32,008**
Average intervention rate	**2.1%**		**2.3%**		**2.6%**		**2.7%**	

Table 44: Forecast meter installations and meter interventions – basis of Business Plan

Therefore the adjustments to our submitted costs are an error and should be reversed. We estimate this error has resulted in the GD2 DD allowance being c. £4m too low (see the table below for the impact by network).

Estimated size of Smart Metering error (£m, 2018/19 prices)	Smart Metering: Business Plan submission (ex. Repex)	Smart Metering DD Allowance (exc. Repex)	Smart Metering Corrected for intervention rate	Difference to DD Allowance
EoE	9.44	7.87	9.44	-1.57
Lon	8.46	7.05	8.46	-1.41
NW	4.68	3.90	4.48	-0.57
WM	3.41	2.84	3.13	-0.28
Total	26.00	21.67	25.50	-3.84

Table 45: Estimated impact of correcting intervention rate

With regard to imposing a 2.5% intervention rate on all GDN, we disagree with this approach and believe the DD has not provided sufficient justification for taking this approach. Looking at our own experience of actual intervention rates between 2016-17 and 2018-19, we see differences in intervention rates between our networks which are outside of our control. The table below shows the average annual intervention rate for these years across our networks and shows that the intervention rate varies significantly between our networks and that our business plan numbers already represent a conservative view of the rate of meter interventions.

	EoE	Lon	NW	WM
2016/17	2.2%	2.8%	2.7%	3.6%
2017/18	2.3%	2.8%	2.8%	3.3%
2018/19	2.0%	2.2%	2.6%	2.7%

Three year average	2.1%	2.6%	2.7%	3.2%

Table 46: Annual average intervention rates

Given, Ofgem has not provided any evidence or logical basis for capping the intervention rate at 2.5% and GDNs will experience different intervention rates for reasons outside of their control. Therefore, we propose Ofgem should accept GDNs' proposed intervention rates and where our forecast intervention rate is:

- above the 2.5% cap imposed, Ofgem should accept our business plan costs and workloads in full.
- below the 2.5% cap, Ofgem should uplift our costs and workloads to reflect the 2.5% rate has identified.

We consider this approach is consistent with approach to regression modelled costs and also the approach to other non-regression model items (i.e. Growth Governors), where Ofgem has allowed an efficient level of costs higher than companies' submitted costs.

4. Growth Governors:

While we have not proposed any investment for Growth Governors in GD2, we disagree with the approach Ofgem has taken by including growth governors as non-regressed items and so excluding their costs from the regression model. This approach creates error and bias in the model against Cadent and other GDNs which choose to invest in lower cost alternative solutions.

Growth Governors are rarely installed on Cadent's networks as we focus on lower cost pipeline solutions. For example, when faced with a low pressure issue our modelling team will assess a range of options beginning with model testing and adjustments to network pressures, then assessment of network pinch points (locations where laying short lengths of pipe or the installation of valves can materially improve pressures) and finally laying longer lengths of pipe, upsizing existing pipes or governor installation. Installation of governors is generally more expensive and protracted due to the necessity to purchase or lease land for new installation, whereas installation of pipework can quickly resolve customer low pressure issues.

We chose, therefore, not to submit funding for this activity as volumes are low and volatile. By removing Growth Governor funding from the regression model, while leaving the costs of alternative solutions in the regression model, Ofgem is ignoring trade-offs between growth governors and alternative solutions. As a result it is artificially lowering the benchmark position, while funding the other GDNs to deliver governor solutions. We consider that Growth Governors are suitable for inclusion in the regression model, and we disagree with their exclusion.

5. Diversions:

We agree with Ofgem's proposed approach to Diversions:

- Ofgem has based allowances on the GD1 historic run rate. This aligns with our business plan submission, where we recognised the significant uncertainty around diversions and as such only included the minimum workload that could be reasonably expected in GD2, which we estimated to be 80% of GD1 workloads. We also proposed an uncertainty mechanism to address workload in excess of this minimum level – please see our response to GDQ44 for our response on Ofgem's proposed approach to an uncertainty mechanism for below 7 bar diversions.

- For the purposes of assessing efficiency, we are unsure why Ofgem has not uplifted our allowed diversion costs as the amount we submitted is below the amount Ofgem's assessment would have allowed. An uplift is in line with Ofgem's approach to regression modelled costs, as well as other separately assessed non-regression items i.e. Growth Governors.

Supporting Information: Reduction to proposed outputs for North London MOBs

Given a reduction of the scale proposed in Ofgem's DD it will simply not be possible to deliver Cadent's planned output for North London (From £60.3m down to £26.3m).

Below is the workload detail for North London that supports the submitted costs in the Business Plan Data Table what we need to undertake in addition to 1) the mandatory inspection surveys and 2) mandatory remediation of any severe corrosion identified:

Type of MOB	HRB	MRB
DR4 work, locating unknown or not recorded in ground assets	990	15,335
Installing or digging out missing PIVs	942	16,263
Removing trip hazards - PIV lid	54	662
Installing brackets to ensure pipes are supported adequately	499	7,580
Informing building owners about ventilation issues	904	13,270
Informing building owners about fire stopping issues	1,263	16,092
Resolving installations where previously decommissioned pipes are impacting on building safety	2,099	32,017
Sealing up open ended pipes e.g. a valve not capped off	21	319
Ensuring that ECVs can be operated by customers	277	6,259
Resolve illegal connections	8	102
Provide Network Diagrams as required by fire regulations	2,346	35,101
Install signs showing location of emergency valves and label riser pipes to avoid miss-identification by those doing building work	1,105	38,075

A 60% reduction in these workloads would leave considerable risk on the network. Examples of not doing such work are illustrated below:

- DR4s – assets not shown on maps and so therefore hard to locate, increasing the risk of damage and impacts future asset management
- PIVs – needed if there is a fire or other emergency to safely isolate the gas supply
- Premature pipe replacement where pipes have deteriorated through not being adequately attached / supported – disruptive for customers and extra unnecessary spend.

Maintenance Budget includes the following:

- High-Rise (HRB) and Medium-Rise Building (MRB) Riser Survey Inspections
- HRB and MRB Minor Interventions following identification in Survey Inspections
- HRB and MRB Pipeline Insolation Valve (PIV) Interventions
- Inspection of Complex Distribution Systems (CDS)
- Survey of buildings with large single services
- Follow up repairs of buildings with large single services
- Survey buildings with banks of meters
- Follow up repairs of buildings with banks of meters

Gas Distribution Questions

GDQ39 – Do you agree with areas selected for technical assessment?

No for the following reasons

a) The DD approach is a partex approach, neither totex nor bottom up. This is an error as it has led to erroneous estimation of company efficiencies as trade-offs between activities are ignored and the approach has been applied selectively, with multiple errors of logic and formulae

b) It is essential to obtain different views of efficiency, both true totex and bottom up – as stated in the gas distribution SSMD consultation and recently reiterated by Ofgem in the ED2 SSMD consultation.

c) The DD's approach to Technical Assessment is flawed because:

   a. It treats investment and opex differently, depending on how costs are labelled

   b. It takes no account of the interaction with spend which is included with the model

   c. It is inconsistent with the SSMC, because it represents a single approach, rather than "*a variety of tools, including disaggregated and aggregated regression analysis, and technical and engineering assessments*"

d) We agree with Technical Assessment of Bespoke Outputs – but the DD approach is inconsistent because some GDNs have termed an activity a Bespoke Output while others have not, and neither have all costs labelled as Bespoke Outputs been removed from normalised costs for all GDNs

e) Technical Assessment of IT capex should play no part in a Totex approach due to trade-offs between capex and opex, automation and staff numbers: IT capex should be included in totex regressions and not subject to separate Technical Assessment due to multiple trade-offs.

f) Technical Assessment of capex projects in a Totex approach should be limited to exceptional items, not an arbitrary, blanket £0.75m threshold, as this takes no account of Maintenance opex / capex trade-offs which are an important part of ensuring that an appropriate comparison is being made of relative total costs to deliver the same outputs.

g) Technical Assessment has not been applied evenly between GDNs – 14% of Cadent's planned LTS spend has been Technically Assessed, compared to 53% for the other GDNs, this undermines the partex assessment of Cadent's efficiency.

h) Outside of a true totex approach, within a pure bottom-up approach there would be scope for Technical Assessment of IT costs and engineering projects.

i) In a bottom up approach IT capex and opex must be assessed together to overcome the multiple trade-off issues - accounting, organisation, outsourcing, rental versus ownership, Cloud etc issues.

j) In a bottom up approach, there is scope for Technical Assessment of significant engineering projects, but the results need to reflect capex / opex trade-offs – as at RIIO-GD1.

We fundamentally disagree with much of the DD approach to Technical Assessment, because the whole approach to cost assessment is deeply flawed. It consists of a single partex approach, which:

- Is neither top down or bottom up - rather than the multiple approaches required and as used by the CMA.
- Fails the RESET test, which means the model is inaccurate, as previously accepted by Ofgem.
- Excludes a significant level of comparable costs.
- Is calculated using a single time period, rather than using several.
- Fails to apply smoothing to all capex.
- Contains many errors of formulae and logic.
- Results from an opaque, flawed and insufficient process given that the model was not consulted upon.
- Is inconsistent with not only the approach to cost assessment for ED2 as set out in July 2020, but also the SSMC for gas distribution.

If the DD approach stands, it will lead to customer detriment, with the customers of some GDNs paying too much, and others too little. Because Technical Assessment is a significant part of that flawed approach, we disagree with it.

In its place, as shown by NERA, who we commissioned to review the DD approach to cost assessment, we propose a balance of more robust models, which provide a very different picture for Cadent and especially for London GDN.

Specifically in respect of those costs that Ofgem treated as subject to Technical Assessment, these were as follows:

- Bespoke Outputs;
- Capex projects > £0.75m;
- IT and Telecoms capex;
- Major atypical repex projects;
- Gas holder demolition; and
- PSUP (physical security) costs.

The DD approach to Technical Assessment meant that these costs were removed from the partex totex benchmarking and added back after the modelling, with subsequent application of ongoing efficiency.

We believe that it is important to obtain different views of efficiency, as recommended by the CMA in the Bristol Water 2015 appeal, which should include both top down (as in RIIO-GD1) and bottom up approaches.

Technical Assessment is a useful tool both as part of a bottom-up approach, or where items are not suited for inclusion in a genuine totex approach. We give our views on Technical Assessment under each approach below.

1. Totex approach

We believe that costs for an activity should only be removed from a totex approach if they meet three criteria:

- activities are truly not comparable between networks;
- no adequate regression workload driver exists; and
- activities have little impact on other costs that are included within the totex regression.

In contrast, the DD's approach to Technical Assessment, as set out in paragraphs 3.139 and 3.140 of the GD Annex, is quite different:

> *"The discrete nature of some investments limits our ability to model costs and benchmark through direct comparison. This may be because an investment is uncommon across networks, lacks historical comparators or has other highly unique characteristics. In these cases we have undertaken a technical assessment."*

We consider the DD's approach to be flawed for three reasons:

- First, because it treats investment and opex differently, allowing spend labelled as investment to fall under Technical Assessment, outside of the model, whereas that labelled as opex cannot.
- Second, because it takes no account of the interaction with spend which is included with the model. The GDNs' choices as to how they spend their totex will drive the assessment of efficiency, rather than the total level of spend.
- Third, because it is inconsistent with the SSMC, which stated in paragraph 6.51 that:

  > *"We propose to use a variety of tools to assess GDNs' cost efficiency in RIIOGD2, including aggregated and disaggregated regression analysis, and technical and engineering assessments."*

The DD's approach to Technical Assessment has led to the partex approach to modelling, removing many costs from the regression which do not meet our three criteria set out above.

The result, if unaltered, will not only cause an unreasonable set of allowances between GDNs, with some customers paying more than they should, and others less, but it will also damage future customers through the distortion of incentives. In the DD, some types of cost – in particular non-load capex – are favoured over others. This will cause GDNs to strive to minimise some costs, most notably opex, but not capex, leading away from the minimisation of totex, so that customers will (contrary to their interests) pay more than they should. This represents the very opposite of what the Totex approach introduced in RIIO intended to and successfully achieved.

Turning to the costs treated in DD as subject to Technical Assessment, in a true totex approach, we consider that it is right that Bespoke Outputs – categorised consistently - Holder Demolition and PSUP costs should be considered separately, because these activities fulfil our three criteria for exclusion set out above – they are not comparable across networks, have no adequate workload driver, and have little impact on other costs included within a true totex regression.

However, there is a clear consistency problem with Bespoke Outputs – some GDNs have classed an activity as a Bespoke Output whereas others have not, even if it is the same activity. For example, SGN have a Bespoke Output in respect of shrinkage related pressure management equipment, whereas these costs, which are substantial, are included in Cadent's Base Plan. It is essential that costs for the same activity are treated for cost assessment purposes in the same way.

Furthermore, not all costs that have been subject to Technical Assessment have been normalised correctly. Cadent's Plan contains £55m for the cost of electric / hybrid vehicles, set out in table 5.18 as a Bespoke Output. However, this cost has not been removed as part of the normalisation, making Cadent appear inefficient.

We agree that costs associated with major atypical repex projects should be separately assessed, such as for London Medium Pressure, as they fulfil our three criteria above. Please see GDQ40 for our further views on the technical assessment of this project.

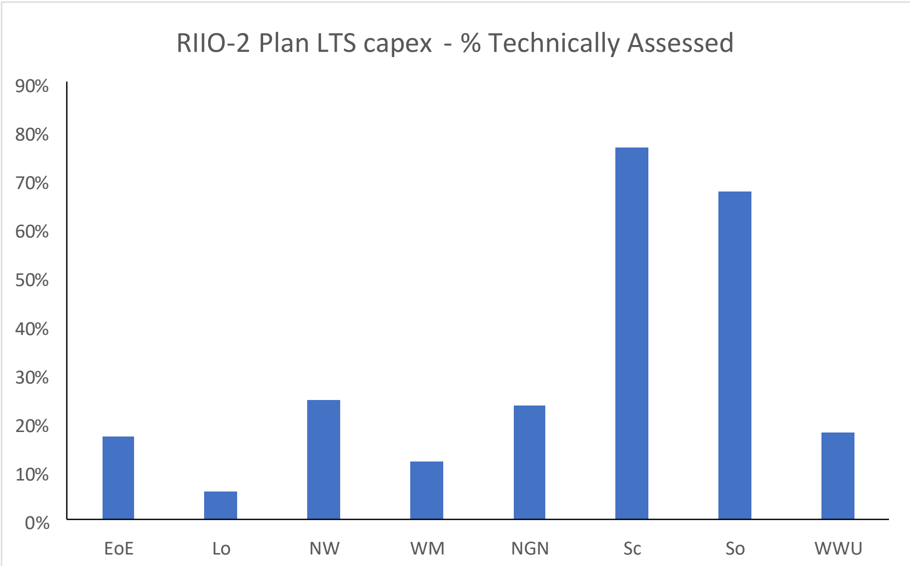
In respect of the DD approach to capex projects, we fundamentally disagree with the approach of excluding all capex projects > £0.75m and IT & Telecoms capex from its partex approach:

- To meet Ofgem's policy intent of a genuine totex approach, as at GD1, only exceptional capex projects – passing our three criteria above - would be excluded from the benchmarking. The only project we are aware of that would fulfil our three criteria for exclusion from a Totex regression are the Thames Tunnel and associated IP project, which has cost around £22m in RIIO-1 with a cost per km around 14 times the norm. The DD approach is removing a far greater value of costs from Totex benchmarking, and so greatly distorting its results.
- The £0.75m threshold for capex projects is arbitrary, with no rationale being provided, and can only be arbitrary under such an approach. If a value of say, £10m has been applied, this would have led to very different results in the partex model.
- There is material trade-off between Maintenance costs and capex, in particular LTS capex and also Other capex, not only due to solution choices, but also due to organisational structures and accounting practices. As stated at CAWG, Cadent's Finance function identified that a further £10m
  p.a. of Maintenance costs for 2019/20 that could be capitalised, which we did not implement as being contrary to how the price control was set. At RIIO-GD1 Ofgem specifically recognised the Maintenance / capex trade-off in its bottom-up approach – it did not need to take any action in its Totex approach, as that treated opex and capex the same.
- There are significant trade-offs between IT costs and other costs, in particular for staff. GDNs can choose to have more back office staff and less automated processes or more IT and less automated processes. Hence these costs should be assessed in the totex regression. Our views on the DD's approach to IT costs are set out more fully in our response to Core Question 18.
- There are many trade-offs between IT capex and IT opex, so that it makes no sense to treat them differently
  - Capitalisation policies differ between GDNs, so one GDN's capex is another's opex.
  - Even within a GDN, the distinction between IT opex and capex is extremely fine in many cases. For example, if we incur software costs as part of a project, we capitalise these if they are "significant", and not related to data migration, training or research and development. Clearly considerable judgement may be involved in the capitalisation

decision. ○ Whether an IT service is provided in-house or as a bought-in service drives whether costs are considered to be capex or opex, with the bought in service being entirely opex.

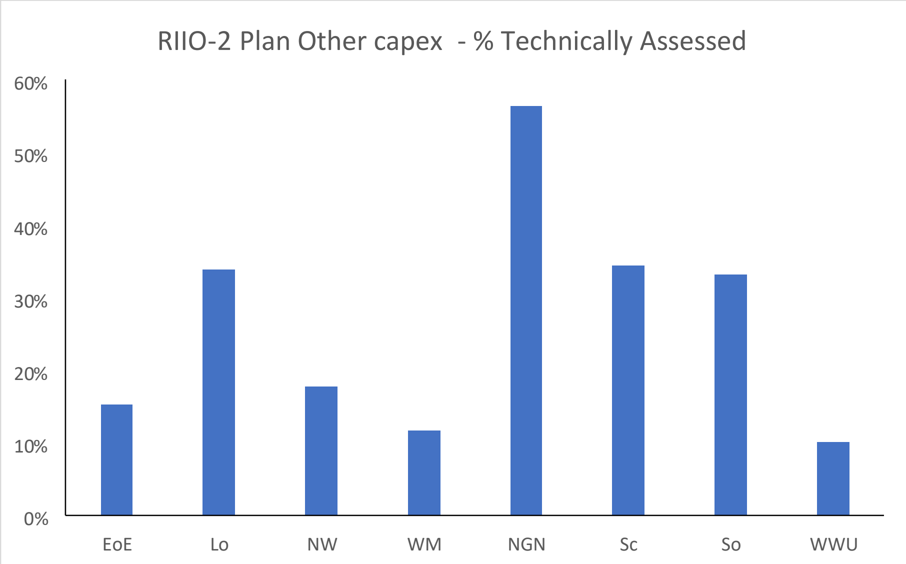
- ○ The increasing use of software as a service, for example through cloud computing, acts to increase the opex proportion, although, so GDN choices over how to acquire software services act to drive the balance of IT costs that are labelled as opex rather than capex. ○ In respect of the costs associated with running the national emergency telephone number, Cadent has both capex and opex costs, whereas the other GDNs, who receive a charge from Cadent, will treat that cost entirely as opex

In addition to the flawed logic, neither have the costs excluded for Technical Assessment been applied evenly between GDNs. The chart and table below show the proportion and value of plan costs which have been subject to Technical Assessment for both LTS, Storage and Entry, and Other capex – with IT capex being the main component of the latter.



LTS, storage, entry	EoE	Lo	NW	WM	NGN	Sc	So	WWU	Total
RIIO-2	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**
Gross	124	118	96	85	83	139	123	74	**843**
TA	-21	-7	-24	-10	-19	-107	-83	-13	**-284**
In partex model	**103**	**112**	**73**	**75**	**64**	**33**	**40**	**61**	**560**

Figure 10: Proportion of plan subject to Technical Assessment: LTS



Other CAPEX	EoE	Lo	NW	WM	NGN	Sc	So	WWU	Total
RIIO-2	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**
Gross	135	101	93	66	96	63	105	50	**709**
TA	-21	-34	-17	-8	-54	-22	-35	-5	**-195**
In partex model	**115**	**67**	**77**	**58**	**42**	**41**	**70**	**45**	**514**

Figure 11: Proportion of plan subject to Technical Assessment:Other Capex

From the tables it is clear that 14% of Cadent's LTS spend and 20% of its Other capex spend has been subject to Technical Assessment, as compared to 53% and 37% for the other GDNs respectively.

The effect of the skewed application of Technical Assessment is to bias the benchmarking results in favour of those GDNs with a high proportion of costs subject to Technical Assessment, and against those where it is low. Even if none of the Technical Assessments were subsequently allowed, a GDN with a high value of Technical Assessment will benchmark well in the DD's partex model, and in the case of Scotland does form the benchmark, because so many of the costs for which there is no regression driver are removed from the model.

In particular, as shown above, the DD approach excludes NGN's high cost IT, and SGN's high cost LTS,
Storage and Entry projects, with the result that the three GDNs appear significantly more efficient than Cadent in the model. On this occasion, with Scotland forming the 85th percentile benchmark the result is an unreasonable cost allowance for all other networks, given that the projects excluded are the chosen solutions to the same or similar problems faced by other GDNs where the costs are still within the regression model.

Indeed, there are further compounding issues and bias between networks created by this methodology. As an example, take IT capex projects. On this cost category Cadent is the most cost efficient (lowest average GDN), yet NGN has a Technical Assessment that determines an allowance of £30m - which is 17% above our Plan submission - but the DD removes the £40m Plan cost from the regression modelling. As a result, NGN's inefficient cost of £10m is excluded from the modelling and so has no consequence for NGN, but makes all other GDNs appear less efficient. In addition, although the NGN allowance is above Cadent's Plan level of spend, the DD proposes that Cadent has to apply for a UM in order to spend over £2m per GDN on IT projects. Further details on this issue are provided in response to Core question 18.

A consequence of the flawed logic and execution of this approach is that NGN customers end up paying more than they should, as shown in the chart at the start of this response. This outcome is not in the interests of NGN's customers, and the the distortion effect it creates on the efficiency of other networks means that consumers generally will either over- or under-pay for such expenditure.

Similarly, although not part of Technical Assessment, we disagree that the costs of repex stubs should be removed from the regression for NGN and SGN and assessed separately. Fundamentally, the requirements of the mains replacement programme apply equally to all GDNs. If the HSE is content with the remaining lengths of Tier 1 mains attached to larger mains in some GDNs but not others, this has arisen from how GDNs have carried out the mains replacement programme. Pro-active GDNs have identified the issue, risk assessed options, put management controls (acceptable stub lengths) in place during RIIO-1, and agreed their position with the HSE through approval of their safety case. Those GDNs with which the HSE is content:

- Have already been routinely replacing the lengths described as stubs and left by other GDNs.
- Have incurred higher unit costs because of this work and so appeared less efficient up to now.
- In the RIIO-2 period are still planning to routinely carry out this work – and so planning to incur higher unit costs than others. That is to say the approach followed in RIIO-1 which did not lead to a 'stubs backlog' being created will continue in RIIO-2.

Consequently, in both past and future cost benchmarking, the results are distorted by the fact that some GDNs are routinely carrying out stubs work while others have not. Therefore, in the future cost benchmarking, so that GDNs are treated on a like for like basis, the stubs related costs and workload should not be treated separately to the rest of repex. This is discussed further in our response to GDQ 26, as is our reasoning for why contributions, growth governors, shrinkage and GSOS Payments should be included in the modelling.

To summarise, in a genuine totex approach, we consider that Technical Assessment should apply to Bespoke Outputs that are categorised consistently between GDNs, major, atypical repex and capex projects, gas holder demolition and PSUP costs.

We consider that the DD's abandonment of a true totex approach, in favour of treating capex differently to opex, compounded by uneven and error strewn application, will cause customers to pay more than they otherwise would. It also fundamentally disadvantages Cadent, which has traditionally been a high opex, low capex company.

2. Bottom-up approach

The purpose of a bottom-up approach is to provide a different, more granular view than a true Totex approach. Under a bottom up approach, it is inevitable than some trade-offs between different cost categories will be missed, but the approach should attempt to capture as many as possible, as Ofgem did at RIIO-GD1.

With that in mind, in a bottom-up approach, we believe that there is greater scope for Technical Assessment in bottom-up analysis than in a true totex approach.

In addition to the Technical Assessments that should be carried out on a genuine Totex approach, we believe that Technical Assessment of IT & Telecoms costs is desirable, but that this must be on a totex basis – combining both opex and capex – otherwise the work is fatally flawed for the reasons set out above and will inappropriately reward and penalise GDN for their choice of IT & Telecoms strategy rather than efficiency.

We also consider that there is scope for expert review of engineering projects with no workload driver, although, as at GD1, the results should be tempered by a recognition of the trade-offs between opex and capex.

A summary of the approach to Technical Assessment, comparing the approach taken at DD to what would be expected under a full totex approach and under a bottom up approach, is shown below. It shows that the DD approach is inconsistent with either a full totex or a bottom-up apaproach.

Approaches to Technical Assessment	DD approach	"Full totex" approach	Bottom up approach
Bespoke Outputs – inconsistent treatment	TA	N/A	N/A
Bespoke Outputs – consistent treatment	N/A	TA	TA
Capex projects > £0.75m	TA	RM	RM
Major atypical capex	N/A	TA	TA
Granular capex with opex / capex trade off	N/A	RM	TA
IT & Telecoms capex	TA	N/A	N/A
IT & Telecoms totex	N/A	RM	TA
Major repex projects	TA	TA	TA
Gas holder demolition	TA	TA	TA
PSUP	TA	TA	TA

Note: TA: technical assessment, RM: regression model

Table 47: Approaches to Technical Assessment

Gas Distribution Questions

GDQ40 – Do you agree with our proposed approach?

Our response to this question should be read alongside GDQ38 and GDQ39. In addition, we also refer to our answer to GDQ29 on normalisations, where the use of technical assessment to move away from a regression model is introducing cherry-picking and bias errors into the determination of efficient allowance

The use of Investment Decision Packs (IDP), and supporting SQ process, if correctly applied provides a good basis for the qualitative assessment described in 3.140 and is in line with the approach which Ofgem had outlined in their guidance documents. We are not confident that Ofgem's engineering team have made use of all available data in their analysis: for example, in discussing Ofgem's response to DDQ17 in our bi-lateral on 21st August it was stated that we had not provided volumes of activity when in fact the required numbers are clearly set out in the BPDT.

The subsequent expert review process to adjust repex and capex allowances has a number of weaknesses which must be carefully managed. Whilst independent expertise provides insight, the process is essentially subjective and potentially inconsistent. This introduces significant risk into assessment of submitted business plans. If Ofgem are to maintain the reductions proposed in DD they need to demonstrate what cross checks or control processes have been put in place to mitigate bias and ensure that this approach is robust.

The implementation of the approach to date has lacked transparency - unless all none commercially sensitive working files, meeting notes and other artefacts are made available it is not possible to understand or justify the interventions which Ofgem have made. Ofgem did not release enough detail on the work of their consultants at the beginning of the DD process, and although additional information has since been supplied it is still unclear, in some areas, how the notes and observations which have been shared have translated into decisions on funding. We would challenge Ofgem's engineers on their interpretation of our IDPs in a number of areas but have limited our challenges to areas which have actually flowed through into changes in our funding. We want to work with Ofgem to ensure that adjustments ahead of FD are evidence based and transparent.

We agree with the application of on-going efficiency to technically assessed items, however, we consider that for technically assessed costs the level of challenge applied needs to recognise the companyspecific ongoing efficiency embedded in the business plan rather than the DD approach which only takes into account the industry average embedded efficiency. As a result, the level of on-going efficiency challenge to technically assessed costs is too high.

The selection of schemes for technical assessment changes companies' relative performance, compromising the benchmarking process. Where multiple schemes are removed for technical assessment the company's costs reduce, moving them towards the frontier – this reduces any reduction applied through benchmarking but more importantly creates an artificial appearance of efficiency which other networks are then compared against. The impacts of Ofgem's selection of schemes for technical assessment has not been normalised for in the benchmarking process, creating distortions. This is particularly evident with regards to SGN who have presented a significant element of their NARMs investment as separate projects (this is not in line with the guidance set out in RIIO-GD2 Investment Decision Pack), this work has been technically assessed and removed from benchmarking.

Results of proposed approach

In responding on the structure of the proposed approach it is necessary to respond on the implications it has for the areas of work being technically assed.

Capex Projects: Capacity upgrades

Ofgem's current proposal, for our Capacity Upgrades at both NTS and PRS sites applies a 28% reduction to the funds included in the BPDTs. We do not agree with the scale of reduction in costs which Ofgem have proposed, it will not provide the necessary funding to deliver this work.

1. There are mathematical errors in the BPDTs table which Ofgem are already aware of and need to be corrected (Ref Cadent SQ_CA_23) to remove costs from the NL network and to incorporate additional funding in the EoE.
2. We accept Ofgem's challenge on removing the "10% uncertainty" & "risks associated with delivery of the solution" from the cost breakdown included within the study outputs, this was a double count.
3. We note Ofgem's challenge on our Cadent direct costs, our latest view is that these are in the range of 13%-16%. As such our December position (16%) for these complex projects remains appropriate.
4. Our latest work at Dawley shows a 65% cost increase above what was submitted in December 2019; significant complexities have been identified following further survey, design work and stakeholder engagement. Risks such as these are evident across this work area and lead us to use of a higher contingency cost in our December submission.
5. We have progressed with further design work and risk assessments and have improved our quantification of risks; we now estimate that the level of contingency risk is in a range between 30% to 35%. Our experience with Dawley demonstrates that our scope is lean and that an allowance in this range is reasonable.

Points 1 and 2 are mathematical corrections to the December plan. Points 3 to 5 show that our December plan is still within the forecast outcome range based on the latest information we have. The scale of reduction proposed by Ofgem in DD would not fund maintaining resilience to comply with our Licence obligations for 1 in 20 supply resilience.

This example shows weaknesses in the Ofgem approach, although specific issues have been identified in which costs can be refined (item 1&2) the other cost challenges (item 3 & 5) reflect the subjective insight of Ofgem's consultants. Whilst independent they do not have the current hands on experience of delivering investment, or full range of information available to the company. Ofgem have not provided evidence to justify the position they have taken – a lack of transparency. The DD process allows companies to respond and provide more information to better inform decision making and we would like to see Ofgem provide additional information to substantiate the position they have taken.

Further details are given in Cadent Q5.

Capex Projects: Offtakes & PRS Metering

We note the reduction set out in 3.49 of the Cadent Annex for Metering. This reduction is based on Ofgem's judgment, with no evidence provided to substantiate the cost challenge which has been applied.

The delivery of this work is recorded in the NARMs methodology and any impacts from this change would need to be considered when calculating NARMs funding.

Other areas: RDOC, Valves, Brunel Bridge, Mersey Tunnel,

PSUP We note you have made no changes to these investment

areas.

London medium pressure

We disagree with Ofgem's proposal to treat LMP as a reopener. Our view is that an allowance should be made in the base plan to cover investment in the LMP scheme as it has been in RIIO-1, and we have provided additional details on scope, timings and costs to support this position.

It is unclear from the stated technically assessed cost approach how a decision is made which results in funding being moved into a UM. Again, there is a lack of transparency on Ofgem's approach.

Please see response set out under Cadent Q5.

IT and telecoms capex

We do not support the conclusion of this analysis or the subsequent reduction in ex-ante funding. The extent of this adjustment is to provide ex-ante funding for only 7% of our IT capex investment plan, a plan that when assessed top down is the most efficient across the networks. Whilst the remainder of our funding requirement has been placed in an Uncertainty Mechanism, this is not a suitable method to release funding into our business activities.

The primary approach for IT should be a top down (true) modelling approach of all costs comparing the performance of the GDNs. This could be complemented by a technical review within a bottom up totex approach. Further details on our position are in Question 26.

It is again unclear from the stated technically assessed cost approach how a decision is made which results in funding being moved into a UM

For further details on the application of Ofgem's approach to IT, please refer to our response on GDQ18.

Gas Distribution Questions

GDQ41 – Do you agree with our proposed disaggregation methodology?

No, we do not agree with the Draft Determination's (DD's) proposed disaggregation methodology. It incorrectly:

- applies the implicit adjustment evenly across all activities, despite the adjustment being based on a modelling approach that excludes some totex items (essentially a semi-totex, or "partex" model), and non-regression analysis that is heavily weighted towards repex. This results in, for example, cost allowances for capex being unduly influenced by efficiency challenges on opex and repex.
- applies the implicit adjustment to areas where there have already been significant disallowances, without consideration of whether it's appropriate to apply further efficiency challenges to those activities.
- ignores the need for bottom up cost modelling to inform the calculation and application of the implicit adjustment and instead assumes that there is one correct model specification and that companies are equally efficient across all areas of their business which is incorrect and inconsistent with the approach at GD1 and the RIIO-GD2 methodology.

These are all material errors that must be addressed for Final Determinations (FD).

We also note that the DD approach potentially compounds other errors in the model, which we have identified in our response to earlier questions, and may exaggerate the impact of these modelling errors.

We have also identified errors in the calculation of the implicit adjustment that need addressing for FD, including:

- double counting the efficiency challenge by applying the regression model challenge to nonregression modelled costs, which is incorrect and inconsistent with the approach taken to other costs excluded from the model and assessed separately;
- inclusion of non-regression modelled costs in the calculation of the implicit adjustment rather than making challenges directly to the relevant activities, which would be more appropriate, given Ofgem has the costs to that level of detail and it would avoid challenges on specific activity areas effecting other un-related cost activities.
- the DD's approach to adjusting for workloads post regression modelling, where the model uses costs adjusted for workloads but a CSV that hasn't been adjusted to workloads. As a result of this error Ofgem is inappropriately excluding costs post modelling, which is likely to increase the size of the implicit adjustment.
- Ofgem's approach to calculating the adjusted normalised costs for the regression model and the net totex which relies on the same adjustment numbers despite, in the one case being applied to gross totex and in the other case being applied to net totex.

We disagree with the DD's proposed approach to disaggregation including in how it has applied the implicit adjustment across activities, as well as how it has calculated the adjustment. The approach taken at DD has errors in both the approach to cost benchmarking and calculation of allowances, as well as errors in the calculation of catch up efficiency. We consider that the approach taken to applying the catch up efficiency challenge will for some activities result in allowed unit costs that are beyond the frontier and are not deliverable.

Our concerns are centred on the following key issues:

1. The blanket application of catch up efficiency to all cost activities, even where significant disallowances have already been made, without considering how the efficiency challenge should be reasonably split between the different activities,
2. The failure to develop and use bottom up cost models that would help inform a rational allocation of the efficiency challenge.
3. How Ofgem may use the resulting unit costs to set PCDs.
4. Calculation and application of the "implicit adjustment", which results in double jeopardy.

Please note in responding to this question, we have assumed the intention is to apply the implied adjustment equally across all activity lines as described in the Step by Step Guide to Cost Assessment published as part of the DD, and not the approach described in the GD Annex which contradicts the Step by Step Guide and describes using weighting factors to disaggregate the implied adjustment. Our assumption is based on the fact that this is the approach taken in the Allowances model.

1. Application of the implicit adjustment ("the catch up efficiency challenge")

We disagree with the approach taken to applying the catch up efficiency challenge equally across all activity areas. While the DD only applies this efficiency challenge to "the modelled component" of submitted totex, it has applied it equally across activities without consideration of whether it is appropriate to do so. This approach is flawed because it assumes that:

- further efficiency savings can be made in areas where there have already been significant adjustments, without considering whether an efficient company could deliver the required work for the remaining costs;
- a company is equally efficient across all of its activities; and
- the DD regression model is not a full totex model, excluding some totex items (essentially it is a semi-totex, or "partex" model).

Within the network there will inherently be different levels of efficiency, a network, although in the topdown regression being off the pace may for example be at the efficient level in the repex activity. Applying this even catch-up will then result in implied unit costs that are undeliverable and inherently incorrect. It will also be inconsistent with the PCD unit costs. This is discussed further in response to GDQ17 and 20.

The table below shows the implicit adjustment applied in the Draft Determinations (DD) to the modelled component of our submitted costs following the removal of costs relating to bespoke outputs, technical assessments, reclassifications and exclusions.

	Size of catch up efficiency challenge
EoE	13%
Lon	17%
NW	7%
WM	7%

Table 48: Catch-Up challenge

This challenge, based on the outputs of the DD regression and non-regression modelling, is heavily influenced by opex and repex and therefore cannot provide a fair and proportionate level of catch up equally for opex, capex and repex. The table below shows that over 80% of the costs in the model for Cadent are for opex and repex.

Regression modelled costs	EoE	Lon	NW	WM	NGN	Sc	So	WWU
Opex	47%	45%	45%	42%	39%	38%	37%	42%
Capex	18%	16%	14%	18%	21%	24%	17%	23%
Repex	36%	39%	41%	39%	40%	38%	46%	34%

Table 49: Proportion of regression model costs

Additionally, the catch up efficiency challenge is heavily influenced by the DD non-regression analysis of Streetworks and MOBs, which are heavily weighted towards repex with c. 60% of the £523m analysed by non-regression being repex activities.

Nonregression modelled costs	EoE	Lon	NW	WM
Opex	28%	32%	33%	26%
Capex	13%	5%	3%	9%
Repex	59%	63%	64%	65%

Table 50: Proportion of non-regression modelled costs

It is, therefore, an error to assume that the resulting catch up efficiency challenge derived from comparing submitted modelled costs to allowed modelled costs can be applied equally across all expenditure areas.

To add to this, we are concerned with Ofgem's approach of including the results of the non-regression analysis in the calculation of the catch up efficiency challenge. All of the DD challenges made in the nonregression analysis can be made directly to a specific activity, however, by including the results from the non-regression analysis within the catch up efficiency challenge it has spread the cost challenges relating to one activity across all activities. For example, on Smart Metering over 90% of the challenge made relates to five opex activities, and to which the challenge could be directly made. Instead by including this challenge in the catch up efficiency it has spread the challenge across all cost activities regardless of whether they are related to smart meter interventions or not. Similarly on Streetworks over 80% of the challenge relates to repex, which would be more appropriate to make directly to the relevant cost lines rather than include in the catch up efficiency challenge. This is an error in methodology and we discuss this issue further in section B "Calculation of the implicit adjustment".

The approach taken at DD is also inconsistent with the approach taken at GD1, where a more balanced disaggregation was taken and Ofgem:

- developed and used bottom up cost models – setting overall cost allowances based on an unweighted average of the results from the preferred modelling approaches to acknowledge that there was no single correct specification for modelling efficient costs and recognised that companies perform differently across different activities;
- applied adjustments and activity specific efficiency challenges directly to the relevant activity.

This can be seen in the tables below, which show the different rankings of companies under the totex models and the bottom up cost models.

GDN	Efficiency rankings	
	2012	2014
EoE	5	2
Lon	8	8
NW	6	5
WM	4	1
NGN	1	3
Sc	3	4
So	7	6
WWU	2	7

Table 51: ***Extract from Ofgem's GD1 Final Proposals – Cost Efficiency Supporting Document: Totex model rankings***

Cost activity	NGGD				NGN	SGN		WWU
	EOE	Lon	NW	WM	NGN	Sc	So	WWU
	2012 rankings - historical costs model							
Work management	8	4	7	6	2	3	1	5
Emergency	6	8	7	3	2	4	5	1
Repairs	4	5	3	1	7	6	8	2
Maintenance	6	3	7	1	2	8	4	5
Mains reinforcement	1	2	8	5	6	4	3	7
Connections	8	7	2	6	1	5	3	4
Repex	6	3	5	8	1	2	7	4
	2014 rankings - 2 year forecasts model							
Work management	7	5	6	3	4	2	1	8
Emergency	3	4	8	2	5	7	6	1
Repairs	3	7	2	1	6	8	4	5
Maintenance	4	1	7	2	5	8	3	6
Mains reinforcement	8	5	3	2	7	4	1	6
Connections	5	8	1	6	4	2	7	3
Repex	3	8	5	6	2	1	4	7

Table 52: Extract from Ofgem's GD1 Final Proposals – Cost Efficiency Supporting Document: Bottom up model rankings

At GD1, the use of bottom up cost models provided a balanced, 'rich picture' view of GDN cost efficiency, and also allowed a more proportionate approach to estimating and applying the catch up efficiency challenge to individual activity areas. This resulted in a balanced approach to setting cost allowances, which GDNs could understand and have some confidence that the allowed costs represented the efficient cost of delivery. We note that the recently published RIIO-ED2 Sector Specific Methodology Consultation proposes the use of the same 'rich picture' approach (a combination of topdown and bottom-up models) that was adopted at GD1 and RIIO-ED1. We also note that Ofwat relied on a portfolio of models to determine efficient costs at PR14 and PR19, and that the CMA endorsed this approach in the Bristol Water appeal of the PR14 final determination.

The approach taken at DD ignores this past approach and regulatory precedent. It results in an unbalanced and unreliable view of cost efficiency, which is applied in a disproportionate manner. In particular, we consider that the approach taken to applying the catch up efficiency challenge will for some activities result in allowed unit costs that are beyond the frontier and ultimately do not bear any resemblance with reality.

For example, the figures below show the impact of the challenges in Tier 1 mains and services unit costs as well as Emergency costs. They show that the challenges: to London result in allowed unit costs below those allowed for Scotland and Southern (which is not credible given the challenging of working in the capital); and that the approach to disaggregating the efficiency challenge has resulted in a 40% reduction in allowed emergency costs compared to 2017/18. Such levels of funding would mean we are not financed to meet our licensed obligations.

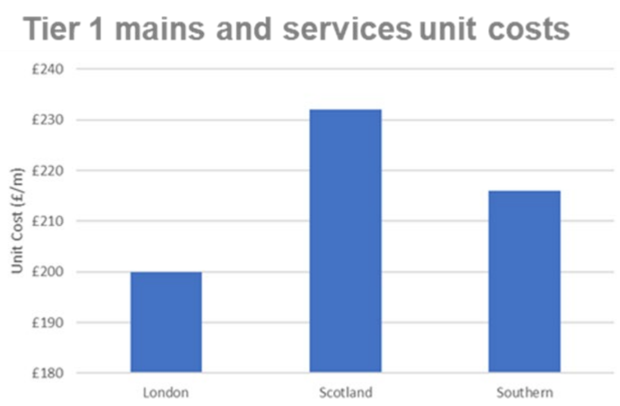


Figure 12: Tier 1 Mains and Services unit costs

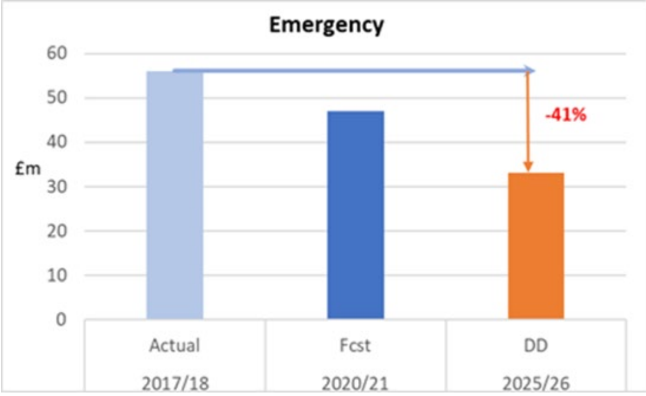


Figure 2: Emergency costs challenge

The DD approach to disaggregation will compound the errors in the regression model, and therefore the impact shown in the figures above may be exaggerated as a result of the overall DD approach. We have identified these errors in our response to the earlier questions relating to cost assessment.

To move from the robust approach at GD1 (and the approach consulted on in the RIIO-GD2 methodology is an error which has not been explained within the DD.) We also consider that Ofgem's failure to signal and consult on this deviation from its methodology to be a serious flaw in its engagement process, particularly given it held regular Cost Assessment Working Groups (including in the run up to DD) where changes in approach could have been discussed.

Continuing with this approach will create significant issues for GDNs. The proposed RIIO-GD2 framework results in c. 70% of costs being covered by specific PCDs and uncertainty mechanisms – this makes it more important that component parts of the price control are accurate as there will be fewer opportunities to trade-off costs between areas. Therefore the impact of not developing opex, capex and repex specific efficiency challenges could further pressure financeability, for example it would result in setting PCDs based on the unit costs that would not allow GDNs to recover the efficient cost of delivering the commitment (and would also be contrary to Ofgem's stated objectives of ensuring challenging but achievable targets). Additionally, the approach is likely to create an imbalance in the split of fast and slow money which may place further pressure on financeability. It is, therefore, vital that efficiency challenges are more targeted at the appropriate activity.

For final determinations, it is vital that:

- it uses bottom up cost models to inform the catch up efficiency challenge and the setting of cost allowances at an activity level,
- results from the non-regression models are made to the relevant activities and not included in a totex catch up efficiency challenge, and
- where significant reductions have already been made to activities pre-efficiency, that clear consideration is given to the appropriateness of applying a further efficiency challenge to the remaining costs and the impact on unit cost.

Please note, we would also disagree with any proposal to apply weightings based on the share of submitted costs to derive disaggregated allowances. We consider the only valid, robust approach is to follow the approach we have outlined above (and which has been previously used by Ofgem, with no justification as to why the DD have now departed from historical and regulatory precedent).

2. Ofgem's proposed approach to using disaggregation to set PCDs

At the 14 August 2020 Cost Assessment Working Group, Ofgem presented for the first time how it intended to disaggregate further the baseline repex allowances to inform unit costs for PCDs. Prior to this point, GDNs weren't aware of the proposal or the existence of a separate model as neither of which had been published as part of Draft Determinations.

Ofgem's proposed approach to disaggregating allowed baseline repex to individual activity level costs, as presented at CAWG, relies on using the allowed level of repex (as determined by applying the implicit adjustment across all areas of modelled totex) and disaggregating it by using the proportion of submitted modelled costs for that activity (post exclusions and reclassifications) to the total level of submitted modelled repex.

We disagree with this approach for the reasons we identify under section A, and that the approach to reaching Ofgem's allowed baseline repex is incorrect.

3. Calculation of the implicit adjustment ("the catch up efficiency challenge")

In addition to the errors discussed above, we have identified a number of errors in relation to the calculation of the implicit allowance:

1. Application of modelled catch up efficiency challenge to non-regression modelled costs
2. Use of non-regression modelled costs to set the catch up efficiency challenge
3. Failure to develop bottom up costs models to set the catch up efficiency challenge

a) Application of modelled catch up efficiency to non-regression modelled costs and adjustments to calculate efficient modelled costs

Ofgem has applied the scalar factor derived from the regression models to non-regression modelled costs, which have already been assessed separately and which Ofgem has already adjusted downward as a result of this assessment, many of these adjustments have been significant. Despite these nonregression items being deemed inappropriate to be included in the totex regression model and having substantial efficiency challenges made to them, Ofgem has applied the scalar factor to these costs. This is inconsistent with the DD approach to other assessed costs excluded from the totex model, and also results in an efficiency challenge being applied to these costs twice.

We estimate that this error in methodology has resulted in efficient modelled costs that in total are too low by c.£19m across our four networks.

(£m, 2018/19 prices)	
EoE	4.4
Lon	8.9
NW	3.2
WM	2.5
Total	19.0

Table 53: Double Counting of catch-up efficiency

b) Use of non-regression modelled costs to set the catch up efficiency challenge

As highlighted in section A of this question, we strongly disagree with including non-regression modelled costs in the calculation of catch up efficiency.

Rather than applying the challenges at an activity level or opex/capex/repex level, Ofgem has included the challenge as part of the catch up efficiency which is then applied equally across all activity areas. This is inappropriate as the challenges made to the separate assessments are not equal across opex/capex/repex. Ultimately, this approach results in cost allowances at an activity level that do not bear any resemblance to the costs of an efficiency company to deliver those activities, and will create significant issues when developing unit costs for uncertainty mechanisms and PCDs.

The table below shows the split of the non-regression efficiency challenge if Ofgem were to break it down between opex, capex and repex, and shows that challenges are significantly different across the expenditure areas.

Non-regression challenge	opex	capex	repex	Total
EoE	-17%	4%	-21%	-17%
Lon	-45%	19%	-12%	-21%
NW	-15%	9%	-6%	-8%
WM	17%	-45%	-7%	-4%
Total	**-28%**	**3%**	**-13%**	**-16%**

Table 54: Non regression efficiency challenges (pre-application of regression model scalar)

Looking more closely at the activity level, we can see that challenges could be applied to specific activity lines. For example, if we take the separate assessment on smart metering – where Ofgem has challenged opex and capex smart metering costs but not repex costs. The table below summarises the challenge applied in the separate assessment.

% challenge	Opex				Other capex	Repex	Total
	Work Management	Emergency	Repairs	Business Support			
EoE	-17%	-17%	-17%	-17%	-17%	0%	-16%
Lon	-17%	-17%	-17%	-17%	-17%	0%	-16%
NW	-17%	-17%	-17%	-17%	-17%	0%	-15%
WM	-17%	-17%	-17%	-17%	-17%	0%	-15%

*Table 55: **Smart metering challenges (pre-application of regression model scalar)***

Despite disaggregating the challenges across activity areas in the separate assessment model ([4] Smart Metering), this has not fed through into the calculation of cost allowances. Instead the total challenge of c. 15%-16% is included in the calculation of the catch up efficiency challenge which is then applied equally across all activities – even those not associated with smart metering. This is a methodological error and results in unbalanced cost allowances, which are not representative of the efficient cost to deliver the activities.

This issue is not limited to smart metering and is repeated through the other separate assessments. The tables below provide further examples of this issue.

% challenge	Opex	Capex	Repex	Total
EoE	-26%	4%	-39%	-26%
Lon	-21%	19%	-31%	-22%
NW	-16%	9%	-24%	-18%
WM	-30%	-45%	-40%	-39%

Table 56: Streetworks challenges (pre-application of regression model scalar)

% challenge	Opex	Capex	Repex	Total
	Maintenance	Connections		
EoE	-14%	N/A	0%	-8%
Lon	-56%	N/A	0%	-26%
NW	-14%	N/A	0%	-6%
WM	54%	N/A	0%	17%

Table 57: MOBs challenges (pre-application of regression model scalar)

For Final Determinations, it is vital that challenges from separate assessments are applied directly to the relevant activity lines and not included in the calculation of the catch up efficiency challenge. If this approach is not taken, it will be impossible to develop unit costs for PCDs that are fair and representative of the efficient cost to deliver the commitment. Failure to address this error could result in a range of serious consequences for all GDN and customers including:

- GDN are likely to be insufficiently funded to carry out their statutory duties (which would be inconsistent with Ofgem's financeability duty).
- the likelihood that GDNs face perverse/weakened incentives.
- the likelihood that customers are not paying the efficient cost under PCDs – they may end up paying too much.

c) Failure to develop up bottom up cost models to calculate activity specific catch up challenges and costs allowances that are representative of the true efficient cost to deliver the activity.

As discussed in section B, we are seriously concerned that Ofgem has not used bottom up cost models to inform the calculation of the catch up efficiency challenge. Ofgem's reliance on a 'partex model' is biased and incorrectly assumes that there is a single correct specification for modelling efficient costs and that a company is equally efficient across all of its activities, which is clearly not the case.

At GD1, the use of bottom up cost models provided a balanced, 'rich picture' view of GDN cost efficiency, and also allowed a more proportionate approach to estimating and applying the catch up efficiency challenge to individual activity areas. This resulted in a rational and balanced approach to setting cost allowances, which GDN could understand and have some confidence that the allowed costs represented the efficient cost of delivery. We note that the recently published RIIO-ED2 Sector Specific Methodology Consultation proposes the use of the same 'rich picture' approach (a combination of topdown and bottom-up models) that was adopted at GD1 and RIIO-ED1. We also note that Ofwat relied on a portfolio of models to determine efficient costs at PR14 and PR19, and that the CMA endorsed this approach in the Bristol Water appeal of the PR14 final determination.

The approach Ofgem has taken at DD completely ignores this past approach and regulatory precedent (without any proper justification for doing so) and results in an unbalanced view of cost efficiency which is applied in a disproportionate manner.

For GDNs and stakeholders to have confidence in efficiency modelling at the final determinations, it is vital that Ofgem reverts to its GD1 position and the position in the Sector Specific Methodology Decision[25], and use bottom up cost models to inform the calculation of the catch up efficiency challenge.

4. Other Errors

In reviewing the calculation of the catch up efficiency challenge, we have identified several errors in the calculation of the catch up efficiency challenge and its application.

a) Calculation of workload adjustments post modelling

The DD applies workload adjustments post modelling to correct for workload adjustments in the CSV. This approach to dealing with workload adjustments in the model is flawed:

- For the totex model, the DD has used normalised costs after exclusions and cost adjustments to 'uplift to the central case' (connections and reinforcement). However it has not adjusted the CSV for either the exclusions or 'uplifts to the central case'. This results in a mismatch between the costs and the cost driver in the model.
- Instead, the DD approach relies on calculating post-model adjustment to take into account workload adjustments relating to 'uplifts to the central case' (though not all), and for workload exclusions on repex.

[25] Both Ofgem's Sector Specific Methodology Document (published May 2019) and consultation on Tools for Cost Assessment confirmed the intention to follow the same approach at GD1, and Ofgem did not reveal through its CAWGs that it intended to deviate from its approach.

- This approach is counterintuitive, is very likely to increase error in the regression model and double counts the cost exclusion.

The application of the workload adjustment is also flawed – it is used to adjust Ofgem's view of totex modelled costs. This results in a further downward adjustment on modelled costs. However, as the adjustments only relate to opex and repex (upwards for opex, downwards for repex), this approach and then the later calculation of the implicit adjustment means it is overly effected by the repex challenge – which is then smeared across totex.

b) Inconsistent application of exclusions and reclassifications

To calculate the normalised costs for the totex regression model, the DD removes certain disallowances and makes other adjustments to gross totex. These same adjustments are also used to calculate totex allowances later e.g. disallowances, adjustments, remove of bespoke outputs and technical assessments etc. However in calculating allowances, these adjustments are applied to our net submitted totex.

While not all costs have contributions related to them, the approach (and model set up) risks removing gross costs from our net submitted totex (or in the case of uplifts, adding gross costs to net submitted totex), or using net costs to normalise costs for the regression model. This issue needs to be resolved for final determinations.

c) Repex disaggregation model – adjustments not made for reclassification

As per GDQ 102, within the model, the "Cal_AdjCosts sheet" and "Cal_Agg" sheet only remove exclusions from our submitted costs but do not adjust for reclassifications. For example, for EoE the model removes £57m of repex costs but does not add back in £16.5m of costs for reclassification for reinforcement for insertions. This is inconsistent with Ofgem's methodology and also the approach taken in the Allowances model (["9] Allowances"), and therefore we consider it to be an error.

Gas Distribution Questions

GDQ42 - Do you have any views on our common UMs that haven't been covered through any of the specific consultation questions set out elsewhere in this chapter? If so, please set them out, making clear which output you are referring to.

Third-party damage and water ingress

Alongside this pass-through mechanism, Ofgem have proposed a licence obligation for GDNs to attempt to recover all costs from responsible parties or under relevant insurance policies prior to requesting pass through allowances.

We propose that this obligation should only apply on a reasonable endeavour's basis. This reflects the adversarial nature of pursuing such costs from third parties in some cases, and at the extreme such claims could result in significant financial implications for contractors that could prevent their continued operation.

HSE policy changes

Ofgem's proposal for an HSE policy change re-opener broadly aligns to our position. However, we have specific comments on the scope of this mechanism, and we do not agree with proposals for materiality thresholds, as outlined below.

Scope

Under the current proposals, the HSE policy changes re-opener only relates to changes that impact the IMRRP. However, there are changes in relation to wider HSE policies outside of the IMRRP that may impact our costs and workloads in RIIO-2. We believe these eventualities should be within the scope of the re-opener.

Importantly, these changes may not be driven by a formal reissuance of policy. Instead, the HSE may undertake enforcement action (which could also be directed at another network) which requires us to change our approach. Further changes could also be triggered by a change in interpretation of risk from the HSE. It's important that the definition of this mechanism contains sufficient flexibility to account for these scenarios, given that they constitute a change in requirements we must meet.

Materiality thresholds

As outlined in Core Q12, we do not support the use of a 1% materiality threshold for re-openers and have outlined alternative proposals that reflect the nature of the RIIO-2 price control. This should apply in the case of HSE policy changes.

Gas Distribution Questions

GDQ43 - What are your views on the proposed re-opener for Tier 1 stubs?

We do not support the need for a re-opener for Tier 1 stubs. The management and replacement of Tier 1 stubs is a normal part of the IMRRP and hence is part of a company's normal asset management activities. Costs to deliver such work should therefore be assessed as part of the normal course of business of repex.

It is therefore appropriate for lengths delivered and associated costs to be included in the totex regression modelling. Failing to do so and creating a separate assessment for this aspect of repex would undermine the validity of the totex regression modelling and lead to unintended consequences where allowances are disproportionately set for different networks, leading to impacts for their customers. We have outlined our concerns with the approach that has been taken to removing costs for repex stubs in response to GDQ26.

Gas Distribution Questions

GDQ44 - What are your views on our proposal to introduce a <7bar diversions re-opener?

We welcome Ofgem's proposal to allow Cadent's submitted diversions costs and workload, for all our networks. However, as outlined in response to GDQ38, we are unsure why Ofgem has not uplifted our allowed diversions costs, as the amount we submitted is below the amount Ofgem's assessment would have allowed.

We agree with the decision to include a diversions re-opener for RIIO-2. We identified the uncertainty associated with these costs, and welcome that a common measure has been proposed that recognises our bespoke submission in the business plan.

However, we suggest changes are required to the proposed scope of this mechanism, and we do not agree with the proposals for re-opener windows and materiality thresholds, as outlined below.

Scope

It is not appropriate to constrain the UM to below seven bar mains assets, when diversions impact our whole asset base. To support economic growth or respond to environmental changes it is sometimes necessary for us to relocate above ground assets such as governors or pressure reduction stations - similarly we may be required to relocate high pressure pipelines. Constraining this mechanism to a single asset group fails to acknowledge the full set of assets we may be required to re-locate.

We also understand, following responses from Ofgem to clarification questions submitted after the Draft Determination, that this re-opener is intended to only capture costs classified with the "Non-Rechargeable" category of repex. This excludes the non-chargeable element of chargeable diversions (Lines 107 to 190 of BPDT 4.05). We do not think this is logical and in line with the policy intent surrounding this uncertainty mechanism.

Networks should be able to recover all non-chargeable costs created by diversions, regardless of whether they are part funded by third parties. Ofgem will note that the Contributions in BPDT 4.05 lines 107 to 190 (columns X to AK) do not fully net off the Gross costs (columns B to V). The non-chargeable costs in lines 107-190 consist of activities including legal arrangements for land easements and licences. We propose these costs should be included within the mechanism to consistently acknowledge the risks associated with diversions.

Re-opener windows

As outlined in our response to Core Q12, we propose annual re-opener windows, with a maximum of two submission opportunities, are a more effective and appropriate mechanism design for all re-openers. As a minimum, we do not agree with a single re-opener window in January 2022. As outlined in our bespoke UM submission in December, we must undertake diversion works to maintain the safe operation of networks, enable growth and to ensure we can continue to access our assets following third-party development. This work is triggered by external developer demand or changing environmental factors and is consequently difficult to forecast. Relying on a single window in January

2022 does not provide adequate opportunity to address the uncertainty in the volume of work that may be triggered throughout the RIIO-2 period. It is therefore difficult to understand why Ofgem prefers to err on the side of nonrecoverability by licensed companies when the issue would easily be resolved by adopting a more reasonable and proportionate approach for re-opener windows.

Materiality thresholds

As outlined in Core Q12, we do not support the use of a 1% materiality threshold for re-openers and have outlined alternative proposals that reflect the nature of the RIIO-2 price control. This should apply in the case of diversions.

Cadent
Your Gas Network

Gas Distribution Questions

GDQ45 - What are your views on the triggers and windows for the MOBs safety re-opener?

We support Ofgem's proposal adopt the bespoke proposal included in our business plan submission as a common re-opener for all GDNs.

Triggers

As outlined in our December submission, we believe triggers for this re-opener should relate to the introduction of new safety standards that we are required to meet with respect to MOBs. This includes the passage of legislation following the Hackitt review in Parliament that has implications for our work. This would also include any mandatory programmes or notices made by the HSE in relation to MOBs. We therefore support the triggers set out in paragraph 4.45 of the Draft Determination, which are externally determined and readily available. We welcome the proposal to further engage on the precise form of a trigger through consultation with the Licence Drafting Working Group.

Re-opener windows

As outlined in our response to Core Q12, we propose annual re-opener windows, with a maximum of two submission opportunities, are a more effective mechanism design for all re-openers. In relation to the specific triggers outlined above, these could occur at any time during the RIIO-2 period. Therefore, constraining submissions to two specific windows is inappropriate. It is therefore difficult to understand why Ofgem prefers to err on the side of non-recoverability by licensed companies when this issue would easily be resolved by adopting a more reasonable and proportionate approach for re-opener windows.

If one statutory body, the MHCLG or HSE, has mandated action with respect to MOBs, it would be consistent for the other regulatory arrangements to provide funding at the same time. An annual window sends the right message to customers that Ofgem will not place barriers in front of essential safety work being progressed.

Materiality thresholds

As outlined in Core Q12, we do not support the use of a 1% materiality threshold for re-openers and have outlined alternative proposals that reflect the nature of the RIIO-2 price control. This should apply in the case of MOBs.

Gas Distribution Questions

GDQ46 - What are your views on our consultation position to address bespoke decarbonisation of heat re-openers through our proposed innovation stimulus, Net Zero and Heat Policy reopener mechanisms?

We welcome recognition that RIIO2 needs to fund decarbonisation projects, and we believe the Ofgem framework is consistent with our Business Plan proposals, although there is an urgent need to provide greater clarity as soon as possible ahead of the start of the RIIO-2 period. For significant expenditure the re-opener process would need to include a process to confirm the funding and financing approach. This would include the WACC, as it should not be assumed this is a routine investment comparable with our BAU regulated activities.

Heat policy reopeners will only allow network initiated triggers if heat policy is confirmed and the impact assessed in 2022 and no later. This is too prescriptive especially as Government have referred to heat policy decisions closer to the middle of the decade. As with our general view on windows, to ensure the regulation does not present a barrier, an annual January window each year would be our recommended approach.

The heat policy triggers should enable regional heat policy delivery as well as national policy decision, including devolved Government and regional bodies such as the Greater London Authority and Greater Manchester Combined Authority.

The heat policy trigger wording needs to be revised to refer to Distributed Entry charging and access arrangements rather than "connection charging arrangements". This would ensure changes to either connection charging or network pricing in UNC would be covered.

The heat policy reopener should make it very clear that it can also cover costs associated with preparation of plans and policy as well as implementation, and our comments in other answers regarding preparatory work and anticipatory triggers apply equally to the heat policy reopener. These amendments would add the flexibility to ensure funding and other regulatory changes are in place as early as possible.

Using the distributed entry charging as an example. If no re-opener progress is initiated until the trigger of a UNC change approval, then funding for entry investments would be delayed. Developing the reopener in parallel with the UNC process would ensure both Code and Licence were synchronised and the full package implemented to support green gas as early as possible.

We note that the heat policy re-opener is currently proposed to be limited to the gas sector, which risks ignoring whole system thinking and the reality that any changes to heat policy, either regionally or nationally is likely to impact both electricity and gas networks.

When considering appropriate funding through uncertainty mechanisms, the assessment process must be capable of considering longer term developments, as well as meeting the immediate need. Sizing the assets to only meet the short term need, may deliver immediate efficiencies, but these would soon be offset by the subsequent less efficient investments for future phases and requirements. An example of

Gas Distribution Questions

this would be building hydrogen infrastructure of a size to support an industrial cluster, that is then not capable of efficient expansion for domestic heat or other uses.

GDQ47 - What are your views on the questions set out in paragraph 4.57 of this document in relation to large hydrogen projects?

The questions are all reasonable, and we would welcome Ofgem's timetable for their development of the regulatory framework required to answer these questions.

Many of the questions in 4.57 would be answered in a process to determine the licencing regime for construction, ownership and operation of large hydrogen infrastructure. Such a process can be informed by networks, but we would expect this to be led by Ofgem and Government.

We note the discussion on competition for large hydrogen projects, and would urge that the additional complexity and delays the different levels of competition can introduce are measured carefully against the perceived benefits. There is considerable value to be gained from minimising the complexity for these first of a kind, ground breaking initiatives, which will have complex and unavoidable high priority technical and safety challenges to manage to make ensure the projects are successful. Rigid imposition of regulatory economic purity may not be appropriate for this first of a kind projects. These initial projects can however provide valuable learning to inform the efficient wider scale role out of hydrogen infrastructure. For example, the first offshore electricity transmission connections were initially developed without the transmission licencing regime in place.

There remains a lack of detail for how large construction projects such as HyNet can be taken forward within the innovation framework. It is not clear from the draft determination if it is SIF, Net Zero or Heat Policy. We believe SIF could be the most appropriate route for the pre-construction work including Front End Engineering Design for future projects, as it can be quickly mobilised and directed by Government. It could be designed to accommodate the full construction and commissioning, however the greater scope to amend Licences are likely to be required, which are provided through the decarbonisation re-openers. We do not object to funding through other routes but note that these may introduce delay. In the absence of a further level of detail, it is not possible to draw any firm conclusions on the best approach at this time.

HyNet has an even more urgent need for funding clarity as a result of the bidding process for the Government's Industrial Decarbonisation Challenge (IDC) fund. Due to the timing of this, and that of the detailed SIF and Net Zero framework, we believe a specific RIIO-2 allowance may be the only realistic course of action to provide the necessary funding certainty at this stage. It would be linked to the costs submitted into the IDC bid, with a simple use it or lose it allowance around a PCD for the delivery of the HyNet FEED study. We are happy to engage on this in more detail with Ofgem and BEIS over the next few weeks.

There is no reference to the acceptability of asset based funding for large asset projects such as these. If Cadent is to undertake the construction and operation for large hydrogen assets such as HyNet, then there would need to be a process to confirm both the funding and financing approach. This must include the WACC, as it should not be assumed this is a routine investment comparable with our BAU regulated activities.

Without urgent action to provide the required level of detail to allow the mechanisms to go live, there is a very strong chance the Ofgem framework will become a significant barrier to decarbonisation. We are eager to work with Ofgem and the other networks to build the detailed mechanisms required to ensure the critical projects required to achieve our net zero ambitions can be progressed at pace. Our assumption is that similar mechanisms will need to be in place for electricity network operators so a whole system approach can be adopted.

To illustrate the need to support a fast pace of implementation, we note the developing plans in the North
West where regional ambitions for net zero are well ahead of the national target for 2050. The Mayor of Manchester is committed to achieve net zero by 2038, and recently Electricity North West and Cadent have published a joint plan to achieve this, which requires a balanced approach with both significant electrification and use of hydrogen at scale for some aspects of heating. This plan will require HyNet' s initial and later phases to be completed as early as possible, and de-risking the critical delivery steps will be an important principle to support the necessary timetable.

Across our region there are ambitious Net Zero plans across a number of Local Authorities who are looking to energy infrastructure providers to provide a balanced view of what can be achieved in the near and long term. Working with DNO's we are demonstrating the least-cost whole system pathway and we expect net zero infrastructure investment needs will be developed based on regional demands. The necessary mechanism to finance of these programmes will need to be flexible to regional differences.

Gas Distribution Questions

GDQ48 - Do you have any other comments in relation to this section?

No additional comments.

Gas Distribution Questions

GDQ49 - What are your views on our proposal to introduce a new domestic connections volume driver?

We support the use of a connections volume driver and made bespoke proposals for such a mechanism within our December business plan submission. However, the common proposals outlined in the Draft Determination vary in terms of both scope and use of unit cost rates compared to our business plan submission.

In our response below, we outline our concerns with the Draft Determination's proposed mechanism, and outline alternative treatments in line with our original submission that will address the risks associated with new connection volumes in RIIO-2 more effectively for consumers.

Proposed mechanism scope

In our December submission, we proposed a volume driver that related to all, rather than only domestic connections. Having undertook analysis on the components of connections costs, we are minded to accept the Draft Determination's position for the scope of the mechanism, given the significant share of total connections costs that are captured by the domestic connection segment to date.

However, for this to be acceptable, it must be the case that our base allowances contain sufficient costs to address volumes of non-domestic connections in RIIO-2. In our December submission, we provided a baseline submission based on the lowest volumes of new connections observed in RIIO-1 for each of our networks. Further costs were modelling through our proposed uncertain mechanism, with Ofgem 'adding back' our central cost estimate from this analysis to put our baseline forecast on the same basis as other GDNs.

Through subsequent engagement through the DD query process, we have sought to understand how this adjustment for costs previously captured within our UM have been allocated between different connections categories. We are yet to receive this clarification. As such, we request that Ofgem provide clarity on this breakdown as soon as possible, as well as details on how the baseline allowance and volume driver will interact, to ensure there is sufficient funding for both domestic and non-domestic connections.

Separately, we have noted to Ofgem in queries that the connections UM costs submitted within our December BDPTs were reported on a net basis. In adjustments within the normalisation models, these were converted to a gross cost, before being added to our submitted baseline (which was reported on a net basis). There appears to be an error in that gross and net costs have been combined on an inconsistent basis.

Proposed mechanism unit costs

We have specific concerns on the design and calibration of unit costs within the volume driver mechanism, which must be addressed before we can comment on these proposals. This includes ensuring that appropriate unit costs are embedded in the driver, which we been unable to determine from the information provided in the Draft Determination.

DDQ20 submitted to Ofgem has addressed the issue of the transparency of these unit costs. Currently we are still awaiting an update on our question, which has requested the costs be broken down into a dictated template we have attached.

As outlined in our response to GDQ36, we have significant concerns over the approach taken to develop synthetic unit costs for connections. This issue is explored fully in our response to this earlier question, but below we summarise our concerns with regard to the use of these costs within the volume driver:

- As a principle, it is inappropriate to use the synthetic unit costs as the basis for determining cost allowances under an uncertainty mechanism. While synthetic cost drivers can be a useful construct for modelling costs in a top-down regression model, they are in no way reflective of the actual efficient costs of delivery.
- Additionally, the minimum data requirements used to develop synthetic unit costs are inappropriate for developing a fair industry average. They:
    - are based on a small number of observations - requiring only data points from two companies over two years;
    - remove all outliers that are 100% (or more) away from the average and therefore do not address differences in scale, complexity or capacity requirements of connections; and
    - appear to rely on scaling factors to calculate some unit costs without justification for the scaling factors.
- As such, the proposed synthetic costs cannot be considered to be a true industry average. Without visibility of the underlying calculations behind the synthetic unit costs, we have concerns, based on the issues outlined above, that the values may exhibit a bias against our East of England and London networks.
- These costs also don't reflect regional differences for pay and productivity, with adjustments made through normalisation. Uplifts will be required in our individual networks before use within the uncertainty mechanism.
- The synthetic unit costs also do not address differences in mix of workload. For example, if our unit costs were based on a different mix of large/small, complex, large capacity connections to another GDN then our unit costs may have been identified as outliers and excluded from the synthetic calculations.
- Finally, we note that the gas connections market is a competitive market, with independent providers competing against GDNs to provide connections. Basing allowances on an industry average unit cost could have serious consequences for the market, particularly where the industry average unit cost is higher than the efficient cost of delivery in a particular network. In this situation, a GDN would be incentivised to compete for more connections and would be rewarded for doing so - providing it with an unfair competitive advantage against independent providers.

Concerns with the use of synthetic unit costs were also identified by CEPA (Pg. 26 4.4 Synthetic Unit Cost Annex):

> *"We recommend that Ofgem considers alternative cost assessment approaches for connections as a synthetic unit cost approach is unlikely to be appropriate.*

From an ex-ante qualitative perspective, unit cost comparisons may be difficult

because the complexity of connections can differ significantly between GDNs. For example, connections that require more than 169 kW peak demand may require additional reinforcement. In addition, a development with multiple connections can spread the fixed costs across multiple units, leading to a lower unit cost relative to a single connection.

These concerns are realised through our assessment, which shows that unit costs vary significantly between GDNs (failing criterion 4) and over time (failing criterion 5 for some connection activities). The large variability between GDNs may be due to unit costs being calculated on a net cost basis, which takes into account differences in cost contributions between GDNs.

Ofgem may want to explore alternative cost drivers to explain variations in connections costs between GDNs and over time (e.g. number of new connections and/or complexity of new connections)."

For the concerns outlined above, we propose an alternative approach is taken to developing unit costs for the volume driver. This would involve calculating unit costs for individual networks based on the total costs that have been submitted in December (with applicable adjustments as made at Draft Determination for regional efficiency and frontier shift), alongside the associated workloads. This would produce a more suitable unit cost that more closely reflects the actual costs of delivering domestic connections.

Gas Distribution Questions

GDQ50 - What are your views on our proposal to continue with the large loads re-opener?

We support the principle of a re-opener mechanism to address uncertainties in the volume of large loads that may connect to our network in GD2. However, we do not agree with the proposals for re-opener windows and materiality thresholds, as outlined below.

We provide our comments on the scope of this mechanism as currently defined in our response to GDQ51.

Re-opener windows

As outlined in our response to Core Q12, we propose annual re-opener windows, with a maximum of two submission opportunities, are a more effective mechanism design for all re-openers. As a minimum, a single re-opener window in January 2022 is inappropriate. New large loads may wish to connect at any time during the price control, and a single window skewed towards the beginning of this period does not provide adequate opportunities for us to respond to this risk. It is therefore difficult to understand why Ofgem prefers to err on the side of non-recoverability by licensed companies when this issue would easily be resolved by adopting a more reasonable and proportionate approach for re-opener windows.

Materiality thresholds

As outlined in Core Q12, we do not support the use of a 1% materiality threshold for re-openers and have outlined alternative proposals that reflect the nature of the RIIO-2 price control. This should apply in the case of new large loads.

Cadent
Your Gas Network

Gas Distribution Questions

GDQ51 - Do you agree with our definition of a 'large load' to use for this re-opener?

Definition

In paragraph 4.67 of the Draft Determination, a new large load is defined as:

- One that has passed the Economic Test
- Requiring specific reinforcement upstream of the Connection Charging Point not chargeable to the new load

We are supportive of a definition that addresses the risks associated with new large loads connecting to our network, for example power generation sites. Such sites have connected to our networks at an increasing rate in RIIO-1, and often require reinforcement to support their operations at times of peak consumption.

Power generation units may not individually satisfy the conditions as currently outlined in the definition of a large load, however their aggregate impact on the network (as power generation sites are often clustered together geographically) can result in the need for significant reinforcement. Therefore, the definition should have the flexibility to consider the aggregate impact of such connections.

To ensure these impacts are addressed through the re-opener, we propose further detail is required on the size of a 'new large load' within the definition. We propose the re-opener should apply to all new large loads with a peak demand over 1,500 scm/h (that satisfy the existing conditions in the proposed definition). This threshold would capture power generation sites from 5MW and above, where we have historically observed challenges. Such sites are equivalent to approximately 2,100 domestic customers in a single connection point. It would also capture other large loads such as CNG filling stations.

Controls

Ofgem note in paragraph 4.72 of the Draft Determination that for this re-opener to be triggered, evidence must be provided that costs:

- Cannot be fully recovered from the connecting party
- Are not already funded through the GDN's baseline allowance
- Could not have been avoided by network management, for example through contractual arrangements with parties connected in the affected area.

We actively work to ensure that reinforcement is only undertaken where required. We have processes for RIIO-2 whereby reinforcements are evaluated systematically, to ensure that no other viable alternatives are discounted. In the case of power generation, this includes providing signals to areas of our network where connections can be made without the need for additional reinforcement. As such, triggering this uncertainty mechanism would be a last resort, with controls in place to ensure the best solution for customers is adopted.

However, even with a robust process in place, we can't fully control the location decisions of such parties, and therefore the mechanism must provide an opportunity to mitigate this risk to our business.

Our proposed process for evaluating reinforcements ensures that costs we propose to recover through the re-opener can be justified in a consistent manner, supporting effective use of the re-opener process.

Gas Distribution Questions

GDQ52 - Do you agree with our proposal to continue with a smart meter rollout re-opener?

We support the use of an uncertainty mechanism to protect against the uncertainty around volumes of smart meter interventions, driven by the overall progress of the smart meter rollout. However, we have specific comments on the scope of this mechanism, and we do not agree with the proposals for reopener windows and materiality thresholds, as outlined below.

Scope

Our experience to date in RIIO-1 of smart meter intervention costs has demonstrated the challenges associated in this area. We have incurred significant costs in this area to date, however due to the new processes and industry engagement Cadent have put in place and the extended timescales the suppliers have been given to deliver the smart metering rollout, costs have not been sufficient enough to breach the materiality threshold required for a re-opener submission in RIIO-1.

We do not agree it is appropriate for these costs to be fully borne by our shareholders, given that work of this nature is primarily driven by the rate of the smart meter rollout, which is outside of our control. Therefore, we propose the scope of this mechanism should ensure that historic costs which have yet to be reclaimed in RIIO-1 can be included within a submission. If this amendment is not made, we expect for this issue to be resolved through the RIIO-1 close out process.

Re-opener windows

As outlined in our response to Core Q12, we propose annual re-opener windows, with a maximum of two submission opportunities, are a more effective mechanism design for all re-openers. As a minimum, we do not agree with a single re-opener window in January 2022. Further submission opportunities would align with the newly established deadline for the smart meter rollout (now due 2023) and allow us to provide evidence when this process is closer to completion. The impact of the coronavirus crisis on the smart meter rollout further supports the need to expand the opportunity to address this uncertainty beyond a single window early in the price control. It is therefore difficult to understand why Ofgem prefers to err on the side of non-recoverability by licensed companies when this issue would easily be resolved by adopting a more reasonable and proportionate approach for re-opener windows.

Materiality thresholds

As outlined in Core Q12, we do not support the use of a 1% materiality threshold for re-openers and have outlined alternative proposals that reflect the nature of the RIIO-2 price control. This should apply in the case of smart meters.

Cadent
Your Gas Network

Gas Distribution Questions

GDQ53 - Do you agree with our proposal to continue with a common streetworks re-opener?

We support the continued use of a common streetworks re-opener in RIIO-GD2, and the proposal to expand its scope to include costs driven by new lane rental schemes or further new requirements (alongside new permit schemes). As outlined in our Uncertainty Mechanism submission in December, we face considerable uncertainty over both the number and scope of new schemes or requirements that may be introduced in our network area.

However, we do not agree with the proposals for re-opener windows and materiality thresholds, as outlined below.

Wider observations

Experience across re-opener submissions in RIIO-1 highlights the complexity associate with streetwork costs. Therefore, it is important that there is upfront transparency and clarity on what cost information will be required, and how re-opener submissions will be assessed. This is critical to ensuring the success of the mechanism in RIIO-2.

We also note that Ofgem has disallowed all costs related to penalties within base allowances. As outlined in detail in our response to GDQ38, we do not support this adjustment - an efficient level of penalties should be included in totex allowances. An efficient level of such cost should also be captured within the scope of the re-opener.

Re-opener windows

Ofgem's proposal for a single re-opener window in January 2022 for streetworks leaves minimal time in RIIO-2 to assess and fully calculate both actual and forecast costs. It also fails to provide adequate opportunity to respond in relation to new schemes or requirements that may be introduced in later years of the price control. As outlined in our response to Core Q12, we propose annual re-opener windows, with a maximum of two submission opportunities, are a more effective mechanism design for all reopeners.

To illustrate the challenges associated with a single re-opener window for street works, consider the example of Surrey County Council, who have recently made proposals for a lane rental scheme which is expected to progress in line with the timetable below after consultation with the Department for Transport:

- Mar 2021 Proposed initial Lane Rental scheme introduced by Surrey CC
- Jun 2021 End of 3 month 'test' period and true costs being introduced

This would provide us with less than 6 months to begin gathering relevant cost information on the new lane rental scheme to evidence a re-opener submission in January 2022. The example of Surrey CC also represents a highways authority whereby our network footprint is less than 10%. This would serve as a poor predictor of costs that could arise from further lane rental schemes introduced elsewhere.

This challenge is further compounded by additional regulatory changes, such as the new specification of the reinstatement of openings in highways commencing in May 2021. Under the current proposal, these standards will not have had time become embedded within the industry, thereby limiting the cost evidence that networks could provide in a January 2022 re-opener submission.

Further submission opportunities would allow networks to provide well evidenced submissions for additional costs and remove the need to heavily rely on forecasts to cover costs driven by new requirements. Finally, baseline allowances have been developed with regard to schemes that are currently in place, the requirement for submitted costs to relate to "new schemes" should cover any scheme that is introduced after our business plan submission (and not just those that arise within the RIIO-GD2 period).

It is therefore difficult to understand why Ofgem prefers to err on the side of non-recoverability by licensed companies when this issue would easily be resolved by adopting a more reasonable and proportionate approach for re-opener windows.

Materiality thresholds

As outlined in Core Q12, we do not support the use of a 1% materiality threshold for re-openers and have outlined alternative proposals that reflect the nature of the RIIO-2 price control. This should apply in the case of streetworks.

Gas Distribution Sector: Annex

1. **First economics – RIIO-2 Frontier Productivity Growth**
2. **Cranfield University – Estimating Soil Erosion Risk**
3. **Wardell Armstrong – Land-use Factors that influence reduced depth of cover.**
4. **NERA – Review of Ofgem's GD2 Draft Determination Cost Assessment**

Frontier Productivity Growth

A report prepared for the Energy Networks Association

August 2020

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1. Introduction

This paper contains a review of Ofgem's July 2020 approach to estimating frontier productivity growth. It builds on our previous February 2019 paper[26] for the GB gas distribution networks and seeks, in particular, to locate the judgments that Ofgem is required to make later this year in its final RIIO-GD2/T2 determinations within the proper macroeconomic context.

The paper is structured into three main parts, as follows:

- section 2 develops the observations that we made in our first paper about the UK "productivity puzzle" and about the importance of addressing head on the impact that slow economy-wide productivity growth can be expected to have on energy network businesses. It also considers the effects that the COVID-19 pandemic and ensuing economic turbulence might have on productivity in the short and medium term;
- section 3 makes a number of more technical observations about the analysis in the CEPA report[2] published alongside Ofgem's draft decision document; and
- section 4 concludes.

[26] First Economics (2019), Frontier productivity growth: a report prepared for the Energy Networks Association. [2] CEPA (2020), RIIO-GD2 and T2: cost assessment – frontier shift methodology paper.

2. Macroeconomic Context for RIIO-2

2.1 Recap of First Economics' February 2019 report

Our 2019 paper explained that estimates of frontier shift are typically obtained via benchmarking to historical rates of productivity growth in industries with similar characteristics. In its RIIO-GD1/T1 reviews, Ofgem's reading of the comparator data was that a frontier energy network ought to be able to reduce its opex by 1.0% per annum and its repex/capex by 0.7% per annum. Table 2.1 shows that this tallied very closely with views expressed by the Competition Commission (CC) and the Competition & Markets Authority (CMA) in recent regulatory decisions, as well as estimates made by other economic regulators in price reviews conducted up until 2017.[27]

Table 2.1: Assumptions made by regulators about rates of annual frontier productivity growth in decisions issued up to 2017

	Opex	Capex
Ofgem, RIIO-GD1/T1, 2012	1.0%	0.7%
CC, Northern Ireland Electricity, 2014	1.0%	1.0%
Ofgem, RIIO-ED1, 2014	1.0%	0.7% to 1.0%
Utility Regulator, NI Water, 2014	0.9%	0.6%
CMA, Bristol Water, 2015	1.0%	-
Utility Regulator, GD17, 2016	1.0%	1.0%

We went on to suggest that it had become quite difficult for a regulator simply to roll forward such assumptions into new price controls. One of the major economic issues of the day has been the UK economy's failure to replicate pre-2008 rates of productivity growth since the global financial crisis, and it seemed to us that companies and Ofgem unavoidably had to come to a view during the RIIO-2 reviews on the implications that lower economy-wide productivity improvements would have for the rate of energy network efficiency improvement during the 2021-26 regulatory period.

Table 2.2 reproduces estimates made by the Bank of England[28] in 2019, which neatly capture the scale of the drop that there has been in the trend rate of productivity growth since 2008.

Table 2.2: Bank of England estimates/forecasts of annual total factor productivity growth

	1998-07	2008-10	2011-14	2015-18Q3	2018Q422Q1
TFP growth	1.0%	-0.6%	-0.1%	0.2%	0.3%

Source: Bank of England.

Our assessment was that it was unlikely that energy networks would be immune from the factors that have been weighing on productivity growth in the rest of the economy. We took this view in part, because there was clear evidence of a slowdown in productivity improvement in regulated industries at around the same time as recorded rates of productivity growth began to decline in

[27] The table does not include the estimate that Ofwat made of frontier shift in its PR19 final determinations. This decision is currently the subject of a CMA redetermination process.
[28] Bank of England (2019), Inflation report, February.

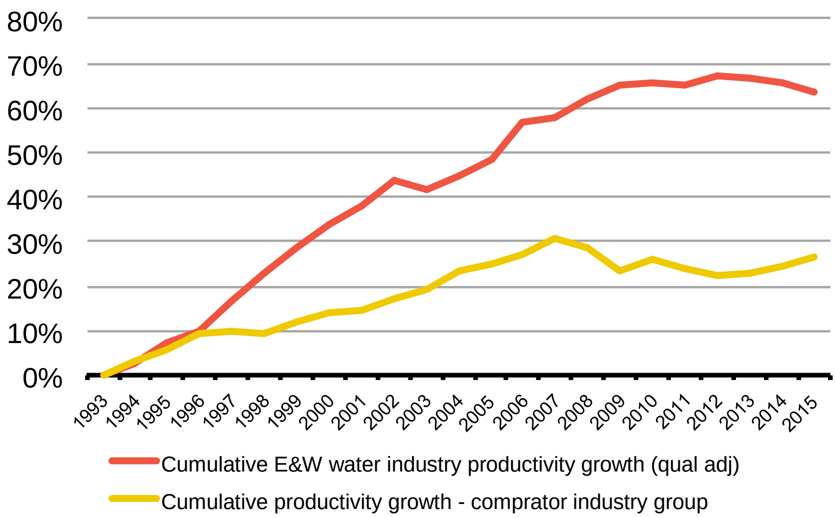
other industries. Table 2.3 summarises the electricity distribution networks' experiences (as the sector in which data availability allows for the clearest pre- and post-crisis comparisons).

Table 2.3: Electricity DNOs' average annual total factor productivity growth

	DPC1/2	DPCR3	DPCR4	DPCR5	RIIO-ED1
TFP growth	3.3%	4.0%	3.2%	-1.2%	0.4%

Figure 2.1 depicts a similar picture in the England & Wales water industry (red line) and in a broader basket of twelve non-regulated comparator industries (yellow line).

Figure 2.1: Total factor productivity growth (cumulative)



Source: Frontier Economics (2017), Productivity improvement in the water and sewerage industry in England since privatisation.

We also thought that the structure of the network industries meant that there is a direct feed through from productivity growth in other sectors of the economy through to overall energy network productivity. A modern-day network business will typically out-source most of its capital expenditure and maybe around one quarter of its operating expenditure, meaning that its ability to deliver efficiency improvements is dependent to a considerable degree on the ability of its contractor partners to deliver new cost savings. To the extent that these firms are struggling with productivity, it seemed to us that energy networks are also likely to find it more difficult to make productivity improvements than in the past.

We did not feel after looking at the above data that we were able to come to a precise estimate of the ongoing productivity growth that frontier network companies should be including in their business plans. Instead, we recommended that each company needed to make their own assessments of possible trajectories for the RIIO-2 period informed by both the analysis in our paper and their own experiences with alliances and other supply chain partners.

2.2 Ofgem's July 2020 draft determination

Most gas distribution and transmission companies recognised the importance of the points that we had put to them and went on to explain in their December 2019 business plans how they thought that wider macroeconomic trends were relevant to their businesses. However, we were surprised to see Ofgem choose not to dwell on the "productivity puzzle" in its July 2020 draft determination document.[29] Ofgem instead wrote a single paragraph on the topic, as follows:

> We have considered including productivity growth forecasts from the Office of Budget Responsibility (OBR) and Bank of England (BoE). These forecasts are influenced by short and medium term risks to the economy such as the UK's exit from the European Union and COVID-19. In the context of a rising trend in longer term productivity forecasts, we do not wish to place significant weight on such economy-wide and short-term forecasts, as network companies are not exposed to these short-term risks (to volume and revenue) as their comparators in the wider economy and are better able to withstand any short-term shocks. OBR and BoE forecasts may therefore underestimate productivity in network companies and are not appropriate for setting ongoing efficiency.

From our standpoint, the brevity of this analysis is hard to reconcile to the importance of the issues at hand. The RIIO-2 reviews are the first real opportunity that Ofgem has had to consider the apparent slowdown in regulated industry productivity growth, as well as the UK's disappointing recent productivity record, and we would have expected a regulator to want to chew over both the economic analysis and the accompanying diagnoses and prognoses that have been issued by different commentators. It was jarring, therefore, that Ofgem elected deliberately not to confront the subject head on.

We also have difficulties with specific aspects of the statement set out above.

First, we think that Ofgem is wrong to characterise the decision it has to make in its RIIO-2 reviews in terms of whether it should or should not to place weight on particular short-term forecasts. The OBR and Bank of England numerical projections may or may not prove to be correct, and we recognise – as, indeed, the OBR and the Bank of England recognise – that there was a considerable uncertainty around the future path of productivity growth even before the COVID-19 pandemic. The main issue here, however, is not whether forecasters can forecast accurately but the clear and incontrovertible evidence that there has been a demonstrable step change in productivity growth across the UK economy since the global financial crisis and the question of how this stall is affecting and will continue to affect the companies that Ofgem regulates.

Second, the reference to a "rising trend in longer term productivity forecasts" is misleading. As we set out in section 2.1, the overall picture can be more accurately described as one in which:

- productivity growth has fallen markedly from the rates of growth that industries achieved prior to 2008; and
- there is hope that productivity growth will soon start to recover, but without any real expectation that growth rates will revert to pre-2008 norms.

It is quite wrong, therefore, to think of lower productivity growth as a short-term issue or a temporary blip. Ofgem only has to look at the number of words that economists have written on productivity in recent years[30] to know that something has happened that has affected the country's economic fundamentals in a significant way.

Third, we agree with Ofgem that there could be something in the notion that regulated energy network companies might be impacted differently by the factors that have been holding back economy-wide growth. The question that logically follows is: to what degree? This demands further investigation and analysis. Ultimately Ofgem then needs to make a judgment on the extent to which it ought to allow for a slowdown in energy network productivity growth in the content of falling productivity growth elsewhere, taking account of the drivers of productivity growth

[29] Ofgem (2020), RIIO-2 draft determinations.
[30] We provided a sample of references in annex 2 of our 2019 paper.

throughout the industry supply chain. It cannot just dismiss the wider macroeconomic picture as an irrelevance on the basis that energy networks are regulated monopolies.

We therefore think that the short paragraph that Ofgem placed in its July 2020 document fails to do justice to a complex subject area. We also think that Ofgem could usefully utilise the time that it has before it issues final determinations at the end of the year to expand on the evidence and analysis that it has produced to date.

2.3 Suggested approach

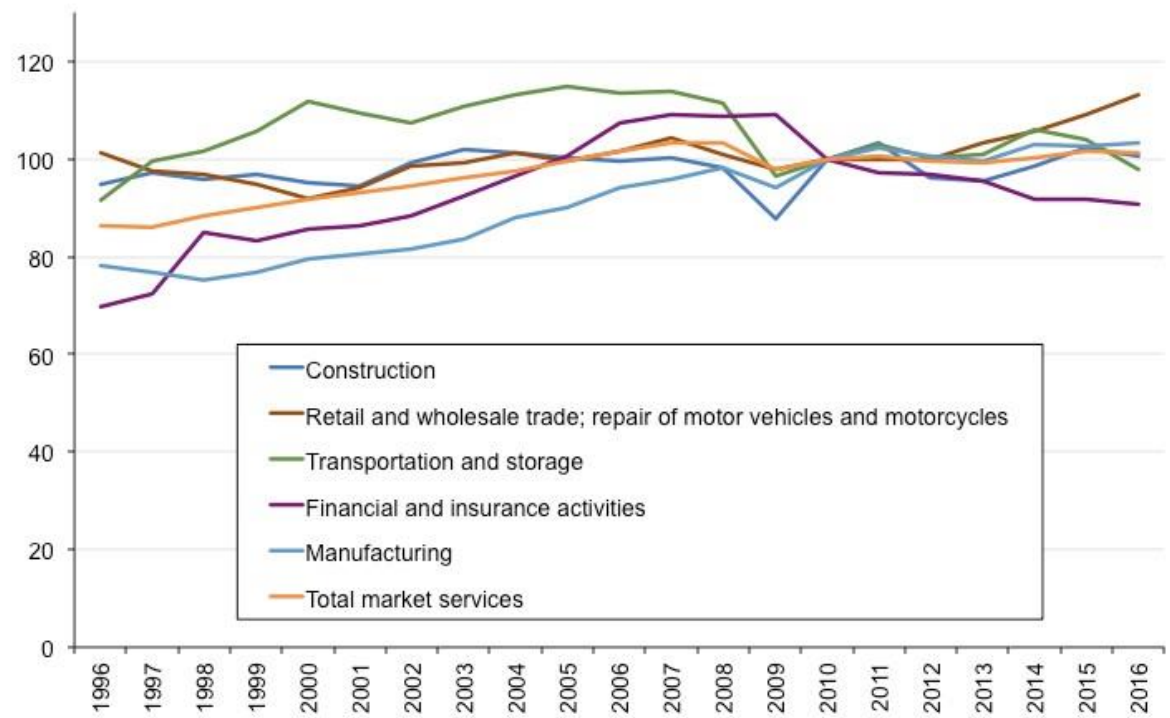
Taking the above points together, we consider that it is essential to approach the judgment that has to be made when assembling RIIO-2 price controls in terms that address directly the question of whether to allow for lower frontier productivity growth than regulators have typically assumed in the past.

We think that this can best be done by identifying in turn:

- the trend rate of productivity growth in comparator sectors of the UK economy prior to the 2008 global financial crisis; and
- the trend productivity growth that there was in the same comparator sectors since 2010 up until the start of 2020.

The source EU KLEMS data for this analysis is given in Figure 2.2. We also provide more up-to-date ONS series in annex A of the report, which presents a near-identical picture through to 2019.

Figure 2.2: Value-added productivity (2010 = 100)



Source: EU KLEMS.

On a visual inspection of figure 2.2, it should be apparent that the tram lines for Ofgem's RIIO-2 decision are going to need to be defined in terms of:

- the positive rate of productivity improvement seen in most comparator industries up to 2008; and
- the near-zero productivity growth that there has been, on average, since 2010.

In sections 3 and 4 of this paper, we give take on the technical assumptions and choices that we think Ofgem ought to make when it seeks to draw precise quantitative benchmarks from the above data set.

2.4 COVID-19

When making its determination, Ofgem will also need to take account of the impact that COVID-19 is likely have on productivity growth. As with a number of other aspects of the price control, it is difficult to be definitive as at August 2020 on what the implications of the pandemic will be, with the epidemiological outlook and the economic outlook both still moving around in the face of numerous uncertainties. It may nonetheless be helpful to capture the sense of direction that the OBR[31] and the Bank of England[32] have set out in their most recent publications. (Note that the latest OBR and Bank of England analysis was released after Ofgem issued its draft determination.)

Both bodies have stated that productivity will be weighed down by forced changes in working practices during the 'containment' phase of the pandemic response. The gas distribution and transmission networks are better placed than we are to explain how they have been affected by these changes, but several of the productivity-reducing reactions highlighted in the published reports – working from home, social distancing measures – look to us to be as relevant to the energy networks as to any other firm in the economy.

Looking more broadly, the experts see a mix of positives and negatives for productivity growth in the short term. On the one hand, there are worries that the COVID-19 shock will both reduce the amount of innovation that comes from new firms entering the economy and increase the capital scrapping that arises when firms exit markets. Balanced against this, infant companies tend initially to achieve lower levels of productivity than established companies, while firms that exit the markets tend to be less productive than surviving firms.

In the medium term, the key factor that the OBR and Bank of England both focus on is the amount of "scarring" that there will be from decisions that companies make in 2020 and 2021. The chief concern here is the extent to which current uncertainties and the build-up of corporate debt will cause firms to put investment and R&D expenditure on hold. If there are sustained cutbacks in these areas, lower spending might stifle innovation and inhibit the kind of productivity growth that would emerge naturally in more normal economic conditions.

The OBR's assessment after weighing these factors is as follows:

> Our upside scenario assumes a short-lived rise in unemployment, that the business investment lost during lockdown is recovered afterwards, and that business failures are limited. Consequently, it assumes scarring is negligible and output follows the path assumed in our March forecast beyond the near term. The central and downside scenarios both assume some scarring, with output at the five-year horizon lying 3 and 6 per cent below our March forecast in our central and downside scenarios respectively. Broadly, this is the result of three factors: a longer-lasting rise in unemployment; permanently forgone business investment, which reduces capital deepening and productivity growth; and business failures that result in capital scrapping and the loss of intangible capital. The size of the scarring effect is highly uncertain given the difficulties in predicting how the economic disruption in any given scenario would feed through these various channels. Nevertheless, they are in line with external estimates, and it seems

[31] OBR (2020), Fiscal sustainability report, July 2020.
[32] Bank of England (2020), Monetary policy report, August 2020.

> reasonable to believe that the longer output remains below its pre-crisis level, the greater such effects are likely to prove.

The Bank of England's central case assumptions are similar:

> Key judgement 2: there is some long-lasting scarring, largely due to persistent weakness in productivity.
>
> The risks around activity in the medium term are also judged to be weighted somewhat to the downside. The downside risk to activity from uncertainty is likely to translate into downside risks to GDP over the medium term. In particular, uncertainty can weigh on decisions which incur fixed costs for firms, such as investment and hiring. Slower recoveries in investment and hiring could also weigh on the supply capacity of the economy through their spillover effects on productivity growth and labour market mismatch. The downside skew to activity in the medium term is judged to be somewhat lower than in the near term, however.

As in the preceding discussion, the question for Ofgem to opine on in December is how far the energy network sector will be affected by the wider economic headwinds. There seems to be a general acceptance that 2020 will be a lost year for productivity growth across the economy. Thereafter, concerns about capital shallowing perhaps ought not to be so relevant in a regulated, monopoly industry. However, Ofgem will also need to consider the impacts that COVID-19 and recession are having all the way down through the industry supply chain. It may be that the regulated licensees themselves are largely unaffected by "scarring", but it could still be that contractor partners struggle to manage the effects of revenue loss and future uncertainty. Where this is the case, it is not unreasonable to think that COVID-19 could ultimately impact network costs in an unfavourable way.

3. Technical Review of CEPA's Report

In section 2.3 we said that Ofgem ought to define the upper and lower bounds to the assumptions that it can legitimately make about RIIO-2 frontier productivity improvement with reference to the pre- and post-crisis rates of productivity in comparator industries.

We offer the following comments on the way in which CEPA has said that Ofgem can draw information from the EU KLEMS database.

3.1 Gross output vs value-added productivity measures

CEPA observes that productivity can be measured in terms of:

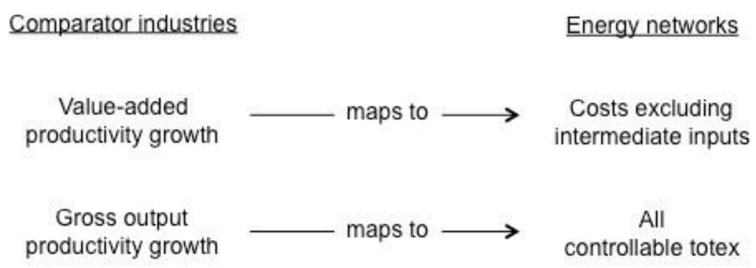
- the ratio of value added to labour and capital inputs; or
- the ratio of gross output to all inputs.

In a growth accounting exercise, the first of these measures isolates the ease with which a firm is able to transform intermediate inputs into a finished product or service. The second measure tracks the way in which a final output is produced out of the full range of capital, labour, energy, materials and services that an industry draws upon.

Ofgem is entitled to use either or both of these measures to define the productivity growth that it expects the energy networks to deliver during the RIIO-2 period. However, there has to be an internal consistency within the calculations, i.e.:

- if Ofgem is benchmarking to the value-added productivity growth achieved by comparator firms, Ofgem has to apply its chosen benchmark to the value-added that the energy networks themselves generate in their activities; and, similarly
- if Ofgem is benchmarking to the gross output productivity growth achieved by comparator firms, Ofgem is logically permitted to allow for a comparable quantum of cost savings across the whole of the networks' expenditure base.

Figure 3.1: Admissible benchmarking approaches



For reasons that are not entirely clear to us, there is not this internal coherence in CEPA's work. Instead, CEPA recommends that Ofgem can take benchmarks for value-added productivity growth and challenge the networks to deliver the selected rate of productivity growth across the whole of their totex. Subsequently, Ofgem goes on – wrongly – to evaluate the merits of value-added vs gross output productivity metrics solely in terms of statistical accuracy, without recognising that the way in which it intends to apply its chosen metric matters.

Figure 3.2: CEPA's/Ofgem's preferred benchmarking approach

This is a straight-forward pick'n'mix error. If Ofgem wishes to use value-added productivity growth metrics it needs to isolate the value-added within energy network companies' expenditures and provide for future cost savings only in this portion of firms' costs – i.e. excluding materials and 'other' costs. Based on the breakdown of costs that Ofgem has cited in its work on real price effects, this would entail providing for future productivity growth in approximately three-quarters and ✂✂ of gas distribution and transmission totex respectively. (NB: we applied exactly this methodology in our RIIO-GD1 work for the GDNs.)[33]

Table 3.1: Value-added as a % of controllable totex

	GDNs	NGGT	NGET	SHET	SPT
Labour	70%	✂✂	✂✂	✂✂	✂✂
Plant and equipment	4%	✂✂	✂✂	✂✂	✂✂
Transport	2%	✂✂	✂✂	✂✂	✂✂
Value added	76%	✂✂	✂✂	✂✂	✂✂

Source: Ofgem draft decision document.

Alternatively, if Ofgem prefers to give a cost challenge across the whole of companies 202126 controllable totex, it needs to reference comparator productivity growth in gross output terms. This would entail locking in the required -0.6% to -0.3% downward adjustments to value-added productivity growth benchmarks that CEPA identifies in its work.

Either way, we can be clear that the productivity estimate in Ofgem's draft determination is too high in relation to the assembled comparator evidence.

3.2 Total factor productivity vs partial productivity measures

CEPA suggests that Ofgem can use a partial productivity measure – i.e. labour productivity growth – when estimating potential opex productivity growth. Provided that Ofgem is allowing elsewhere in its calculations for the investment that permits companies to substitute capital for labour and increase output per worker, this is a reasonable approach. However, it follows, once again, that Ofgem has to make sure that it uses labour productivity growth only to relevant categories of energy network expenditure and not to total costs.

The appropriate mapping in this case is shown in figure 3.3 overleaf.

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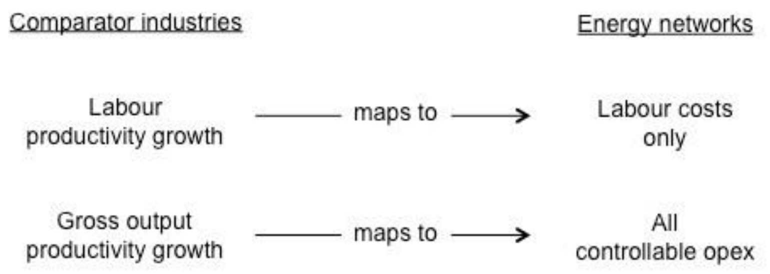
[33] See, for example, First Economics (2012), The scope for future productivity growth: a report prepaed for Northern Gas Networks, section 4.2.2.

Figure 3.3: Admissible benchmarking approaches – opex



Neither CEPA nor Ofgem apply the correct mapping in their calculations. Instead, both apply benchmarked rates of growth in output per worker to non-labour inputs like materials costs.

Figure 3.4: CEPA's/Ofgem's preferred benchmarking approach – opex

This constitutes another pick'n'mix error, which Ofgem needs to correct before it makes its final determination

3.3 Time period

We discussed the overall considerations that we think should guide Ofgem's use of historical data in section 2. Putting to one side momentarily the questions there are about how best to anticipate what companies might be able to achieve in the next five years, we can note at a more technical level that CEPA's selection of a 1997-2016 reference period is problematic for two reasons.

First, on any reasonable reading of the data, the chosen start date and end date do not give a homogeneous sample of data. Rather, the 1997-2016 statistics are really a composite of pre-2008 data, the 2008-10 recession/recovery and the subsequent post-crisis economy, with an obvious structural break in the middle. This can be seen clearly in figures 2.1 and 2.2 and in the statistics in table 3.2 overleaf.

Table 3.2: Average productivity growth by period (%)

	1997 to 2007	2007 to 2010	2010 to 2016
Construction	0.3	-0.1	0.1

Retail and wholesale trade; repair of motor vehicles and motorcycles	0.7	-1.4	2.1
Transportation and storage	1.3	-4.2	-0.4
Financial and insurance activities	4.2	-2.8	-1.6
Manufacturing	2.3	1.4	0.5
Total market services	1.9	-1.1	0.2

Source: EU KLEMS and First Economics' calculations.

Aggregating the three columns of the table into a single, composite productivity out-turn obscures what is really happening in the underlying data. Implicitly, CEPA's 1997-2016 averages give a ~50% weighting to pre-crisis productivity growth, ~15% weighting to the crisis/recovery period and ~35% weighting to post-crisis data. CEPA did not, however, choose these weights consciously. Instead, they come about by chance rather than via any sort of analytical judgment. Consistent with our earlier comments, we think that it is much better to weight the evidence in a more deliberative manner.

When doing so, the second point we would then make is that it makes more sense to think in terms of tram lines set with reference to pre-2008 productivity growth and post-2010 productivity growth rather than CEPA's preferred 1997-2006 and 2006-16 periods. While we can understand CEPA's logic of wanting to map to business cycles, there is not a single unique way of defining the start date and end date of any individual cycle. In contrast, a pre2008 and post-2010 classification captures very directly the change in the trend rate of productivity growth that occurred after the 2008-10 recession.

3.4 Geometric vs arithmetic averages

The figures in table 3.1 above are compound annual growth rates. We have not been able to replicate the sector-by-sector figures that CEPA cites in its report, but it looks to us like CEPA might be quoting the simple arithmetic average of 12-month productivity growth rates. If this is the case, CEPA's methodology is a departure from the approach that is usually employed in frontier shift studies. It also fits incongruously with the way in which Ofgem is applying productivity growth rates in its RIIO-2 totex calculations – i.e. Ofgem is using compound productivity growth to rebase 2018/19 efficient expenditure through to 2025/26.

CEPA may wish to relook at this aspect of its calculations in the light of Ofgem's draft determination methodology. We note that compound annual growth rates appear to be up to 0.3% lower than CEPA's reported figures.[34]

3.5 Choice of sectors

CEPA's recommended productivity growth ranges are based on the average of its calculations of out-turn productivity growth rates in two subsets of the UK economy:

- subset 1 – construction; wholesale and retail trade, repair of motor vehicles and motorcycles; transportation and storage; financial and insurance activities; and

[34] For instance, we calclate the average annual rate of growth in construction indiustry value-added productivity growth in the period 2006 to 2016 was 0.1%. This compares to a figure of 0.4% cited by CEPA.

- subset 2 – all industries except real estate, public administration and defence, education, and health and social work.

In relation to subset 1, we agree that CEPA has correctly identified the four most logical comparator sectors for an energy network business. We also agree that there is a case for placing more weight on the construction industry, with commensurately less weight on the other industries, due to the concentration of construction-like activity within energy network totex.

In relation to subset 2, we question how much weight Ofgem should put on a broad measure of near-economy-wide productivity growth. CEPA's chosen basket of industries rightly excludes three public-sector industries worth ~20% of the total economy (in value-added terms). However, the remaining ~80% contains a number of sectors that would not usually be thought of as good comparators for energy networks, such as the mining, agriculture, accommodation and food services, and arts and entertainment industries, as well as a residual amount of public sector activity.

The thinking in previous productivity benchmarking exercises has been that it is important to construct a 'nature-of-work comparator' that matches up as closely as possible the mix of activities that a regulated company conducts (NB: an exactly analogous thought process applies in the analysis of real price effects). The second of CEPA's comparator groups falls a long way short of this standard. Accordingly, we do not think it deserves to be given the same weight as the subset 1 comparator group.

3.6 Forward-looking forecasts

CEPA's ranges contain two overlays to capture some of the uncertainty that we have highlighted in relation to the medium-term outlook for productivity:

- a potential downward adjustment to reflect the possible persistence of recent weak economy-wide productivity growth; and
- a potential upside adjustment to reflect what CEPA says is the OBR's optimism about future labour productivity growth rates.

The second of these adjustments, which CEPA states could potentially add +0.05% to the RIIO-2 frontier efficiency challenge is based on projections made before COVID-19. In its July 2020 fiscal sustainability report,[35] the OBR states:

> In the central scenario, the level of productivity in the medium term is 2 per cent lower than in March and it is a further 2 per cent lower in the downside scenario.

This takes away the rationale for any potential upside adjustment.

Our suggestion is that Ofgem should consider the need for a possible downward adjustment as part of the overall judgment that we are asking it to make in December 2020.

3.7 Innovation funding

CEPA posits in its report that the innovation funding that Ofgem has handed out to the energy networks since 2010 could have a positive impact on future rates of productivity growth. It ultimately recommends that Ofgem can consider adding 0.2% per annum to the productivity growth rates that emerge from a conventional benchmarking exercise.

[35] OBR (2020), Fiscal sustainability report, July 2020.

We have reviewed the arguments that CEPA makes. However, we are not convinced that CEPA has adduced sufficient evidence to warrant the inclusion of a 0.2% uplift over comparator productivity growth rates.

It is important, first of all, to ask how often innovation funding goes to projects that are unlocking long-term cost reductions versus the achievement of other objectives like quality of service, environmental/sustainability, and safety improvement. It is noteworthy in this regard that three of the four examples of successful innovations that CEPA identifies on p.21 of its report (substitution of natural gas with hydrogen, biomethane injection, and carbon emission reduction) are about delivering better outcomes for customers and the environment rather than cost savings.

We then need to know what percentage of any efficiency savings that RIIO-1 innovation funding has unlocked are already reflected in Ofgem's base totex modelling versus what proportion are still to come through after 2019. If, as seems likely, some of the efficiency has already impacted expenditure in the first six years of the RIIO-1 controls, it would be inappropriate for Ofgem to account for the same savings a second time in its estimate of future, yet-to-be-achieved productivity growth.

To the extent that innovation funding can be expected to increase the post-2019 run-rate of ongoing productivity improvement, the next question is whether regulatory support enables the energy networks to out-perform other sectors of the economy or whether regulation is merely replicating the activity and outcomes that one sees in competitive markets. Our recollection is that the original rationale for setting up ring-fenced funds was to remedy what was seen as a deficit in energy networks' R&D expenditures due to regulation. It is not at all clear to us, therefore, that the interventions that Ofgem has been making should be characterised as transforming the energy network companies into super-innovators with a superior track record to firms in the rest of the economy. Rather, it seems more natural to think in terms of Ofgem plugging a gap that might otherwise have seen a regulated sector fall short of the natural innovation, and attendant productivity growth, that goes occurs in CEPA's chosen comparator industries.

Finally, CEPA notes that several aspects of its 0.2% quantification are quite arbitrary, notably:

- the profiling of cost savings between the RIIO-1, RIIO-2 and later price control periods;
- the assumption that innovation expenditure ought to generate a positive payback within 20 years; and
- the estimate of what constitutes a reasonable rate of return.

When these points are put alongside the difficulties that there are in linking innovation funding directly to productivity growth and out-performance of comparator industries, it is hard to conclude that the 0.2% is anything other than one illustrative thought experiment among many hypothetical scenarios that one could conceivably draw up. Accordingly, we do not think that Ofgem has anything like the evidence that it requires as a regulator to make an upward adjustment to the comparator benchmarks.

4. Conclusion

Correcting for the observations that we make in section 3 – i.e. the pick'n'mix error in applying value-added productivity growth rates to all totex, the filtering of time periods, geometric vs arithmetic averages, the choices of comparator sectors, and the 0.2% innovation uplift – will reduce the historical benchmarks that CEPA and Ofgem obtain from the EU KLEMS data set significantly below the 1.44% (opex) and 1.22% (repex/capex) figures that Ofgem used in its draft determination.

We do not consider that it is necessary to restate the views that we have given in previous First Economics papers about the appropriate replacement figures.[36] Instead, we can simply point out that there is, given the passage of time, no new data that would cause the reading that Ofgem takes from pre-2008 experience to be any different from the reading that Ofgem and other regulators have taken in previous price control reviews, as set out again in table 4.1.

Table 4.1: Assumptions made by regulators about rates of annual frontier productivity growth in decisions issued up to 2017

	Opex	Capex
Ofgem, RIIO-GD1/T1, 2012	1.0%	0.7%
CC, Northern Ireland Electricity, 2014	1.0%	1.0%
Ofgem, RIIO-ED1, 2014	1.0%	0.7% to 1.0%
Utility Regulator, NI Water, 2014	0.9%	0.6%
CMA, Bristol Water, 2015	1.0%	-
Utility Regulator, GD17, 2016	1.0%	1.0%

The key question for Ofgem to opine on in December is: is there reason to set the RIIO-2 frontier productivity growth assumption somewhere below the figures in the above table? We have shown in this paper that both of the major new pieces of information that have emerged since the RIIO-1 determinations – the failure of UK companies to revert to pre-2008 productivity growth rates and COVID-19 – point down rather than up. We have also said that it is not straight-forward to discern exactly how much the energy networks will be affected by whole-economy headwinds in comparison to other industries.

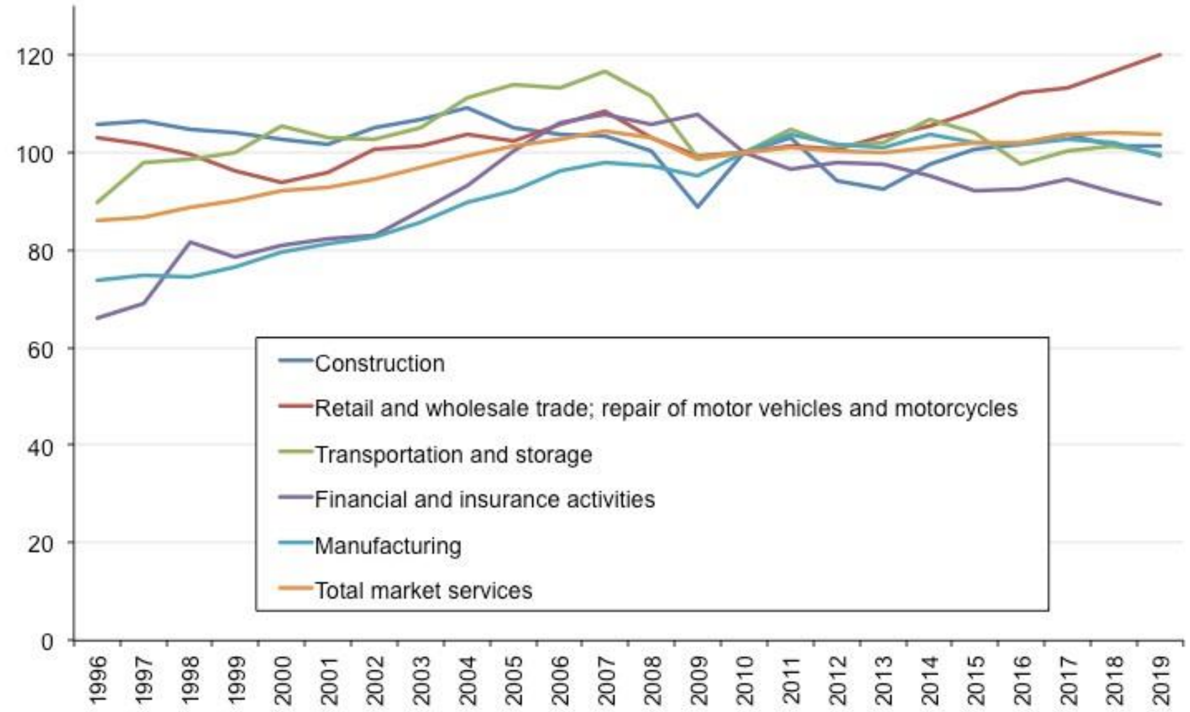
We are happy to admit that we do not have all the answers to the conundrum. The only firm conclusion that we feel able to draw as outsiders in what is undeniably a challenging corner of the RIIO-2 reviews is that Ofgem needs to tackle this issue head on in its internal discussions and in its final determination document. To do otherwise would be tantamount to side-stepping completely one of the key determinants of companies' 2021-26 expenditures.

Annex A

The sector-by-sector productivity data in section 2 of the report comes from the EU KLEMS project[37] – a database compiled by academic researchers that contains growth accounts for all of the EU's member states. The most recent release from this database, issued in 2019, goes up to 2016 only. More recent UK data has been published by the Office of National Statistics in the form of a regular quarterly release of multi-factor productivity estimates.
Figure A1 picks out the most relevant statistics from the ONS' July 2020 issue.[38]

[36] Our previous reports can be accessed at: http://www.first-economics.com/reports.html.
[37] https://euklems.eu/
[38] https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/datasets/multifactorproductivityexperimentalestimatesreferencetables

Figure A1: ONS multi-factor productivity growth estimates for selected industries (2010 = 100)



Source: ONS.

Figure A1 is very similar to figure 2.2 in that only one industry (retail and wholesale trade) shows any meaningful productivity growth in recent years, with productivity growth in most of the other industries trending close to or below zero.

Estimating soil erosion risk (by water and by wind erosion) in the Cadent network area in comparison with the national picture.

Authors: Rickson, R.J. and Truckell, I.G.

Department: Cranfield Soil and AgriFood Institute

Date: August 2020

Estimating soil erosion risk (by water and by wind erosion) in the Cadent network area in comparison with the national picture, identifying the 'hot spots' of high soil erosion risk.

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Jane Rickson is Chair of Soil Erosion and Conservation in the Cranfield Soil and AgriFood Institute, School of Water, Energy and Environment at Cranfield University. Jane has over 30 years' experience of research, consultancy and teaching in soil degradation processes and their control. Working internationally, her work has focused on better understanding of the causes, severity and extent of soil erosion, and its impact on the delivery of ecosystem goods and services, including agricultural production, water regulation (both quality and quantity) and carbon storage. She uses multi-disciplinary approaches to integrate fundamental and applied land resources science at a range of spatial and temporal scales.

Her work is directed at Research Councils, industry, land managers, policy makers and government. Recent projects include: Development of a Soil Management Information System (AHDB); Better understanding of the soil protection landscape (Defra); Developing a conceptual framework for a soil impact metric for agricultural and commodity supply chains (Institute for Sustainability Leadership, University of Cambridge; CISL); Review of the England and Wales soils evidence base (Welsh Government); Provision of research to develop the evidence base on soil erosion (Committee on Climate Change, Adaptation Sub Committee); and The total costs of soil degradation in England & Wales (Defra) and in Scotland (Scottish Government).

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Cranfield University was recently awarded the Queens Anniversary Prize for its research and education in large-scale soil and environmental data for the sustainable use of natural resources in the UK and worldwide. This is the first time in the Prize's history that an award has been given for soil science.

EXECUTIVE SUMMARY

Soil erosion and the resulting loss of soil depth can have a detrimental impact on major infrastructure, including buried pipelines. GIS can be used to generate quantified estimates of soil erosion risk by overlaying thematic maps of the most influential factors affecting soil erosion, namely soil type (texture) and land use. Three categories of soil erosion risk (Low, Moderate and High) based on these combinations were mapped for England and Wales.

There was a notably higher risk of soil erosion by water in the Cadent network area than elsewhere in England and Wales, with 26% of the total Cadent network area being subject to a high risk of soil erosion by water. This compares to 16% for the rest of England and Wales outside the Cadent network being at high risk of erosion by water.

In East Anglia there was an especially high risk of water erosion, at 33% of the land area. Within the five Cadent network areas, EALDZ has the highest proportion of land at high erosion risk (33%), followed by WMLDZ (29%), NWLDZ (23%) and EMLDZ (19%), all of which have higher proportions of land (% area) under high soil erosion risk than the national picture (16%).

For wind erosion risk, there was a far greater risk of soil losses in East Anglia and East Midlands than elsewhere in England and Wales.

High risk of soil erosion is associated with erodible soils and intensive land uses, especially where arable agriculture and horticulture are practiced.

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1. AIM OF THE PROJECT

The aim of this short project is to present the estimated soil erosion risk (by water and by wind erosion) in the Cadent network area in comparison with the national picture, identifying the likely 'hot spots' of high soil erosion risk.

The area of land under high; moderate and low erosion risk will be mapped, both within the Cadent network area (and its sub areas, EALDZ, EMLDZ NLLDZ NWLDZ and WMLDZ network area) and for England and Wales as a whole. The area of land under the 3 levels of erosion risk will be quantified (as km^2 and as a % of total area), so comparisons between areas can be drawn. Due to data availability, the mapping and analysis is limited to England and Wales.

2. SOIL EROSION PROCESSES

Soil erosion is the detachment and transport of soil particles and aggregates from the soil mass (Morgan, 2005). Once entrained, the eroded material is carried off-site until deposition (sedimentation) takes place. Eroded material may then be re-detached and transported by the next storm event and the process is repeated. The rate of soil erosion is dependent on:

- rainfall / wind erosivity (energy to cause erosion)
- soil erodibility (determined primarily by soil texture, aggregate stability, organic matter content, structure and permeability)
- slope gradient and length
- land use / vegetation cover; and
- land management practice (e.g. ploughing up and down slope versus across the slope).

Different forms of soil erosion have been identified in England and Wales (Owens et al., 2006). Table 1 shows these: erosion by water, wind, tillage and co-extraction, of which erosion by water dominates in terms of extent, severity and frequency. Wind erosion mainly affects sandy and peaty soils in the eastern and middle counties of England, and upland areas of England and Wales. Soil erosion by tillage and through co-extraction tend to be very localized, with very little scientific data available for England and Wales.

Table 1. Comparison of the magnitude of soil loss for different erosion processes in England and Wales (after Owens (2006).

	Wind	Tillage	Co-extraction with root crop and farm machinery	Water
Typical erosion rate range (Mg* ha^{-1} $year^{-1}$)	0.1 – 2.0	0.1 – 10.0	0.1 – 5.0	0.1 – 15.0
Land use affected	Arable, upland, some pasture	Arable	Arable	Arable, pasture, upland
Exported off field	Yes	No	Yes	Yes
**Mg = megagram = 1 tonne*				

3. THE EXTENT AND SEVERITY OF SOIL EROSION IN ENGLAND AND WALES

To understand the impact of soil erosion on the Cadent infrastructure and network, it is necessary to map the spatial extent and magnitude of soil erosion throughout the Cadent Network area. The mapped results can then be compared with other areas of the country.

However, currently there is no systematic monitoring of actual soil erosion rates in England and Wales. A number of localised field surveys have been carried out: some involving long term monitoring (Benaud et al., 2020; Figure 1). However, the results from these studies are very site specific (point surveys) and cannot be extrapolated to the whole country. It should be noted that the severity of soil erosion recorded in upland areas such as the Pennines and the Welsh Mountains is not time related, and may have actually occurred over several years in these high elevation sites.

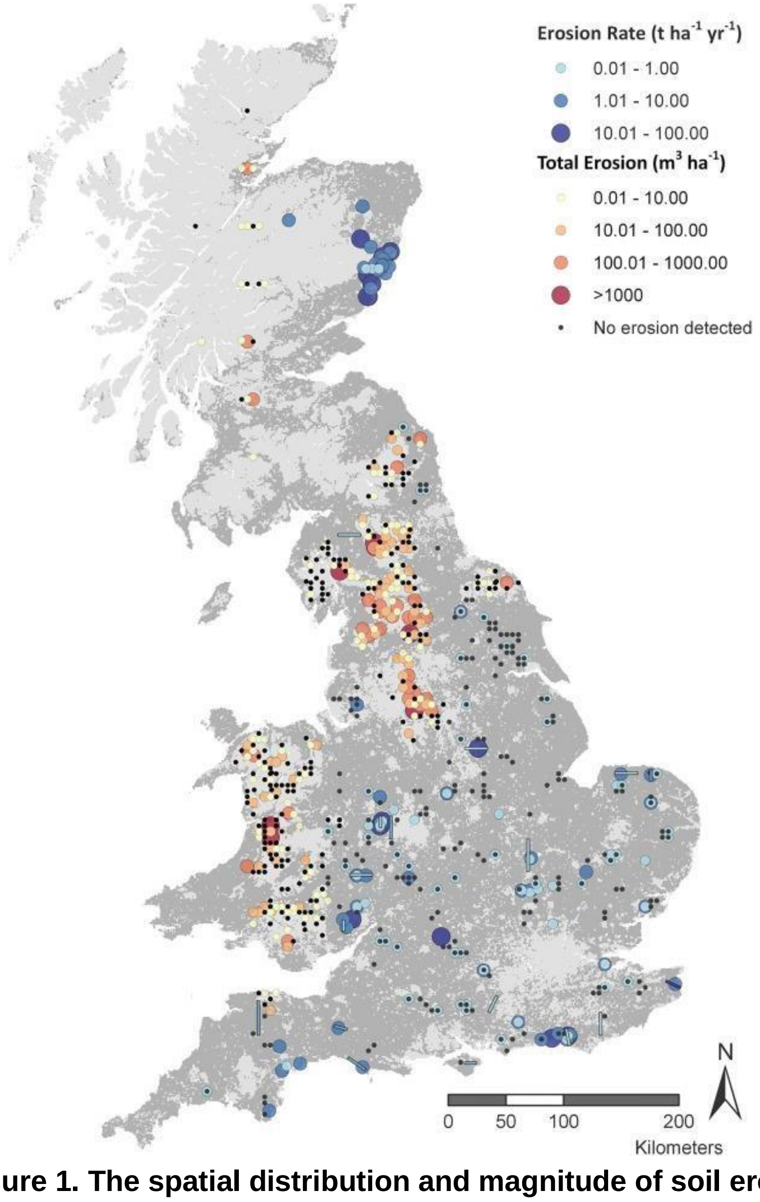

Figure 1. The spatial distribution and magnitude of soil erosion records (t ha^{-1} yr^{-1} for arable and grassland classes, and total t ha^{-1} for upland classes). Rectangles are areas covered by Evans' (1988) overflight transects. The darker shading indicates the distribution of arable or improved grassland (i.e. pasture) areas in the UK, based on LCM2000 map.

3.1. Mapping soil erosion risk

Given the lack of data on actual erosion rates, it is possible to map soil erosion risk based on the factors affecting erosion, such as soil type and land use. This gives justified estimates of the extent and magnitude of soil erosion, and has been done by Morgan (1985) and Boardman and Evans (2006) for example. By superimposing the Cadent Network boundary onto these risk maps, areas of high erosion risk can be seen (Figure 2 and Figure 3).

Figure 2 shows that the Cadent network includes a number of high risk areas. It should be noted that the actual areas of soil loss may be very localised within the mapping unit. The significant areas of water and wind erosion, both separately and combined are found in:

- East Anglia (especially north Norfolk, the fens, the Greensand Ridge and east Suffolk), where sandy soils under arable (intensive and extensive) agriculture in East Anglia are particularly susceptible to soil loss, especially shallow sandy Rendzinas under intensive agriculture.
- The West Midlands (especially on the Ross Sands of Herefordshire and in Shropshire). The moderately shallow silty Eardiston soils in this area show high soil erosion risk under intensive arable agriculture. These soils will be susceptible to greater soil loss on sloping land within this soil type / land use combination. Continued cultivation of these soils has weakened the structure that increases the susceptibility to compaction, slaking and soil erosion.
- The East Midlands (especially the sandy soils of Nottinghamshire)
- The North West – High erosion risk occurs in upland areas (Lake District)
- Wales - where soils with peaty topsoils (Rankers, Podzols and Peat soils) are vulnerable to erosion under unimproved grassland land use. Shallow lithomorphic soils (e.g. Bangor and Skiddaw series) are also vulnerable under unimproved grassland. Erosion loss of the same soils under semi natural vegetation is minimal.
- Yorkshire (West Riding and east Riding, including the Yorkshire Wolds) Shallow lithomorphic soils with clay topsoils tend to be protected by erosion on the limestone and chalk landscapes. However, erosion risk on the sandy textured soils is high, particularly under arable intensive land uses.

Morgan's assessment suggests erosion risk is less extensive in other areas of the country (including the NLLDZ), with only very localised areas of soil erosion risk. Figure 2 shows a similar pattern, with concentrations of high erosion risk in the same areas. In addition, the chalklands of the North and South Downs and Hampshire are mapped as having significant areas prone to soil erosion by water. These areas include the chalk downland landscapes of the South Downs, Wiltshire, Hampshire Chilterns and Dorset. The erosion rates are variable depending on the mix of soil type and land use. The very shallow silty soils (Icknield and Andover) on the chalk escarpment have the greatest impact of erosion, especially where there is intensive arable agriculture. Also, the uplands of Wales are identified as having high soil erosion risk.

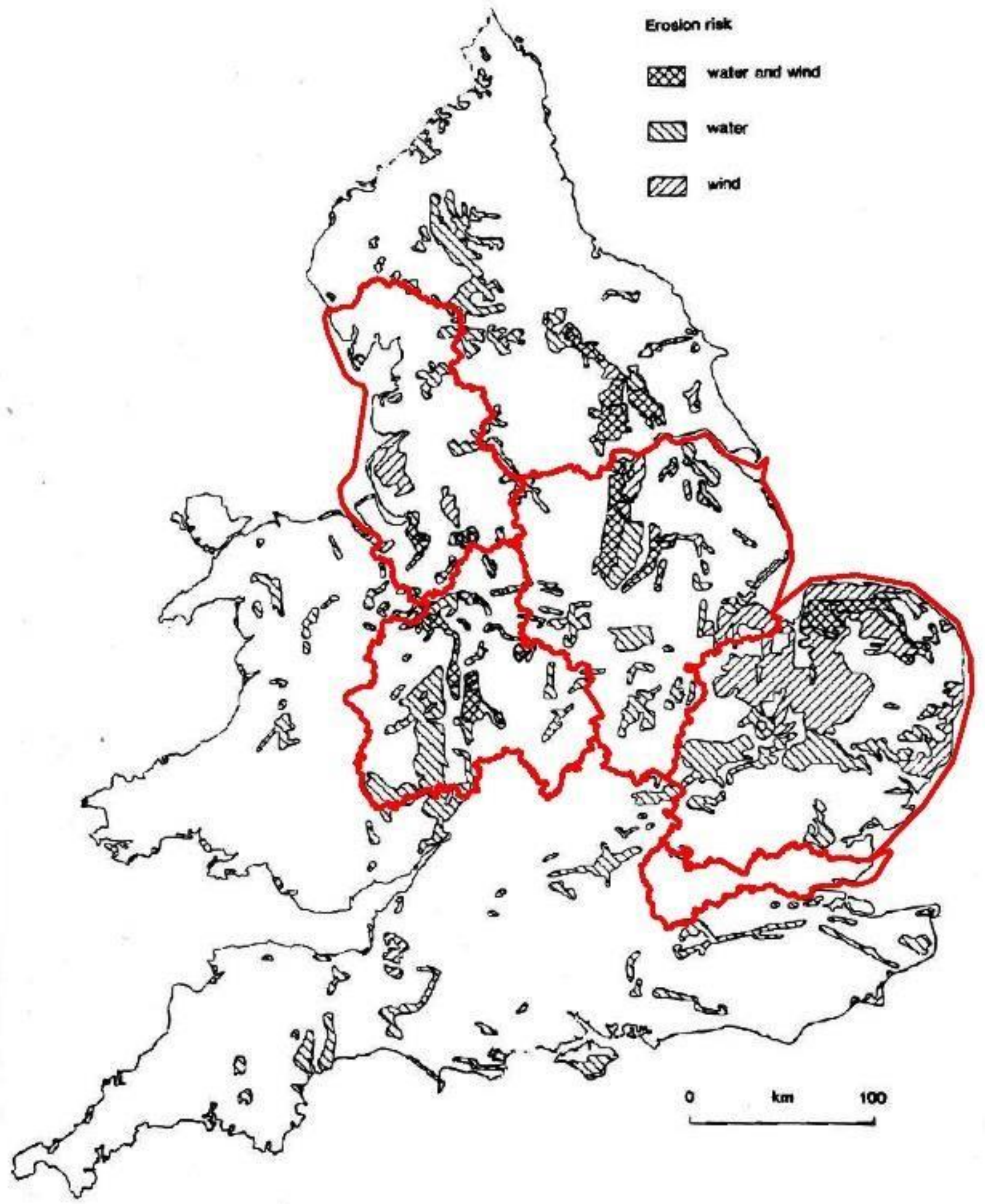

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Figure 2. Soil erosion risk (water, wind, and water and wind combined) from Morgan 1985, with Cadent network boundary shown in red

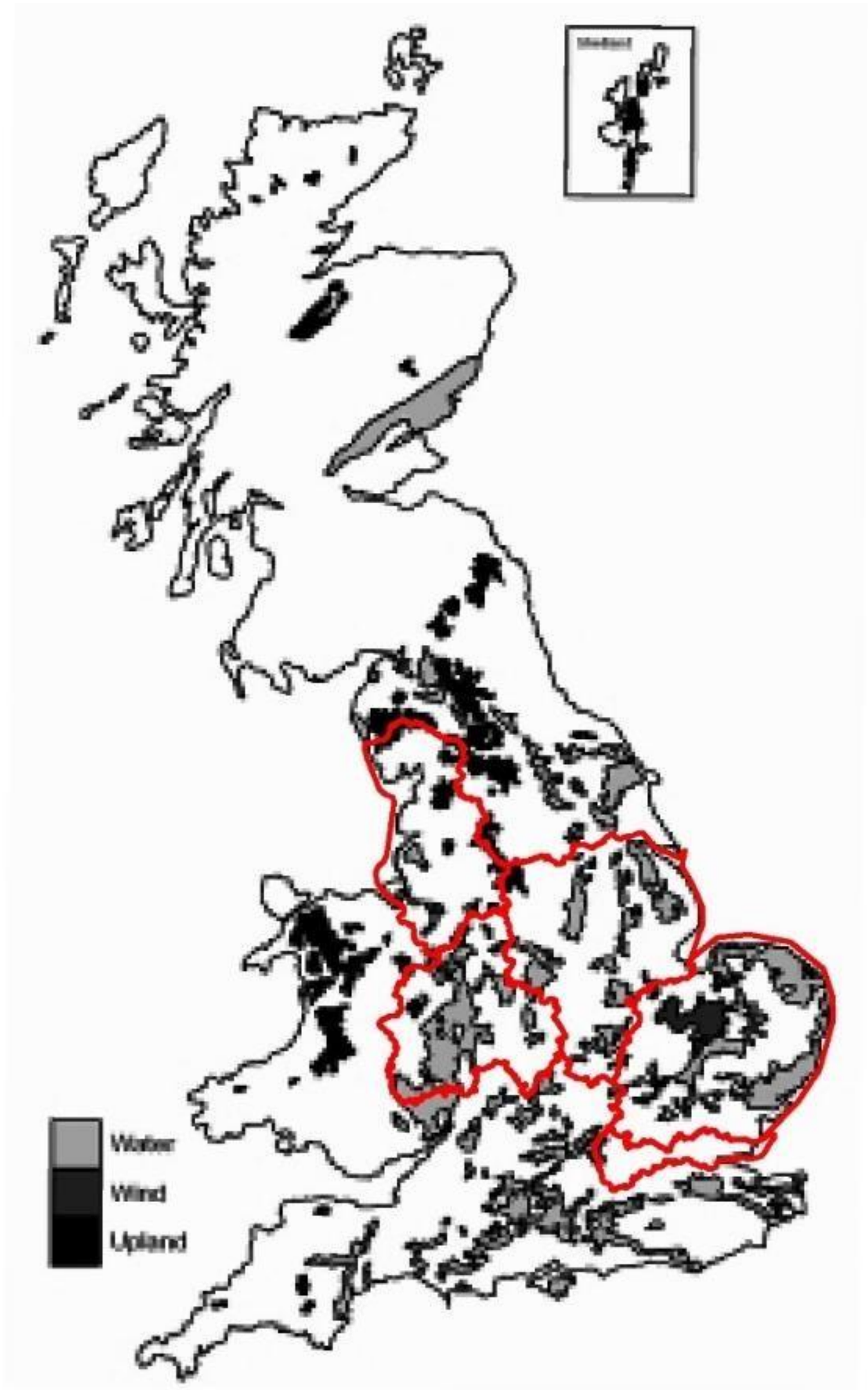

Figure 3. Water, wind and upland erosion risk in England, Wales and Scotland (from Boardman and Evans, 2006) with Cadent network boundary shown in red

For wind erosion risk, very few assessments exist. Figure 4 shows the spatial distribution of wind erosion risk in England and Wales. Areas of high erosion risk include East Anglia, the Midlands, Yorkshire and North East England.

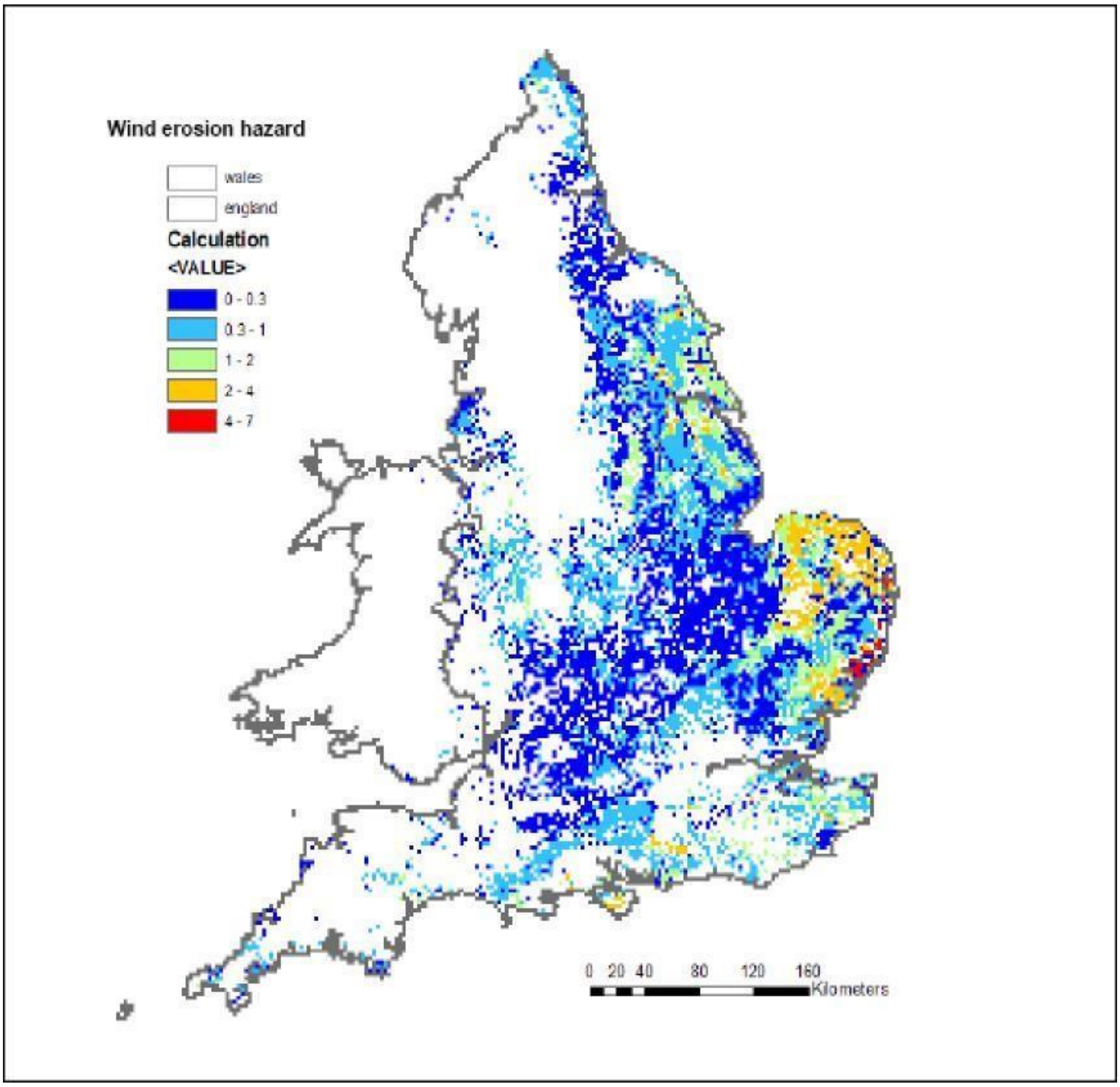

Figure 4. Annual wind erosion hazard for mineral soils (SOM<5%). The scale is a quantitative relative scale. Source data: UKCIP 1961-1990 scenario (simulated by HadRM3 with SRES A2 Medium –High emissions scenario); MetOffice 5 km gridded data; and Digital Soil Information from NSRI: NATMAP, SOILSERIES and HORIZON © Cranfield University (NSRI) 2006. (Taken from Quine et al., 2006, in Owens et al. (2006))

3.2. Quantified estimates of soil erosion risk

3.2.1. Soil erosion by water risk

Whilst the maps of Figure 2, Figure 3 and Figure 4 allow visual comparisons of soil erosion risk, the analysis is based on subjective assessment. GIS can be used to generate more quantified estimates of erosion risk by overlaying thematic maps of the most influential factors affecting soil erosion, namely soil type (texture) and land use. Estimating the likely erosion rate (and thus risk) for each of these soil / land use combinations has been based on the compilation of actual field observations where these combinations occur from the published literature (Table 2), Cranfield University environmental data sources and expert judgement.

Table 2. Selected data of measured erosion rates for different soil / land use combinations in the UK (from Rickson (2014))

Land use	Typical erosion rates* (t ha^{-1} yr^{-1}) reported in the literature / field surveys for different soil / land use combinations			
	Clay	Silt	Sand	Peat
Arable	1.92 [a] 0.23 – 0.36 [b] 0.9 [c] < 2 [d] 0.10 – 5.56 [e]	22.1 [g] 22.7 [h] 3.2 [c] 4.5 [f] 11.2 [i] 0.33 – 7.44 [e]	5.08 [a] 16 [j] 10.8 - 10.9 [b] 0.3 to 44.4[g] 22.7 [h] 0.4 [c] 0.43 [b] 0.41 to 1.7 [k] 1.48 [f] 3.47 [d] 11.2 [i]	
Grassland / pasture	0.36 [f] 0.02 – 3.54 [e] 1.29 [f]	4.09 [a] 4.89 f 2.82 – 4.92 [e] 2.07 [f]	0.2 – 0.98 [b] 4.09 [a] 0.22 [f]	
+Forestry/ Woodland			0.05 [b]	29.76 [l]

[a] (Evans, 2002); [b] (Morgan, 1980); [c] (Deasy et al., 2008, 2009); [d] (Cooper, 2006) [e] (Walling et al., 2002); [f] (Brazier, 2004); [g] (Morgan, Martin and Noble, 1987); [h] (Robinson and Boardman, 1988); [l] (Fullen, 1992); [j] (Reed, 1979, 1986); [k] (Quinton and Catt, 2004); [l] (Carling et al., 2001) Notes:

- Data from Evans (2002) do not specify soil type, but do specify crop / land use. Reasoned assumptions have been made as to which soil type is used for various crops (e.g. oilseed rape on heavy (clay) soil).
- Data from Brazier (2004) derives from Evans (1988, 1993) and . These erosion rates relate to soil types only: No land use data are given. Reasoned assumptions have been made regarding likely land use for different soil types and resulting erosion rates as presented in Brazier (2004).
- Data from Walling et al (2002) are net erosion rates, based on 137Cs techniques.

For mapping purposes, the results have then been simplified into 3 categories of soil erosion risk: Low, Moderate and High for each combination of land use and soil type (Table 3).

Table 3. The relative risk of soil erosion (Low (L), Moderate (M) and High (H)) by land use and soil type in England and Wales

Land use	Soil types			
	Clay	Silt	Sand	Peat
Urban	L	H	H	n/a
Horticulture	L	H	H	H
Arable intensive	L	H	H	H
Arable extensive	L	M	H	H
Grassland improved	L	M	M	H
Grassland unimproved	L	M	M	H
Rough grassland	L	M	M	H
Forestry	L	L	L	M
Woodland	L	L	L	M
Wildscape	L	L	L	M

The results are shown in Figure 6. The statistics generated for each of the 3 categories of erosion risk from Figure 6 are shown in

Within the Cadent network areas, EALDZ has the highest proportion of high erosion risk (33%), followed by the WMLDZ (29%), NWLDZ (23%) and EMLDZ (19%), all of which have higher proportions of land (% area) under high erosion risk than the national picture (16%).

Table 4 and Figure 5. (The ‘No data’ category mainly refers to water features and coastal areas). The results show that 26% of the total Cadent network area is classed as being at high risk of soil erosion by water. This compares to 16% at high erosion risk for the rest of England and Wales outside the Cadent network. These proportions of the area under high erosion risk concur with others in the literature (e.g. Evans (1990); Environment Agency (2005)).

Within the Cadent network areas, EALDZ has the highest proportion of high erosion risk (33%), followed by the WMLDZ (29%), NWLDZ (23%) and EMLDZ (19%), all of which have higher proportions of land (% area) under high erosion risk than the national picture (16%).

Table 4. Area statistics of soil erosion risk classes for the Cadent network areas and for England and Wales as a whole.

	Soil erosion risk class							
	High		Moderate		Low		No Data	
Spatial Area	km²	% of area	km²	% of area	km²	% of area	km²	% of area
EALDZ network area	6,212	33	1,808	10	10,148	54	501	3
EMLDZ network area	3,371	19	1,045	6	12,927	73	344	2
NLLDZ network area	454	16	210	8	1,900	68	221	8
NWLDZ network area	2,377	23	2,213	22	4,888	48	774	8
WMLDZ network area	3,465	29	2,372	20	5,951	50	66	1
Entire Cadent network area	**15,878**	**26**	**7,648**	**12**	**35,814**	**58**	**1,906**	**3**
England and Wales as a whole	30,411	20	24,320	16	94,749	61	4,656	3
England and Wales excluding Cadent network area	**14,533**	**16**	**16,671**	**18**	**58,935**	**63**	**2,750**	**3**

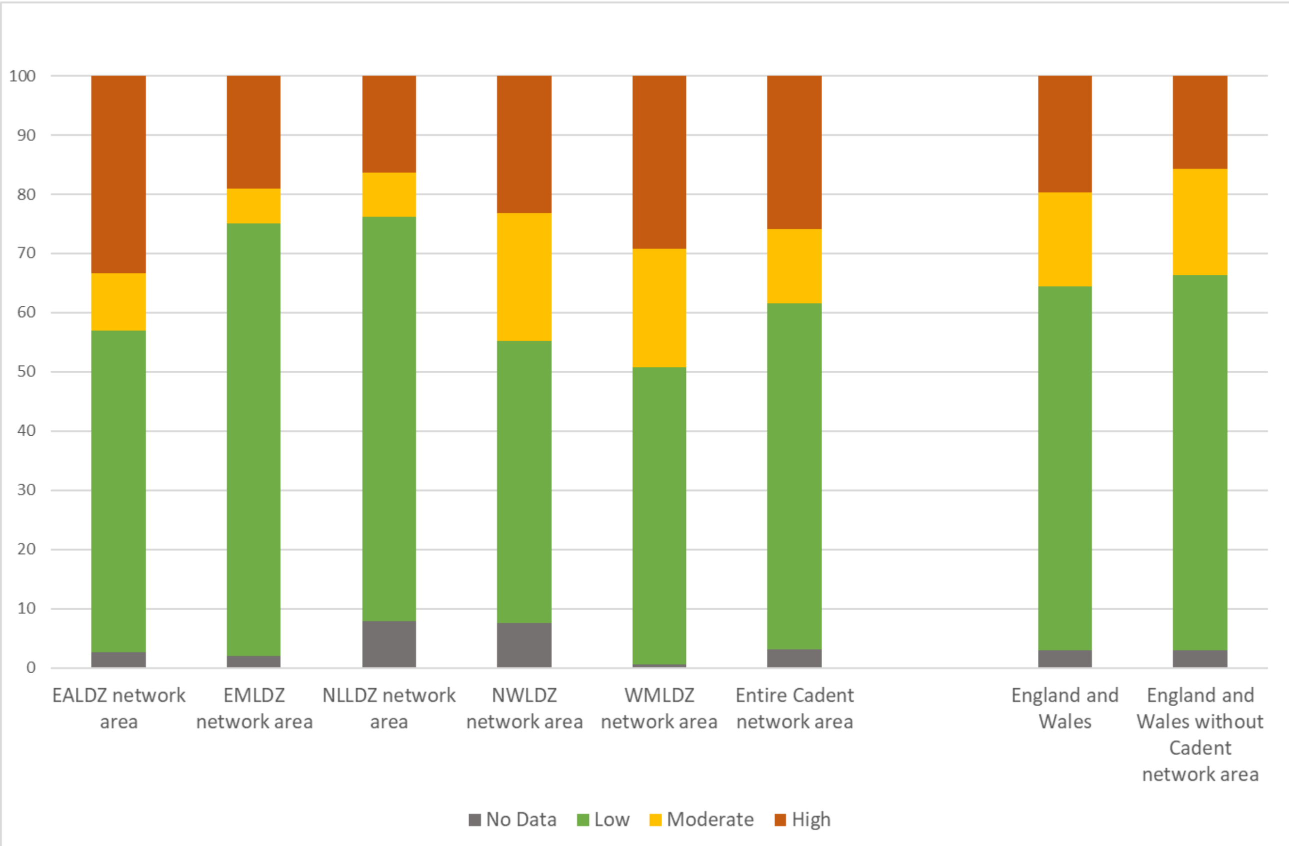

Figure 5. Percentage area under different levels of soil erosion risk for Cadent network areas and for the national picture.

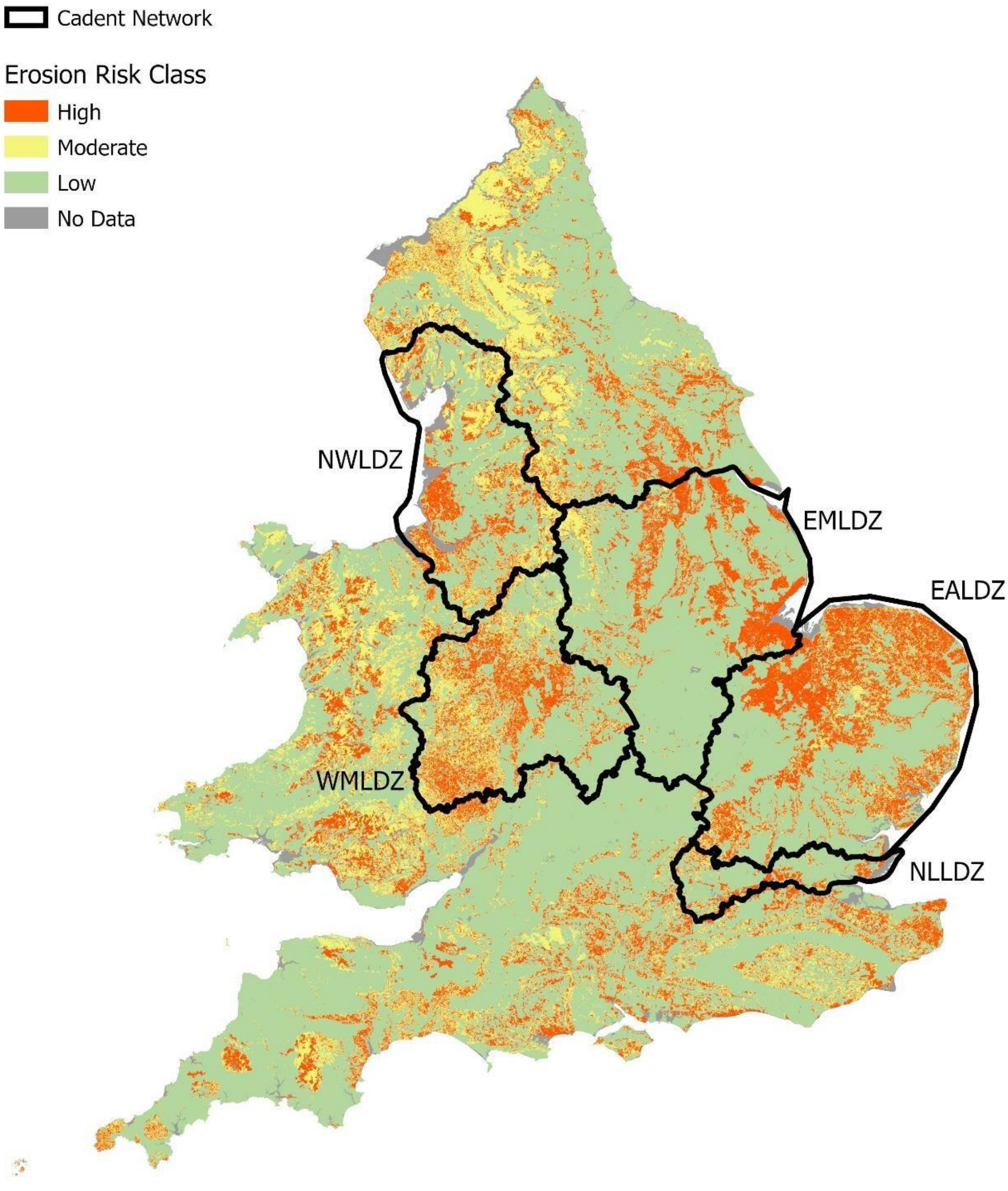

Figure 6. Soil erosion risk classes in England and Wales and within the Cadent Network Boundaries, based on soil type and land use.

3.2.2. Wind erosion risk

It is not possible to carry a similar analysis for wind erosion risk, because field observations are very limited, and a table of relative risk, based on empirical evidence, similar to that of Table 3 cannot be created.

4. DISCUSSION

Soil erosion and the resulting loss of soil depth can have a detrimental impact on major infrastructure, including buried pipelines (Hann et al., 2005; Hann and Morgan, 2006; Morgan et al., 2005; Winning and Hann, 2014). By reducing soil depth, soil erosion processes cause the loss of cover over buried pipes, which can lead to the pipeline becoming exposed in extreme cases and the risk of mechanical failure (Hann & Morgan, 2006). Soil erosion at these rates will require post installation remedial works, adding to the operational cost of the pipeline. Also, installation of new or replacement pipework can cause ground disturbance, compaction (due to heavy construction plant movements) and removal of vegetation along the pipeline corridor which may increase further risk of soil erosion. Any construction work involving the temporary removal and storage of topsoil and compaction of the subsoil by machinery increases the potential for soil erosion due to reduced porosity and low infiltration rates on the compacted soil, resulting in greater rates of surface runoff and soil loss.

Figure 6 gives a broad view of soil erosion risk by water that can be used to compare different parts of the country, including within and outside of the Cadent network areas. The areal distribution of soil erosion risk is similar to that presented by Morgan (1985) and Boardman and Evans (2006), suggesting the methodology used gives reliable estimates of soil erosion risk.

The analysis of the distribution of soil erosion risk shows that Cadent network areas are at a higher risk of soil erosion by water than for the rest of the country, with over a quarter (26%) of the total Cadent network area classed as being at high risk of soil erosion by water. This compares to just 16% at high erosion risk for the rest of England and Wales, outside the Cadent network area. These proportions of the national area under high erosion risk concur with others in the literature (e.g. Evans (1990); Environment Agency (2005)).

The higher proportion of high erosion risk areas in the Cadent network area (compared with the national picture) can be partially explained by the land use and management in many of these areas. High soil erosion risk is found in areas associated with intensive arable land use, including East Anglia, especially in the Fens and north Norfolk. Here, soil erosion risk factors include: frequent soil disturbance through cultivations and tillage; low ground cover (bare soil) before crop establishment and after harvest; and erodible soils (especially sands and silts). The erodible soils of the Greensand ridge running SW – NE are also highlighted, where some of the highest erosion rates have been recorded by Morgan and others (Morgan, Martin and Noble, 1987). Other ‘hotspots’ include the West Midlands, especially around Herefordshire and Shropshire, as well as Nottinghamshire and parts of north west England. This high risk of erosion is associated with erodible soils and intensive land use, especially where arable agriculture and horticulture are practiced.

The Pennines are classed as being at ‘moderate risk’, probably as a result of the predominantly grassland / pasture land use, which protects soils from rainfall and runoff, unlike arable areas where periods of bare soil after harvest and before crop establishment can be vulnerable to erosion.

Within the Cadent network areas, EALDZ has the highest proportion of high erosion risk (33%), followed by the WMLDZ (29%), NWLDZ (23%) and EMLDZ (19%), all of which have higher proportions of land (% area) under high erosion risk than the national picture (16%). This is likely to be related to erodible soils and intensive agricultural land use in these areas.

It should be noted that although the spatial distribution of erosion risk nationally reflects other previous studies, Figure 6 only considers land use and soil type (regarded as the most important factors affecting erosion incidence). As such, other factors such as rainfall, slope gradient and slope length have not been taken into account. These will affect actual erosion rates locally. Figure 6 is not time specific as the effect of rainfall and wind conditions are not explicitly modelled. However, it is widely reported that climate change is likely to accelerate rates of soil erosion by water and by wind, as described in Table 5 (Boardman and FavisMortlock, 2001; Favis-Mortlock and Mullan, 2011; Mullan, 2013; Nearing, Jetten and Stone, 2005; Nearing, Pruski and O'Neal, 2004). This will inevitably increase the risk of soil erosion, making many areas currently classed in Figure 6 as having a 'moderate' risk of soil erosion falling into the 'high' erosion risk category.

Table 5. Impact of changing climate parameters on soil erosion.

Climatic trend	Likely impacts on erosion processes
Increasing summer temperatures	Drier soils that are more prone to wind erosion and hydrophobicity which can lead to increased runoff and associated erosion. (Evans, (1996) http://www.environmentagency.gov.uk/yourenv/eff/1190084/water/213866/wetlands/?version=1&lang=_e). Change in land use / crop suitability e.g. more land under potentially erosive crops such as maize. More vigorous vegetation growth (if not limited by other factors such as water availability), which would offer greater protection from wind and rainfall.
Increasing winter temp	Change in land use / crop suitability More vigorous vegetation growth (if not limited by other factors such as water availability), which would offer greater protection from wind and rainfall. Warmer winters may extend growing periods, but the risk of increased soil degradation may rise due to higher predicted winter precipitation rates that will increase risks of working the land when wet. Later harvest may also increase the risk of loss of soil co-extracted on root vegetables and farm equipment if the soil moisture is high.
More extreme high temperature	Greater risk of unstable atmospheric conditions and high intensity thunderstorms. Also leading to drier soils – see above
Less extreme low temperature	Change in land use / crop suitability
Higher winter rainfall	Wetter soils that are more prone to aggregate breakdown, compaction, smearing and generation of surface flow. Risk higher on spring-planted crops such as maize and potatoes than on winter cereals.
Higher wind speeds	Greater wind speeds driven by higher atmospheric temperatures, combined with drier, more friable, soils in summer months will increase the potential
	for wind erosion. However, erosion by wind is not predicted to change under current predictions of wind speed changes.
Less summer rainfall	Drier soils (see above). Poorer crop canopy development, leading to more exposure of soil when rain does fall.

More intense downpours	Rainfall intensity is strongly and positively correlated with soil erosion rates (erosivity; Panagos et al. (2015)). The more intense the storm, the greater the erosivity of the rainfall event and the greater the potential for erosion. Short duration, high intensity rainfall events may become the dominant mechanism of soil erosion in the future.
Sea level rise and increased coastal flood risk	Only very indirect impacts on inland erosion through hydrological behaviour of the water table
More winter storms	Wetter soils, leading to shorter time to generation of runoff and greater volume of runoff, leading to increased soil erosion risk

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Technical Note

CLIENT:	**Cadent**
PROJECT:	**Technical Input to Ofgem Draft Determination response**
SUBJECT:	**Examination of land use factors that influence reduced depth of cover**
JOB NO.:	**NT15021**
DATE:	**28 August 2020**
PREPARED BY:	**Dr Jakub Olewski, Dr Eleanor Reed, Dr Dave Brignall**

EXECUTIVE SUMMARY

This Technical Note on soils and agricultural land use addresses where regional conditions may accelerate soil loss and the associated reduction of safe cover above buried gas pipelines.

This report examines the proportion of tilled land (i.e. soils turned and disturbed through agriculture) which is substantially higher, between 20% and 40%, in the East of England Cadent network (East Midlands and East Anglia regions) when compared to the rest of England and Wales.

Tilled (arable) land typically has much higher rates of soil loss than permanent grassland (pasture) as a result of the soil being exposed to wind and water erosion, erosion by ploughing, removal of soil on root crops during harvesting and cultivation measures such as destoning. Therefore, there is a greater likelihood of accelerated soil loss in these regions. There are also organic soils and peat, primarily in the Fens of East Anglia, where drainage and windblow have enhanced the reduction in cover.

To summarise, the combined effects of local soil type, land use and agricultural practice in the East of England network, are the primary cause of accelerated erosion and soil loss compared to other areas. As a result, the East of England network will have a greater reduction in soil cover, since pipeline installation, than other networks in England and Wales.

CONTENTS

Technical Note

TABLES

1 Introduction

1.1.1 Cadent Gas have encountered reduced depth of cover over pipeline assets in their East Midlands (EM) and East Anglia (EA) regions, which have been identified through a programme of line walking and surveying for depth of cover.

1.1.2 This Technical Note on soils and agricultural land use addresses where regional conditions may accelerate soil loss and the associated reduction of safe cover above buried gas pipelines with specific reference to the Cadent East Midlands (EM) and East Anglia (EA) networks, compared with other regions in England.

1.1.3 This Technical Note has been prepared by Dr Jakub Olewski and Dr Eleanor Reed. Dr Jakub Olewski, has over 10-years' experience in soil science working in both environmental consultancy and research. His qualifications include PhD in Biological Science (with an emphasis on soil and land management), MSc in Agriculture, MSc in Land and Soil Management, and BSc in Agriculture. He is a full member of the British Society of Soil Science (BSSS) (M.I. Soil Sci.);

this designation recognises scientists and other professionals with a minimum of five years' track-record in soil science research or application.

1.1.4 Dr Eleanor Reed, is an experienced, Chartered (CSci) soil scientist, who draws on a research background to deliver practical soils and agricultural land-use advice to a wide range of clients, specialising in the delivery of large-scale infrastructure projects at the planning and construction phases. Her qualifications include a PhD in Soil Geochemistry, MSc in Agriculture and Environmental Science, and BSc (Hons) in Earth and Environmental Science. Eleanor is a full member of the BSSS (M.I. Soil Sci.), sits on the BSSS council and the Professional Practice Committee.

1.1.5 The technical note has been reviewed by Dr David Brignall FIES, CBiol and CSci, who has over 30 years of experience in soils, agriculture, and the environmental effects of major developments. David has worked in the UK and Internationally on a wide range of projects and has worked as an environmental expert for the World Bank, European Bank for reconstruction and Development, and on a number of EU research programmes (fifth framework and Horizon 2020). David is a Director at Wardell Armstrong and his qualifications include a BSc (Hons) in Agricultural Science and PhD in Agricultural Botany;

2 CAUSES OF REDUCED DEPTH OF COVER

2.1.1 The United Kingdom Onshore Pipeline Operators' Association (UKOPA) lists the following main causes of reduced depth of cover (UKOPA, 2015):

- soil erosion and subsidence of organic-rich soils (oxidation); o land-use (agricultural) practices;
- historic pipeline standards with reduced cover requirements compared to today's standards (not discussed further in this assessment); and
- loss or failure of the anti-buoyancy systems in marsh land or peat bogs (not discussed further in this assessment).

2.2 Soil erosion and subsidence of organic-rich soils (oxidation)

2.2.1 Soils display a large degree of spatial heterogeneity across England and Wales. This is largely due to the varying soil forming conditions present. As a result, there are 296 different Soil Associations mapped across England and Wales; each exhibiting different physical, chemical, and biological characteristics. These characteristics interact to influence the susceptibility of each Soil Association to erosion.

2.2.2 The two main types of erosion are water and wind erosion, a separate category is soil erosion through agricultural processes (covered in the 'land-use (agricultural) practices' section).

2.2.3 The low-lying East-Anglian Fens are considered to be the most important area of the UK for commercial arable farming (comprising ALC Grade 1 and 2 agricultural land), producing, amongst others, a third of England's fresh vegetables and a fifth of England's potatoes and sugar beet (NFU, 2019).

2.2.4 These soils have been extensively drained, to provide favourable conditions for crop growth, however this has led to the drying and subsequent degradation (loss of organic matter), and shrinkage and consolidation (loss in volume) of this valuable peat resource, resulting in peat subsidence (Dawson et al., 2009; Evans et al., 2016). Further peat losses occur during cultivation (tillage) which aerates the organic rich soils, further increasing carbon losses and increasing the susceptibility of the soil to wind erosion (fen blow). A recent study revealed a mean annual reduction in peat depth in the Fens was 1.48 cm per year, measured over 13 years (Dawson et al., 2009), which would equate to 59 cm over 40 years.

2.3 Land use (agricultural) practices

2.3.1 Soil erosion is a natural process, with all soils to some extent subject to erosion processes. However, certain agricultural management practices can accelerate soil erosion processes or increase soil loss processes, including:

- Erosion by ploughing, i.e. gradual movement of soil down the slope with tillage and other cultivation;

- Soil destoning; and
- Removal of soil on potatoes and root crops, such as sugar beet and carrots.

2.3.2 The impact of agricultural land drainage on organic-rich soils and peat is considered in the 'erosion' section above.

Tillage

2.3.3 Tillage is a key operation in arable cropping regimes. This process routinely disturbs and turns the topsoil, increasing the surface area and subsequent drying of the topsoil, which can increase the susceptibility of soil to erosion.

2.3.4 In the period from the 1980s up until the 2010, the use of large scale agricultural equipment for a wide range of husbandry operations used for arable cropping (from tillage through to harvesting) encouraged the removal of hedgerows and shelterbelts to enable the more efficient use of equipment. This has been combined with consumer demand for a wider range of now accepted vegetables from salads such as rocket and spring onions through to baby carrots and other root crops. These factors taken together with climate change, that has increased the length of the available growing season, enables growers to increase crop rotations in the growing season and, as a consequence, the frequency of operations such as tillage that cause the potential for soil erosion to take place.

2.3.5 In the East Midlands, higher value and shorter rotation cropping tends to be more prevalent on lighter sandy loams and sandy silt loams that are amenable to tillage and characterised by a longer period of machinery workable days from early spring to late autumn. These lighter soils are more prone to erosion during dry windy periods and as a consequence of heavy rainfall and higher volumes of surface run-off, when there is insufficient crop cover to stabilise the topsoil.

2.3.6 Therefore, there is a greater likelihood of accelerated soil loss in the east midland region.

Destoning

2.3.7 Destoning is often practiced where vegetables are produced on sandy but naturally stony soils. On these soils, frequent tillage will replenish stones removed from the surface from the lower horizons, such that destoning is a frequent operation undertaken annually or bi-annually to maintain a minimal volume of stones within the topsoil. Based on the greater proportion of land under arable crops and vegetables in the East of England, this practice will be more prevalent in this region.

Soil removal on crops

2.3.8 Soil loss due to crop harvesting, occurs during the harvesting of crops such as potato, sugar beet, carrot, or parsnip roots. These are arable cropping systems typical in the East of England (as illustrated on Plate 1).

3 LAND USE AND SOIL LOSS

3.1.1 The accelerated erosion through tillage, destoning, and soil loss due to crop harvesting, are all standard processes occurring from arable land use and are causes of reduced depth of cover.

Regional differences in land use

3.1.2 Plate 1 illustrates the land use change between 1970 and 1995. This figure highlights the dominance of annually tilled land as a percentage of total farmed area.

3.1.3 The pipelines in regions where there is a greater overall proportion of land that is tilled are therefore more likely to have the depth of cover reduced within their lifetime. Cadent's East of England regions are dominated by tilled agricultural land.

3.1.4 This spatial trend is consistent with the recent Defra Farm Survey Data (2020), with the EA and EM Cadent regions having between a 23 % and 41 % greater proportion of arable area (equivalent of tilled land), than other regions.

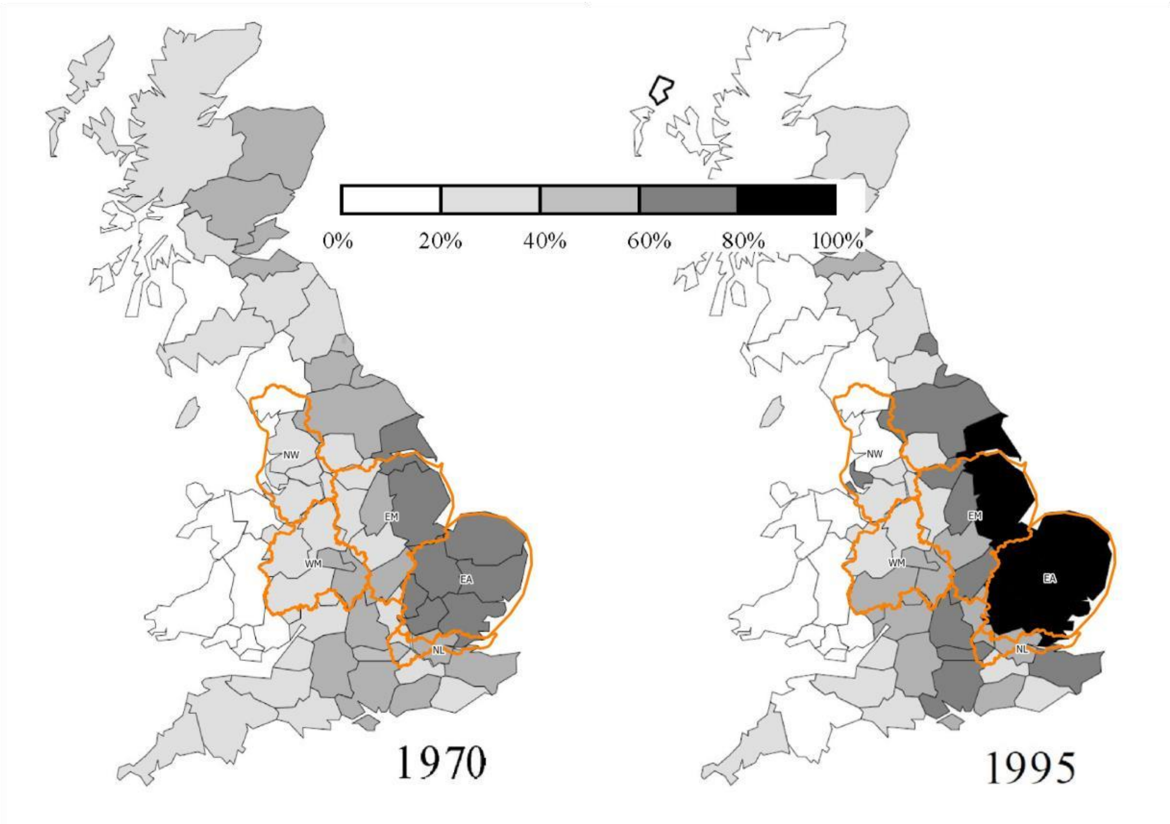

Plate 1: The amount of annually tilled land as a percentage of total farmed area by county; based on Defra statistics; reproduced from (Robinson and Sutherland, 2002). With Cadent's network boundaries superimposed

3.1.5 The following part of the report presents a comparative analysis of agricultural land use in the regions of England and Wales. The comparison is based on the information provided in the Soil Survey of England and Wales publications, each describing soils and their use in different regions (Various authors, 1984). The descriptions of land use are based on the records from 1980 and describe trends observed in the preceding decades and valid as of 1980. It is known that whilst farming has been changing since the 1980's, the trends in agricultural practices observed then would have the biggest effect on the way the land was farmed in the most recent decades and thus affect the loss of soil due to erosion and other factors given in the previous section.

3.1.6 The analysis shows that EA and EM Cadent regions had the largest proportion of agricultural land that was subject to regular tillage (i.e. arable), with substantial areas under vegetables and other horticultural crops, and provide the majority of the sugar beet produced in this country, which is a 'high erosion risk' crop (see summary in Table 1). **Whilst these land uses were present in other parts of England and**

Wales, they comprised a larger proportion of land use in both the EA and EM regions.

3.1.7 The East Anglia Cadent region also comprises the Fens which span c. 240 km^2 and are characterised by silty and peaty soils, and peat. Peat in the fens has been drained and is often used for intensive vegetable farming and continues to subside at high rates (Dawson et al., 2010).

Table 1: Comparison of different type of agricultural uses within Cadent Gas and non-Cadent regions of England 1980

Region	Agricultural land (%)	Tilled land (%)	Wheat (%)	Barley (%)	Sugar beet (%)	Potatoes (%)	Horticulture (%)	Permanent Grassland (%)
EA and EM	70	72	26	23.5	3.8	2.2	4	18
WM	68	53	26	17.4	1.5	1.9	2	41
NW	52	42	3	19.4	0.4	3.1	3	46
Non-Cadent	64	49	10	18.9	0.7	1.5	1	38
Non-Cadent (Wales)	65	19	1	4.6	-	0.5	1	56

Sub-categories are shown as percentage of the total area of agricultural land; arable crops include wheat, barley, sugar beet and potatoes; horticulture incudes vegetables and soft fruit; values of new grassland and rough grazing not included. Aggregated by counties present in relevant regions; counties with partial coverage of Cadent and Non-Cadent regions not included as the data could not be separated. The North London (NL) Cadent region was not included as it is partly located in several counties (Berkshire, Buckinghamshire, and Surrey) and the source data is provided by counties. Source: Soil Survey of England and Wales Regional Bulletins (Various authors, 1984) Source data available on request

3.1.8 There were few other smaller areas outside Cadent regions where arable farming was important, however, when all the regions were aggregated together the average percentage of tilled land was much lower, it was **under 50 % in Non-Cadent regions (including those in South East England) and under 20 % in Wales, whilst the East of England and East Midlands regions had 80 % and 64 % of tilled land (72 % on average)**, respectively.

3.1.9 This comparison between the regional percentage of the tilled land for 1980, 1995, and 2018 (Defra, 2020; Robinson and Sutherland, 2002) shows that the land use patterns on a regional scale remained relatively similar following marked increase in arable land from 1970 to 1980. Therefore, given the slow changes to the land use patterns, the regions that are more likely to be at risk of erosion and other types of soil loss due to predominance of arable land use will remain so for the foreseeable future.

3.1.10 The erosion rates from differing land uses, measured across a number of studies, vary widely. However, soil losses from arable land are often an order of magnitude greater than from permanent pasture (Knox et al., 2015; University of Exeter, 2018).

4 CONTROL OF SOIL EROSION

4.1.1 The text set out above describes the interaction of soil type, climate and agricultural practices increasing soil erosion in the East of England network. These factors are beyond the control of utility companies. This is illustrated in the table below.

Table 2: Main factors affecting soil erosion and ways to control them

Factor	Control	Under operator's control as a part of normal maintenance?	Explanation
Soil erodibility	Choice of pipeline location	No	Location of pipe is chosen at the time of construction
	Increase soil organic matter content to reduce soil erodibility	No	Depends on farming practices, such as choice between arable and grassland land use and inputs of organic matter to the soil
Erosivity of farming operations	Change of farming regime	No	Operator cannot restrict or change type of normal farming activity
Climate including rainfall	Choice of pipeline location	No	Route determined by the needs for connectivity
Ground cover	Crop choice, type of farming (arable, pasture)	No	Governed by the socioeconomic factors, such as prices and subsidies
Slope	Choice of pipeline location	No	Location of pipe is chosen at the time of construction

5 CONCLUSION

5.1.1 The proportion of tilled land (i.e. soils turned and disturbed through agriculture) is substantially higher, between 20% and 40%, in the East of England network (East Midlands and East Anglia regions) when compared to the rest of England and Wales. The intensive arable agricultural and horticultural land uses are an important contributory factor to accelerated erosion and soil loss that are the primary causes of reduction in depth of cover over gas pipelines in the East of England network, compared to other network areas of England and Wales.

5.1.2 The combination of factors that are prevalent in the EM and EA Cadent regions result in an increased risk of pipeline infrastructure being affected by soil erosion resulting in a reduced depth of cover. To ensure the integrity of the network whilst maintaining continuity of commercial agricultural operations, requires remedial works such as reinstating the depth of cover over the pipeline.

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NERA
ECONOMIC CONSULTING

Review of Ofgem's GD2 Draft Determination Cost Assessment

Prepared for Cadent Gas

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Overview

On 9 June 2020, Ofgem published its Draft Determination (DD) for the RIIO-GD2 price control for the British Gas Distribution Networks (GDNs). Ofgem's RIIO-GD2 price control sets revenues and allowances for the 5-year period from April 2021 to April 2026.

In this context, Cadent Gas Limited (Cadent) has commissioned NERA Economic Consulting (NERA) to review Ofgem's approach to cost assessment in its DD. This report reviews the key elements of Ofgem's approach to estimating companies' efficiency, and its approach to setting allowances. In particular, we have reviewed Ofgem's published DD documents, as well as the set of Excel models which Ofgem used to carry out its analysis.

Ofgem bases the majority of its assessment on a single model in which Ofgem explain 84 per cent of totex as the function of a Composite Scale Variable (CSV). Ofgem then calculates allowances based on the modelled costs implied by the model, and applies a 'catch-up' and 'frontier shift' efficiency challenge to companies' modelled costs. In our review, we have identified a series of errors in Ofgem's modelling, and its application of this model to set allowances. By correcting for data and calculation errors alone, we find Ofgem's DD has understated Cadent's allowances for RIIO-GD2 by £284 million.

Ofgem has also made a series of methodological errors. Ofgem materially underestimates the effect on costs of operating in London, as demonstrated by replacing Ofgem's pre-modelling sparsity and urbanity adjustments with controls for density drivers in its regression model (see below). Ofgem ignores evidence that its single regression model is mis-specified. Its CSV variable is based on unreliable weights, and does not capture the underlying relationship between costs and their drivers. Ofgem's approach to weighting its CSV also penalises companies with shares of workload materially different from the industry average, even if these differences are efficient or caused by exogenous factors.

As Table 1 shows, these errors lead Ofgem to materially understate Cadent GDNs' relative efficiency compared to other companies.

The reliability of Ofgem's DD allowances is also undermined by a number of errors in Ofgem's application of its regression model. By excluding certain controllable costs from its regression model, Ofgem ignores cost trade-offs with the remaining costs (i.e. the 16 per cent of totex assessed outside the regression). Ofgem also incorrectly uses "smoothed" capex cost drivers to forecast GDNs' efficient costs for the GD2 control period, which links allowances to their workload in the past, not their workload in the future.

Ofgem sets its catch-up efficiency challenge at the 85th percentile without reference to the reliability of its models and data or regulatory precedent. It also applies its catch-up challenge to non-regressed costs, even though these were not considered in Ofgem's calculation of the efficiency challenge. Finally, Ofgem double-counts the scope for frontier shift by failing to correctly adjust for future productivity savings embedded in modelled costs derived from companies' business plan forecasts.

Executive Summary

Table 1: Overview of Company Rankings in NERA's Modelling

	Ofgem DD	Ofgem DD model with errors corrected	Error-corrected DD model with density drivers added	Error-corrected DD model with elasticity-weighted CSV weights	Errorcorrected DD model with company weights in CSV	Error Corrected DD model with elasticities and company weights in CSV
Model ref	(0)	(1)	(2)	(3)	(4)	(5)
EoE	7	5	3	3	5	4
Lon	8	8	1	8	2	2
NW	6	2	2	2	3	3
WM	5	6	5	6	1	1
NGN	1	1	4	1	4	5
Sc	2	3	7	5	6	6
So	3	7	8	7	8	8
WWU	4	4	6	4	7	7

Notes: (1). Cost and Driver data corrected for: i) all errors identified in Table 3.1 of NERA's report, (ii) Ofgem's incorrect application of the time trend, and (iii), Ofgem's incorrect use of workload-adjusted cost drivers and error in applying workload adjustment in its modelling files. See main report for more details. (2) Density drivers are added better to identify London-effects, (3) "Elasticity weights" are applied to the CSV to better control for the mix of fixed and variable costs in each cost category, (4) Company weights (rather than industry weights) is a sensitivity to show effects of moving away from industry average weights, (5) The final model combines models (3) and (4) Source: NERA analysis of Ofgem data.

Ofgem Assesses the Majority of Costs using a Single Regression, and Applies 'Catch-up' and 'Ongoing' Efficiency Challenges to Most Costs

Ofgem sets GDNs' allowed revenues ("allowances") using a building-blocks approach. Ofgem divides the cost forecasts submitted in GDNs' business plans into several categories based on the methodology it uses to estimate efficient costs within each category.

Ofgem first separates out costs that it considers to be outside of the control of companies, and then splits baseline totex into three categories based on the method it uses to set the corresponding allowance:

- **Regressed costs** assessed using Ofgem's regression model, comprising 84 per cent of forecast controllable costs. Prior to running its model, Ofgem normalises these costs, e.g. to account for regional specific factors and differences in labour costs in different parts of the country;
- **Non-regressed costs** assessed using non-regression models and comprising 8 per cent of forecast controllable costs; Regressed and non-regressed costs together constitute "modelled costs"; and

- **Technically assessed costs**, including the “majority of” outputs assessed on engineering evaluation as well as bespoke outputs proposed by GDNs, comprising 8 per cent of forecast controllable costs.

To assess “regressed costs”, Ofgem uses a single ‘totex’ regression model (which it refers to as “OLS 1”), to estimate a statistical relationship between regressed costs and a “totex Composite Scale Variable” (totex CSV), using forecast and historical data over RIIO-GD1 and RIIO-GD2. Ofgem then uses this model to calculate its view of modelled costs for each company in each year of RIIO-GD2.

Ofgem’s totex CSV driver is a weighted average of different drivers that reflect the attempt to explain eight specific activities included in totex.[39] The components of the totex CSV include scale and workload drivers, in particular “synthetic workload drivers”, which represent Ofgem’s view of the unit cost of carrying out specific repex and capex activities, multiplied by the volume of activities each company carries out, and “MEAV” which measures the size of the network in terms of number of assets, weighted by Ofgem’s view of the replacement value of each class of asset. Ofgem calculates its weights based on industry spend proportions on the category of disaggregated costs that Ofgem intends each driver to represent, and assigns the residual weight (34 per cent) to MEAV.

In order to set allowances, Ofgem adjusts modelled costs (i.e. regressed and non-regressed costs, but not technically assessed costs) to reflect to two separate efficiency challenges:

- A catch-up efficiency challenge applied to modelled costs. Ofgem intends this challenge to reflect the costs incurred by companies at the efficient frontier by reducing the allowances of companies assessed to be less efficient than the benchmark firm; and
- An ongoing efficiency challenge applied to both modelled and technically assessed costs. Ofgem intends this challenge to reflect its view of the scope for GDNs to deliver productivity improvements throughout the price control period, reflecting shifts in the efficient frontier over time.

For its catch-up efficiency challenge, Ofgem selects the 85th percentile of GDNs’ efficiency scores (based on the difference between submitted and modelled regressed costs), i.e. assuming that all companies are approximately as efficient as the 2nd ranked company.

Ofgem applies its ongoing efficiency assumption to efficient modelled costs and technically assessed costs to determine overall baseline totex allowances for each GDN. Ofgem’s ongoing efficiency target is 1.4 per cent for opex, 1.2 per cent for capex and 1.2 per cent for repex. However, since companies’ cost forecasts already include embedded ongoing efficiency targets, Ofgem only applies an additional target to account for its view of the difference between the targets above and the assumptions embedded in companies’ cost forecasts.

Ofgem’s DD Cost Assessment Makes Several Errors which Disadvantage Cadent

Through our review of Ofgem’s cost assessment, we have identified a number of data and calculation errors. Not all of the errors we have identified disadvantage Cadent. However,

[39] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 95.

by correcting these errors while leaving the remainder of Ofgem's DD cost assessment methodology unchanged, we find that modelled allowances rise for Cadent by £284 million over the GD2 period.

The figures in Table 2 result from a scenario in which we correct various errors identified over the course of our analysis, including data errors, formula errors in Ofgem's spreadsheets, the incorrect modelling of the time trend in the regression, and its failure to consistently make workload adjustments when estimating the econometric regression.

Table 2: The Impact on Modelled Allowances for GD2 from Correcting Ofgem Errors

Network	**Ofgem DD**		**Ofgem DD with All Corrections Applied**		**Difference**	
Network	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Allowed Costs (%)*
EoE	1,839	1.10	1,976	0.98	137	7.47%
Lon	1,414	1.17	1,468	1.09	54	3.83%
NW	1,463	1.04	1,528	0.97	65	4.45%
WM	1,113	1.04	1,139	1.00	27	2.45%
NGN	1,567	0.89	1,605	0.87	37	2.39%
Sc	1,105	0.95	1,103	0.97	-2	-0.15%
So	2,525	0.98	2,497	1.01	-28	-1.11%
WWU	1,542	1.00	1,585	0.97	43	2.76%
85th percentile		0.95		0.97		
Cadent	**5,827**		**6,111**		**284**	**4.87%**
Industry	**12,566**		**12,901**		**334**	**2.66%**

Note: Allowed costs represents " efficient costs + Technical Assessments + uncertainty mechanisms + passthrough, inc ongoing efficiency", as reported in Ofgem's file "(9) Allowances". In columns "Ofgem Draft Determination OLS1", we report results as of the version received from Ofgem on 6 August 2020.
Source: NERA analysis of Ofgem data.

Ofgem's errors therefore disadvantage Cadent materially. These material errors also highlight the uncertainty and imprecision with which Ofgem's comparative analysis of GDNs' costs can forecast "efficient" costs for the GD2 period.

In addition to these errors, we have also identified a number of methodological problems with the approach itself, as we discuss below.

Ofgem's Approach to CSV Weightings Materially Disadvantages Cadent

Ofgem's approach to comparative benchmarking is constrained by the limited amount of data available to estimate an econometric relationship between GDNs' costs and drivers of those costs. Because Ofgem has only 8 comparators, its regression analysis cannot comprehensively disentangle the effects on companies' costs from differences between the service levels they offer, differences in their activity and workload, differences in their operating environments, data error and differences in their efficiency.

Ofgem's proposed benchmarking models address this limitation by using a CSV as a scale driver (alongside time trends). While this CSV weights together different drivers of companies' costs to account for various factors, it restricts the econometric model.

Firstly, it makes assumptions on what driver explains what share of totex (i.e. weights). It then assumes that the relationship between each driver and totex can be explained by the assumed weighting on each driver, multiplied by a common regression coefficient (an "elasticity") that applies to all drivers. In fact, the impact on different cost categories may have different "elasticities", defining the rate at which they change due to changes in drivers. We recommend adjusting the CSV by scaling the weights on each driver using elasticities estimated from the disaggregated models (and adjusting so that the sum of weights add up to 1).

Applying this approach (in addition to addressing the errors in Table 2), materially increases Cadent's modelled allowances, by an additional £32 million, or 0.5 per cent of totex.

Table 3: Efficiency Scores and Allowances using Elasticity Weighted CSV

	Ofgem DD with All Corrections Applied		**Ofgem DD with All Corrections Applied & Elasticity Weighted CSV**		**Difference**	
Network	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Allowed Costs (%)
EoE	1,976	0.98	1,988	1.01	12	0.61%
Lon	1,468	1.09	1,486	1.12	18	1.23%
NW	1,528	0.97	1,531	0.99	3	0.19%
WM	1,139	1.00	1,137	1.03	-1	-0.13%
NGN	1,605	0.87	1,595	0.90	-10	-0.62%
Sc	1,103	0.97	1,092	1.01	-11	-0.95%
So	2,497	1.01	2,502	1.04	4	0.18%
WWU	1,585	0.97	1,576	1.01	-8	-0.52%
85th Percentile		0.97		0.99		
Cadent	**6,111**		**6,143**		**32**	**0.52%**
Industry	**12,901**		**12,908**		**7**	**0.06%**

Source: NERA analysis of Ofgem data.

Secondly, by using industry average weights, Ofgem assumes that all GDNs have the same mix of workload. In fact, companies may have different mixes of activities for reasons related to the area they operate in, or because of operational choices to make efficient tradeoffs between activity types. Ofgem's approach of using industry weights has the potential to arbitrarily disadvantage or reward companies with a mix of workload different from the industry mean. An alternative approach that corrects this is to use company-specific weights to develop the CSV, at least as a sensitivity on the industry average approach.

Applying both these changes to Ofgem's CSV (combined with the corrections shown in Table 2) has a material impact on the model's forecast of efficient expenditure for the GDNs, as shown in Table 4. This alternative approach suggests Cadent's GDNs are more efficient than all the other companies.

Table 4: The Impact on Modelled Allowances for GD2 from Alternative CSV Weightings

	Ofgem DD with All Corrections Applied		Error-corrected DD Model with Company & Elasticity Weighted CSV		Difference	
Network	**Allowed Costs (£m)**	**Efficiency Score**	**Allowed Costs (£m)**	**Efficiency Score**	**Allowed Costs (£m)**	**Allowed Costs (%)**
EoE	1976	0.98	1924	0.94	-52	-2.64%
Lon	1468	1.09	1568	0.89	101	6.87%
NW	1528	0.97	1523	0.89	-6	-0.38%
WM	1139	1.00	1176	0.87	38	3.32%
NGN	1605	0.87	1438	0.96	-166	-10.37%
Sc	1103	0.97	1041	0.97	-62	-5.60%
So	2497	1.01	1992	1.42	-505	-20.22%
WWU	1585	0.97	1478	1.00	-106	-6.72%
85th Percentile		0.97		0.89		
Cadent	**6111**		**6192**		**81**	**1.32%**
Industry	**12901**		**12141**		**-759**	**-5.88%**

Source: NERA analysis of Ofgem data.

Comparing these results to our corrected version of Ofgem's modelling (Table 2) shows that Ofgem's approach materially disadvantages Cadent, while Ofgem's approach is materially beneficial for SGN's Southern Network relative to this alternative. These differences between Ofgem's approach and this alternative approach arise because some companies have workloads very different from the industry mean, making Ofgem's CSV inappropriate in some cases.

While there is wide variation in results across these two methods for constructing a CSV, there is no definitive case that one is more reliable than the other. Rather, we would recommend computing the modelled costs implied by both methods, selecting the maximum of modelled costs for each GDN under the two approaches, and then applying an efficiency target to this alternative definition of modelled costs. This approach prevents allowances for GD2 for a particular GDN being biased downwards by arbitrary choices in the construction of the CSV.

Applying this alternative approach to setting allowances results in the allowances shown below in the table below, increasing allowances for Cadent by £17 million, while reducing allowances for the industry as a whole by £410 million.

Table 5: The Impact on Modelled Allowances for GD2 from Taking Modelled Costs from the Maximum Implied by the Alternative CSVs

	Ofgem DD with All Corrections Applied		Error-corrected DD Model, Max of Alternative CSV Approaches		Difference	
	Allowed Costs	*Efficiency Score*	*Allowed Costs*	*Efficiency Score*	*Allowed Costs (£m)*	*Allowed Costs (%)*
EoE	1,976	0.98	1,904	0.94	-72	-3.64%
Lon	1,468	1.09	1,551	0.89	84	5.69%
NW	1,528	0.97	1,508	0.89	-21	-1.35%
WM	1,139	1.00	1,164	0.87	26	2.25%
NGN	1,605	0.87	1,501	0.88	-104	-6.45%
Sc	1,103	0.97	1,029	0.98	-74	-6.71%
So	2,497	1.01	2,348	1.01	-149	-5.98%
WWU	1,585	0.97	1,484	0.98	-100	-6.32%
85th Percentile		0.97		0.88		
Cadent	**6,111**		**6,128**		**17**	**0.27%**
Industry	**12,901**		**12,490**		**-410**	**-3.18%**

Source: NERA analysis of Ofgem data.

Ofgem's Regression is Mis-Specified

However, even after considering this alternative method for computing CSV weights, Ofgem's analysis still gives an incomplete and potentially misleading assessment of GDNs' expenditure requirements over the GD2 control period.

Ofgem's model also fails the Ramsey RESET test, which econometric literature and Ofgem's past price control decisions acknowledge is an important test for model mis-specification. Failure of this test suggests Ofgem may have used the wrong functional form, or possibly omitted important drivers from its modelling. The consequences of this problem are that the regression coefficients Ofgem has estimated are biased, and its modelled costs may be inaccurate. Ofgem's attempt to address this problem, by running a model with a quadratic CSV variable, does not address the problem, as this alternative model specification also fails the RESET test.

Ofgem's Use of the Econometric Modelling Fails to Recognise its Limitations

Ofgem's modelling results are not robust, as we discuss above. For instance, Ofgem's chosen model fails the RESET test, and its CSV does not provide a logical basis for comparing costs across companies. Given these problems with Ofgem's data and model specification, it would constitute an error for Ofgem to place so much weight on its single regression equation.

Given the serious limitations of Ofgem's modelling approach, it would therefore be prudent to base GD2 allowances on a wider set of evidence. For instance, as we suggest above, Ofgem could adjust its definition of modelled costs, selecting the maximum of modelled costs for each GDN under the alternative approaches, and applying its catch-up efficiency target after performing this maximum calculation. This approach prevents GD2 allowances for particular GDNs being biased downwards by arbitrary methodological choices.

Ofgem's London Productivity Adjustment Fails to Control Sufficiently for London Costs

The very large efficiency gap modelled for Cadent's London GDN provides a strong indication that Ofgem's model is not adequately controlling for differences in GDNs' costs. The London GDN appears to be an outlier in Ofgem's analysis, with an efficiency gap of 17 per cent between its business plan cost forecasts and Ofgem's modelled allowances, and 22 per cent to the 85th percentile benchmark (see Table 2).

One possible explanation for this is that Ofgem's approach fails to capture the relatively high costs of serving central London and serving sparse rural areas. As an illustration of this, we have run a variant of Ofgem's model in which we include a "density" driver (in both linear and quadratic terms), while also switching off Ofgem's sparsity and urbanity adjustments. This alternative approach yields materially higher allowances for London, rising by £131 million over the GD2 period to £1,598 million (see Table 6).

The allowances for WWU does not change materially in this sensitivity, suggesting Ofgem's sparsity adjustment is identifying an appropriate adjustment for this effect on companies' costs, even though Ofgem's adjustment for London costs seems to understate the efficient costs of operating a GDN in the dense urban environment.

This alternative model specification which includes density could be used to apply an alternative and more accurate calculation of the London special factor which Ofgem applies prior to running its model, even if Ofgem does not change the specification of the model used to set baseline allowances.

Table 6: The Impact on Modelled Allowances for GD2 from Including Density in the Regression Model

	Ofgem DD with All Corrections Applied		Error-corrected DD model (inc. density variables)		Difference	
Network	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Allowed Costs (%)
EoE	1976	0.98	1995	0.98	18	0.92%
Lon	1468	1.09	1598	0.96	131	8.92%
NW	1528	0.97	1529	0.98	1	0.06%
WM	1139	1.00	1160	0.98	21	1.88%
NGN	1605	0.87	1496	0.98	-109	-6.76%
Sc	1103	0.97	1071	1.03	-32	-2.86%
So	2497	1.01	2449	1.06	-48	-1.93%
WWU	1585	0.97	1546	1.02	-39	-2.43%
85th Percentile		0.97		0.98		

Cadent	**6111**	**6282**	**171**	**2.80%**
Industry	**12901**	**12845**	**-56**	**-0.43%**

Source: NERA analysis of Cadent data

The Reliability of Ofgem's Modelling Does Not Warrant a More Demanding Efficiency Threshold

As set out above, Ofgem's modelling has a number of flaws, suggesting it is not robust. It has made a number of errors, its regression fails important diagnostic tests for misspecification and its results are highly sensitive to changes in model specification. Given the available data, Ofgem is fundamentally unable to estimate a single, robust econometric relationship between GDNs' costs and drivers.

As such, Ofgem's decision to apply an extremely demanding efficiency target (i.e. at the 85th percentile of companies' modelled efficiency gaps) creates a significant risk that Ofgem's allowances will understate the costs GDNs will incur over the GD2 control period.

Ofgem's decision to set the efficiency target at the 85th percentile reflects its aspiration regarding the level of allowances it considers appropriate for GD2, which has no basis in statistical or technical analysis. Indeed, regulatory precedent (including past Ofgem decisions) shows that the level of the efficiency target should be justified by assessing the risk that modelled costs are distorted by data or model error. Ofgem has made no such assessment when setting its efficiency target.

In fact, Ofgem's published statements reveal its selection of the 85th percentile target represents an attempt to claw back historical outperformance during the GD1 control period, not set a realistic cost target for GD2.

Hence, Ofgem's approach entails a significant risk of its allowances for all GDNs being distorted by omitted factors which exaggerate the apparent efficiency of the GDNs with the lowest costs. In fact, these GDNs may perform well in Ofgem's modelling by chance, because the model is mis-specified to their benefit, or Ofgem has omitted some factors explaining why they have low costs when compared to their peers.

In conditions where econometric cost modelling cannot identify robustly the efficient level of companies' expenditure requirements, we recommend basing allowances on a range of alternative methods (see above), and setting a less demanding efficiency target. For instance, in its redetermination of Bristol Water's PR14 price control the CMA applied a median cost target to reflect the limitations on the data and models available to it. We recommend Ofgem applies this same approach at RIIO-GD2.

Setting a target at the median threshold would result in higher allowances across the industry, including an additional £49 million for the Cadent GDNs (when using the error-corrected DD model – see Table 7 below). We find a similar effect when we apply the median target alongside the alternative approach to calculating modelled costs in Table 5 above.

Table 7: The Impact of Applying a Median Cost Target on Modelled Allowances

Network	Ofgem DD with All Corrections Applied	All Corrections Applied, Median Efficiency Target	Difference

Network	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Allowed Costs (%)
EoE	1976	0.98	1,994	0.99	17	0.87%
Lon	1468	1.09	1,480	1.09	12	0.81%
NW	1528	0.97	1,540	0.97	11	0.73%
WM	1139	1.00	1,147	1.00	9	0.78%
NGN	1605	0.87	1,617	0.87	12	0.72%
Sc	1103	0.97	1,111	0.97	8	0.75%
So	2497	1.01	2,515	1.01	18	0.71%
WWU	1585	0.97	1,596	0.97	11	0.72%
*85th / **50th percentile		0.97		0.98**		
Cadent	**6111**		**6,160**		**49**	**0.81%**
Industry	**12901**		**12,999**		**98**	**0.76%**

Source: NERA analysis of Cadent data.

Ofgem Has Made Errors when Applying its Efficiency Target to Set Allowances

Ofgem also fails to justify the application of its 85th percentile catch-up efficiency challenge to non-regressed costs. Since these costs are not included in the benchmark used to calculate companies' level of efficiency, these costs should not be subject to an efficiency challenge beyond the adjustments Ofgem employs in in the various non-regression models.

Finally, Ofgem should change its approach to removing the ongoing productivity improvement already embedded in the costs used to estimate econometric models when setting allowances, since its current approach double-counts these future productivity savings. Ofgem adds the difference between Ofgem's and the average of companies' view of the scope for annual productivity gains, rather than the (particularly high) view of the company setting the efficiency challenge. Instead Ofgem could estimate its econometric models after subtracting the ongoing productivity improvement embedded into companies' business plan cost forecasts, and then apply its view of productivity gains as a final step in calculating allowances, rather than making a partial post-modelling adjustment (and accounting for some expected productivity gains in the model).

1. Introduction

On 9 June 2020, Ofgem published its Draft Determination (DD) for the RIIO-GD2 price control for the British Gas Distribution Networks (GDNs). [40] Ofgem's RIIO-GD2 price control sets revenues and allowances for the 5-year period from April 2021 to April 2026.

In this context, Cadent Gas Limited (Cadent) has commissioned NERA Economic Consulting (NERA) to review Ofgem's approach to cost assessment in its DD. This report reviews the key elements of Ofgem's approach to conducting comparative benchmarking to assess the GDNs' relative efficiency and forecast costs for the GD2 control period, and its approach to using this modelling to set allowances. We have reviewed Ofgem's published DD documents, as well as the set of Excel models which Ofgem used to carry out its analysis.

This report summarises Ofgem's approach, presents our findings on the errors and limitations in Ofgem's DD, and sets out our recommended improvements to Ofgem's approach.

The remainder of this report is structured as follows:

- Section 2 summarises Ofgem's overall approach to cost assessment;
- Section 3 explains the flaws in Ofgem's regression modelling;
- Section 4 explains flaws in Ofgem's application of its modelling to set allowances;

and ▪ Section 5 concludes.

[40] Ofgem (9 July 2020), RIIO-2 Draft Determinations - Gas Distribution Annex.

2. Overview of Ofgem's Approach to Cost Assessment

In this chapter we provide an overview of the approaches Ofgem has used in its GD2 Draft Determination cost assessment, to inform our assessment of it in subsequent chapters.

2.1. Categories of Costs

Ofgem sets GDNs' allowed revenues ("allowances") using a building-blocks approach.[41] This approach requires a forecast of companies' total expenditure ("totex") over the GD2 control period. Ofgem's objective is to set each company's totex allowance to reflect the company's efficient costs of service.[42] To assess companies' efficient costs, Ofgem divides GDNs' costs into several categories.

Ofgem first separates out costs that it considers to be within and outside companies' control. Controllable costs include direct and indirect opex, capex, and repex. Ofgem's forecast of the efficient level of these expenditure items forms Ofgem's determination of each GDN's baseline totex allowance.[43] Ofgem treats non-controllable costs such as business rates and gas shrinkage as pass-through items, remunerated separately from the baseline totex allowance.

Ofgem splits baseline totex into three categories, and applies different methods to set allowances for (i.e. "assess") each:[6]

- **Regressed costs** are assessed using Ofgem's regression model, and comprise 84 per cent of industry forecast controllable costs;
- **Non-regressed costs** are assessed using non-regression models, and comprise 8 per cent of industry forecast controllable costs. Regressed and non-regressed costs together constitute "modelled costs"; and
- **Technically assessed costs**, including the "majority of" outputs, are assessed on engineering evaluation as well as bespoke outputs proposed by GDNs, and comprise 8 per cent of industry forecast controllable costs.

Figure 2.1 summarises the three cost categories and the adjustments Ofgem applies to each. The remainder of this section describes how Ofgem assesses costs in each category in more

[41] Ofgem (9 July 2020), RIIO-2: Draft Determinations – Core Document, p. 13.

[42] Ofgem (9 July 2020), RIIO-2: Draft Determinations – Core Document, p. 39.

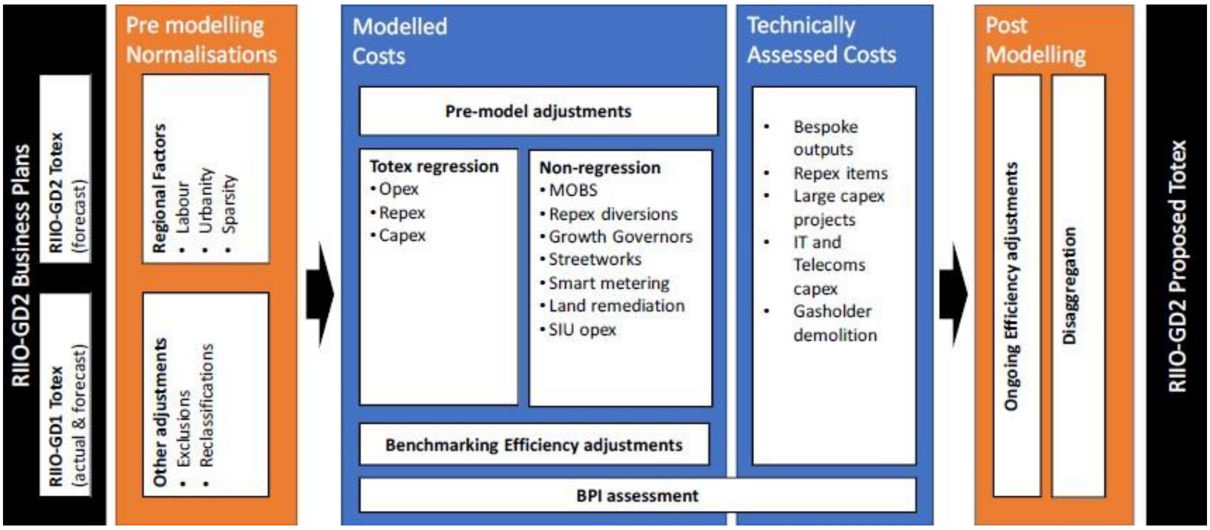
[43] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 82. [6]

Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p.

84.

detail, while Section 2.5 outlines Ofgem's approach to converting assessed costs in each category into totex allowances.

Figure 2.1: Summary of Ofgem's approach to cost assessment



Source: RIIO-2 Draft Determinations – Gas Distribution Annex, p. 84.

2.2. Regressed Costs

Ofgem uses a regression model to set GDNs' allowances for regressed costs. The regression model estimates the relationship between the "regressed" categories of totex and a "totex Composite Scale Variable" ("totex CSV") constructed by Ofgem. Ofgem's totex CSV is a weighted average of different cost drivers that Ofgem assumes explain particular subsets of GDNs' totex.[44] The components of the CSV include scale and workload drivers, shown in Table 2.1:[45]

Table 2.1: The Components of Ofgem's CSV and Their Weight

Totex CSV component	Weight	Cost activities
Emergency CSV	0.05	Emergency
Maintenance MEAV	0.08	Maintenance
Total external condition report	0.06	Repairs
Repex synthetic cost	0.39	Repex

[44] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 95.

[45] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 96.

Mains reinforcement synthetic cost	0.02	Mains reinforcement
Connections synthetic cost	0.06	Connections
MEAV	0.34	Work Management, Business Support, Other Direct Activities, Training and Apprentices, Other Capex

Source: Ofgem, RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 8.
Note: The Emergency CSV is a CSV of customer numbers (with a weight of 80%) and total external condition reports (with a weight of 20%).

Ofgem weights each driver apart from MEAV based on the industry average share (computed across all GDNs) of expenditure in the categories of cost that it assumes are explained by

each driver. Ofgem assumes the remainder of GDNs' costs (i.e. the remaining 34 per cent of regressed costs) is explained by MEAV. MEAV is calculated by multiplying the number of assets of different types that GDNs have in their networks, by the assumed unit cost of a "modern equivalent" replacement.[46] We discuss Ofgem's use of a CSV in Section 3.4.

Ofgem includes cost and driver data for all GDNs across RIIO-GD1 and RIIO-GD2 (2013-14 to 2025-26) in the sample for estimating its regression model.[10] Ofgem's regressions use a 7year rolling average of capex costs and capex drivers to account for the lumpy nature of capex.[47] To calculate these smoothed costs and drivers, Ofgem relies on data as far back as 2007-08 in these categories.

Before running its regression, Ofgem applies several "normalisations" and "adjustments" to make costs comparable across GDNs.[48] These include adjustments for "regional factors" (labour costs, urbanity and sparsity effects) and "pre-model adjustments" that remove, reclassify or upwardly adjust submitted costs. After it uses the model to generate predicted values for each GDN over the GD2 period (see below), Ofgem reverses the normalisation of regional factors before setting GDNs' revenue allowances.

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[46] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 99. [10]

Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p.

96.

[47] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 107.

[48] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 90.

Ofgem considered alternative model specifications but selects a single OLS specification (OLS1) that includes the totex CSV (smoothed), a historical trend component, and a forecast trend component:[49]

$$\log(tttttttttt_{iiii}) = \beta\beta_0 + \beta\beta_1 \log(tttttttttt\ CCCCCC_{iiii}) + \beta\beta_2 tt1 + \beta\beta_3 tt2 + \varepsilon\varepsilon_{iiii}$$

Ofgem's chosen specification includes two linear time trends, one for the historical period and one for the forecast period. By including the time trend variables, Ofgem aims to capture changes in expenditure due to frontier shift and other unobserved time effects.

Given the logarithmic specification of the model, the interpretation of the β_1 coefficient on the totex CSV (0.727) is that a 1 per cent increase in totex CSV would result in a 0.727 per cent increase in regressed costs.

The residual component of the regression ($\varepsilon\varepsilon_{iiii}$) represents the component of costs which are unexplained by the cost driver for each GDN (i), in each time period (t). While this component of the formula can represent data error, differences in cost allocation between companies, or omitted variables, Ofgem's approach assumes this unexplained variation in companies' costs is due to differences in companies' relative efficiency.

Ofgem proposes to use the regression model OLS1, as specified in the regression equation above, but also considers two alternative model specifications. OLS2 is to a model that substitutes the two time trends used in OLS1 for 12 dummy variables used to capture differences in costs from year-to-year.[50] OLS3 is a model which augments OLS1 with an

[49] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 97.

[50] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 13.

additional variable, the squared logarithm of the totex CSV.[51] We discuss and replicate Ofgem's alternative specifications in Section 2 below.

2.3. Non-regressed Costs

Ofgem assesses certain cost categories outside of its regression models. Ofgem's assessment of these costs includes a qualitative review of information provided in the GDNs' Business Plans and a quantitative review of historical and forecast expenditure for each cost activity. Table 2.1 summarises Ofgem's approach to assessing each category of non-regressed costs.[52]

Table 2.2: Summary of Ofgem's Assessment of Non-Regressed Costs

Cost Activity	Assessment
Multi Occupancy Buildings (MOBs)	Ofgem accepts each company's MOBs repex costs in full where it believes the submitted unit costs have been sufficiently justified. For NGN and WWU, Ofgem instead multiplies Cadent's submitted unit cost for RIIO-GD2 to their submitted workloads to set total costs. Cadent is the only company to submit material MOBs maintenance costs.[53] Ofgem "adjusted Cadent's submitted MOBs maintenance costs based on the historical ratio between MOBs maintenance costs and MOBs repex workloads."[18] Only NGN submits MOBs connections costs and Ofgem allows these in full.
Diversions (re-routing of sections of network)	Ofgem makes company-specific adjustments to SGN's submitted unit costs and NGN's submitted workloads where it believes that these are not justified by the companies' Business Plans.
Growth Governors	Ofgem sets a benchmark unit cost per workload that is common across GDNs. Each GDN's modelled cost is its submitted RIIO-GD2 workload times the unit cost.
Streetworks	Ofgem bases each GDN's streetworks allowance on that network's average streetworks costs in 2016/17 to 2019/20 after disallowing costs related to fines and penalties.
Smart Metering	Ofgem reduces Cadent and SGN's submitted costs downwards to be consistent with a reduction in Ofgem's assumed smart meter intervention rates.
Land Remediation	Ofgem accepts all GDNs' submitted costs as it considers that forecasts are in line with historical costs.

[51] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 13.

[52] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 109.

[53] NGN submits costs of £0.002 million.
Ofgem (9 July 2020), RIIO-2 Draft Determinations – Northern Gas Networks, p. 43.

[18] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Northern Gas Networks, p.

52.

SIU Opex	Ofgem accepts all SIU opex (SGN owns and operates five independent gas networks in remote parts of Scotland, referred to as SIUs) for RIIO-GD2 as forecast by SGN.

Source: RIIO-2 Draft Determinations – Gas Distribution Annex and GDN-specific annexes.

2.4. Technically Assessed Costs

Ofgem conducts separate technical assessments of costs relating to large capex and repex projects, bespoke outputs, IT and telecoms capex and specialist areas.[54] Ofgem reviews each proposed investment to determine whether it thinks the needs case is justified, the proposed investment option is the most appropriate, and all associated workload volumes are justified.[55] Ofgem disallows investments it considers to be unjustified. Where Ofgem considers an investment to be justified it sets the corresponding cost allowance through a project-specific engineering assessment of its efficient costs.[56]

Ofgem separately assesses expenditure associated with bespoke outputs and proposes to exclude £356 million of GDNs' forecast incremental expenditure from its technical assessment. Of this, it proposes to accept £47.6 million of expenditure associated with bespoke outputs.[57] Ofgem also separately assesses two of SGN's proposed repex projects separately. Ofgem states project-specific approaches and considerations when accepting or rejecting costs associated with bespoke outputs.

Ofgem undertakes a qualitative expert review of 124 capex investments across all GDNs.[58] This review considers the needs case for individual projects. Ofgem sets an allowance for each justified project based on a bottom-up technical assessment of its costs.

Ofgem evaluated whether companies' proposals for IT and telecoms capex projects were "strong and traceable", evaluating them against criteria it determined. Ofgem proposes to allow baseline funding for projects that meet all criteria. Finally, Ofgem set allowances for costs associated with NGN and WWU's gas holder demolitions using a unit cost approach, as it used at RIIO-GD1.[59]

2.5. Converting Assessed Costs to Allowances

Ofgem adjusts costs to reflect to two separate efficiency challenges when computing allowances:

[54] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 84.

[55] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 114.

[56] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 114.

[57] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 115.

[58] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 116.

[59] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 97.

- A catch-up efficiency challenge applied to modelled costs. Ofgem intends this challenge to reflect the costs incurred by companies at the efficient frontier by reducing the allowances of companies assessed to be less efficient than the benchmark firm; and
- An ongoing efficiency challenge applied to both modelled and technically assessed costs. Ofgem intends this challenge to reflect its view of the scope for GDNs to deliver productivity improvements throughout the price control period, reflecting shifts in the efficient frontier over time.

Ofgem's process of converting regressed costs, non-regressed costs and technical costs into efficiency-adjusted allowances follows the steps below:[60]

1. Ofgem calculates a level of regressed costs for each GDN based on the company's CSV and the coefficients Ofgem estimates in its regression analysis. Ofgem uses the estimated coefficients from OLS1 and an alpha correction (due to using logarithmic transformations of data in the regression model) to set modelled costs according to the following formula:

$$MMttMMttllllttMM\ tttttttttt_{iiii} = aa * tttteetteetteetteeaall(\beta\beta_0 + \beta\beta_1 \log(tttttttttt\ CCCCCC_{iiii}) + \beta\beta_2 tt1 + \beta\beta_3 tt2)$$

2. Ofgem uses modelled regressed costs to compute a totex efficiency score for each GDN:

$$EEEEEEeeEEeetteeEEEE\ CCEEttSStt = \frac{CCSSSSSSeetttttttMM\ (eettSSSSaalleennttMM\ aaMMddSSnnttttMM)\ CCttnnttnn}{MMttMMttllllttMM\ CCttnnttnn}$$

3. Ofgem selects 85th percentile of GDNs' efficiency scores as the benchmark efficiency score.
4. Prior to applying the efficiency challenge, Ofgem adds modelled non-regressed costs to the modelled regressed costs and reverses the pre-modelling adjustments and normalisations.
5. Ofgem converts the modelled gross costs to modelled costs net of customer contributions (net costs).
6. Ofgem multiplies modelled efficient net costs by the benchmark efficiency score (the 85th percentile efficiency score) to determine modelled costs post efficiency challenge. Ofgem refers to modelled costs after applying the catch-up efficiency challenge as GDNs' "efficient modelled costs".

[60] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, pp. 19-21.

7. Ofgem calculates an implied adjustment factor for each GDN by dividing each GDN's efficient modelled costs by the submitted modelled costs. Ofgem then multiplies the submitted costs for each modelled cost activity by the adjustment factor to derive disaggregated efficient costs.
8. Ofgem applies its ongoing efficiency assumption to efficient modelled costs and technically assessed costs to determine overall baseline totex allowances for each GDN. Ofgem's ongoing efficiency target is 1.4 per cent for opex, 1.2 per cent for capex and 1.2 per cent for repex.[61]
9. Ofgem proposes Uncertainty Mechanisms (UMs) for GDNs in RIIO-GD2. The UMs include volume drivers, re-openers, pass-throughs and indexation.
10. Ofgem's final allowed revenues comprise controllable costs (totex), non-controllable costs, pass-through costs and Real Price Effects (RPEs).

[61] At this stage Ofgem applies an ongoing efficiency challenge equal to the difference between its view of ongoing efficiency and the average ongoing efficiency challenge embedded in companies' submitted costs. We discuss this approach in Section 4.3. Source: Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 88.

3. Flaws in Ofgem's Regression Modelling

3.1. Limitations of Ofgem's Econometric Model

In this chapter, we evaluate the econometric benchmarking regression used by Ofgem's DD to assess the majority of GDNs' totex.

Ofgem has a dataset of only eight companies from three ownership groups, with relatively limited year-to-year variation in cost drivers. There are inherent challenges of conducting comparative benchmarking using such a small sample, which can result in apparent inefficiency being conflated with underlying differences between networks and the areas in which they operate. In particular, the small sample limits the "degrees of freedom", which constrains the number of explanatory variables that can be included within the models.

Ofgem attempts to overcome the difficulties of multivariate regression on a small dataset by using a single "Composite Scale Variable" (CSV) made up of a number of different drivers. This simplistic approximation that has a number of limitations (discussed below in Section 3.4) that should lead Ofgem to interpret its results with some skepticism and make a conservative assessment of companies' apparent "inefficiency" that its models identify.

However, even more importantly, Ofgem has made a number of errors, as we set out below. The data used to estimate its regressions and set allowances contain errors. There is statistical evidence that its models are mis-specified. And, despite the extremely small data sample and the intrinsic difficulties it creates for econometric modelling of GDNs' costs, Ofgem has proposed to set GD2 allowances based on a single, flawed model, without taking into consideration a wider set of evidence.

3.2. Errors in Ofgem's Modelling

3.2.1. Errors in Ofgem's data affect its proposed allowances for GD2

Through our review of the Ofgem models and our discussions with Cadent, we have identified a number of errors in the data Ofgem has used to estimate regression models and set allowances for the GD2 period. We list errors identified as of 21 August 2020, in Table 3.1.

Table 3.1: Errors in Ofgem's Data and Calculations

Error	Explanation of issue
NGN Storage Value	We understand from Cadent that NGN's Regulatory Reporting Pack (RRP) for 2018/19 states it has no commissioned storage assets in that year. Table 5.06 of NGN's Business Plan Data Templates (BDPT) shows that the last of its storage assets were decommissioned in 2017/18. However, this is not reflected in NGN's BPDT, leading to NGN's MEAV in Ofgem's models being overstated by an average of £423 million per year.

WWU MOB Assets	We understand from Cadent that all GDNs have some Multioccupancy Building (MOB) assets, but WWU reports zero MOB assets in the BPDT tables, which have been used to calculate MEAV. We understand from Cadent that, using numbers from WWU's most

Error	**Explanation of issue**
	recent RRP and assuming the value to be the same each year, WWU's MEAV increases by £78 million per year.
SGN MOB Assets	We understand from Cadent that SGN's MOB assets reported in the BDPT tables are higher than those reported in the 2018/19 RRP. Correcting these using values reported in RRP for Scotland and Southern yields an annual MEAV reduction of £1,237m and of £1,290m, respectively.
Cadent Pressure Reduction Assets	To account for the fact that Pressure Reduction assets could vary in size, Ofgem applied a unit cost adjustment to each GDN's assets at RIIO1. This adjustment considered each GDN's throughput per asset, compared to the industry average. The same adjustment is applied in the RIIO-GD2 DD MEAV calculations (adjusted for inflation), because the split of industry throughput between GDN's has not changed significantly since the RIIO1 price control. However, we understand from Cadent that since RIIO1 it has revised the number of Pressure Reduction assets (especially Pressure Reduction Stations) down significantly. This affects all Cadent GDNs' MEAV calculations and means that Ofgem understates Cadent's MEAV (and Maintenance MEAV).
Cadent Mains Services	Ofgem replaced the number of services reported by the GDNs with the number of customers reported in RIIO1. Ofgem has done the same for RIIO2, but has not adjusted the data for Cadent's resubmission reflecting higher customer growth. Ofgem therefore understates the Cadent GDNs' MEAVs.
WWU Mains Services Growth	WWU has assumed growth in mains length over 3 times its historical level (mostly in diameter band F, which has a high replacement cost). We understand from Cadent that such a high assumed increase in mains length is likely to be an error, which leads Ofgem to overstate WWU's MEAV for GD2.
Capex Smoothed	In Ofgem's data, the smoothed capex information is hard-coded (see file (6) Regression, sheet 'Cal_StataIN', 'column I'). This means these values are unaffected by changing the normalisation switches (in the global document of the macro). Additionally, Ofgem's "normalisation" files do not normalise capex costs prior to 2014.
MEAV versus MEAV_egep_mobs variable used to calculate CSV totex.	Ofgem states: "In order to ensure MEAV better reflects the scale of GDNs' operation and after discussions with stakeholders at CAWGs, we included both asset types [EGEPs (Embedded Gas Entry Points)

Error	Explanation of issue
	and risers] in the asset base for RIIO-GD2".[62] However, Ofgem uses MEAV excluding EGEPs and risers to calculate the CSV (see document [3] CSV, sheet 'Cal_CSVDrivers').
CSV error plugging in CSV Emergency into CSV Totex and CSV Totex Smoothed	Instead of relying on the Emergency CSV specific to each individual GDN to calculate the totex CSV, Ofgem links to the Emergency CSV for EoE due to a formula error (see file (3) CSV, sheet Cal_CSVDrivers).
Southern Repex Synthetic	File (3) Synthetic Costs, sheet 'Cal Services Synthetic Cost Cadj', row 85 (Southern Other domestic Relays) contains an incorrect cell reference, which overstates Southern's repex synthetic cost for mains and services.
WWU Fuel Poor Connections	We understand from Cadent that Ofgem doubled the volume of Fuel Poor Connections for WWU, overstating its volume by 2,500.
Connections and Reinforcement workloads	We understand from Cadent that Ofgem removed approximately £6 million too much disallowed work of Southern's normalised cost. We have corrected this by deducting £1.27 million additional cost from the costs excluded from Southern's normalised costs.
Cadent Bespoke Output	We understand from Cadent that Bespoke Output costs associated with electric / hybrid vehicles were not removed from the Cadent GDNs' normalised costs. We have deducted these costs in each network's '(2) normalisation' file.
Cadent Emergency CSV	We understand that Ofgem has not reflected Cadent's updated customer numbers in its GDNs' Emergency CSV, to account for the additional connections work mentioned above.

Source: Cadent and NERA analysis.

We have re-run Ofgem's favoured model in its DD, "OLS1", correcting for all the errors listed in Table 3.1, and recalculated allowances for the GD2 control period. As Table 3.2 shows, these corrections have a material effect on GDNs' allowances. Using Ofgem's chosen model specification, correcting errors identified through to 21 August increases Cadent's allowances by £315 million across its four networks, or 5.41 per cent of totex. We understand Cadent has identified other errors since 21 August, but these are not reflected in these results, nor the other sensitivities included in this report.

[62] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, para. 1.37.

Table 3.2: Modelled GD2 Allowances and Efficiency Scores Using OLS1, Before and After Corrections (GD2 allowances in 2018/19 £ million)

	Ofgem Draft Determination OLS1		NERA OLS1 with Data Corrections		Difference	
Network	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Allowed Cost (%)*
EoE	1839	1.10	1,988	1.01	149	8.09%
Lon	1414	1.17	1,486	1.13	73	5.13%
NW	1463	1.04	1,531	1.00	68	4.65%
WM	1111	1.04	1,137	1.04	26	2.31%
NGN	1567	0.89	1,607	0.90	40	2.54%
Sc	1105	0.95	1,102	1.01	-3	-0.26%
So	2525	0.98	2,511	1.04	-14	-0.56%
WWU	1542	1.00	1,587	1.00	45	2.89%
85th Percentile		0.95		1.00		
Cadent Total	**5827**		**6,142**		**315**	**5.41%**
Industry Total	**12566**		**12,949**		**383**	**3.04%**

Note: Allowed costs represents " efficient costs + Technical Assessments + uncertainty mechanisms + passthrough, inc ongoing efficiency", as reported in Ofgem's file "(9) Allowances". In columns "Ofgem Draft Determination OLS1", we report results as of the version received from Ofgem on 6 August 2020, although we were unable to reconcile these with the numbers reported in Ofgem's published DD documents. Source: NERA analysis of Ofgem data.

We have also run the two other models presented in the DD, OLS2 (which uses time dummies instead of time trends) and OLS3 (which adds the squared term of the totex CSV variable) using the corrected data. We report updated allowed costs in Table 3.3 and Table 3.4 below. We report updated regression coefficients in Appendix A.

Table 3.3: OLS2 Allowances and Efficiency Scores Using, Before and After Corrections (GD2 allowances in 2018/19 £ million)

	Ofgem Draft Determination OLS1		NERA OLS2 with Data Corrections		Difference	
Network	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Allowed Cost (%)*
EoE	1839	1.10	1,993	1.02	154	8.35%
Lon	1414	1.17	1,488	1.14	74	5.24%
NW	1463	1.04	1,531	1.00	68	4.63%
WM	1111	1.04	1,137	1.05	26	2.35%
NGN	1567	0.89	1,608	0.90	40	2.56%
Sc	1105	0.95	1,102	1.01	-3	-0.24%
So	2525	0.98	2,512	1.04	-13	-0.50%
WWU	1542	1.00	1,587	1.01	45	2.91%
85th Percentile		0.95		1.00		

Cadent Total	**5827**		**6,149**		**321**	**5.52%**
Industry Total	**12566**		**12,958**		**391**	**3.11%**

Source: NERA analysis of Ofgem data.

Table 3.4: Modelled GD2 Allowances and Efficiency Scores Using OLS3, Before and After Corrections (GD2 allowances in 2018/19 £ million)

	Ofgem Draft Determination OLS1		**NERA OLS3 with Data Corrections**		**Difference**	
Network	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Allowed Cost (%)*
EoE	1839	1.10	1,977	1.00	138	7.52%
Lon	1414	1.17	1,465	1.14	52	3.66%
NW	1463	1.04	1,507	1.01	44	3.00%
WM	1111	1.04	1,126	1.04	15	1.36%
NGN	1567	0.89	1,582	0.91	14	0.92%
Sc	1105	0.95	1,106	0.98	1	0.12%
So	2525	0.98	2,501	1.03	-24	-0.95%
WWU	1542	1.00	1,562	1.01	19	1.26%
85th Percentile		0.95		0.98		
Cadent Total	**5827**		**6,076**		**249**	**4.27%**
Industry Total	**12566**		**12,827**		**260**	**2.07%**

Source: NERA analysis of Ofgem data.

3.2.2. Ofgem has made an error in its modelling of time trends

Ofgem's econometric model includes two time trend variables, separately identifying trend lines for the historical and forecast periods. Ofgem's historical time trend variable is defined as "counting" from 1 to 6 between 2014 and 2019 and is set to zero between 2020 and 2026. Its forecast time trend variable is defined as "counting" from 1 to 7 between 2020 and 2026 and is set to zero between 2014 and 2019.

Ofgem's results show that the coefficient on the forecast time trend is twice as large as the coefficient on the historical time trend, and in a number of places in its DD Ofgem suggests this shows that forecast costs are falling faster than historical costs.[63]

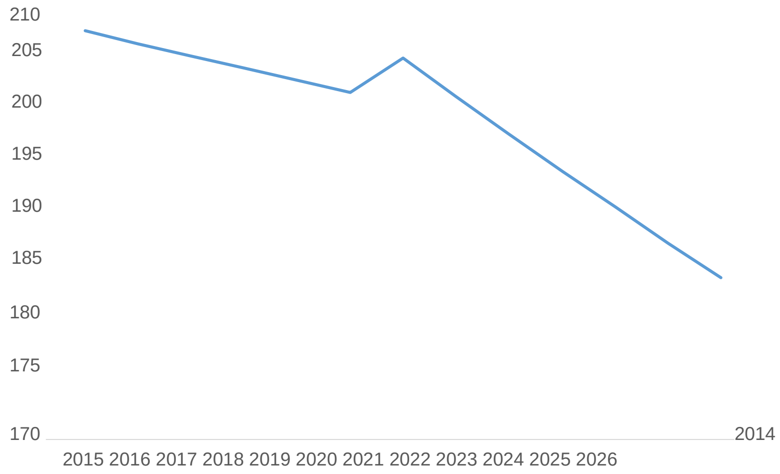
However, because of the way Ofgem has specified its time trend variables, i.e. starting from 1 from 2020 onwards, Ofgem effectively models two separate time trends from a common starting point, one from 2014 to 2019 and the other from 2020 to 2026, rather than allowing costs to decline at a faster rate only after 2020 in its functional form.

Ofgem's time trend variables therefore impose a particular functional form on the data. To illustrate the effect of this error, the regression coefficients in Ofgem's favoured OLS1 model would, for a hypothetical company with a flat CSV value of 1,000 in each year, show

[63] See for instance Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 14.

a counterintuitive jump in 2020, followed by a steep rate of decline over the GD2 period (as shown in Figure 3.1 below). In fact, because Ofgem enforces this type of functional form on the data, the model could not adopt a single time trend, even if a single time trend produced a better fit for the data.

Figure 3.1: Illustration of Modelled Costs Over Time from Ofgem's OLS1 Model (Assumes CSV=1000)



Source: NERA analysis of Ofgem data.

To correct this error, Ofgem would need to re-define its historical time trend such that it continues to count for the entire modelling period (including from 2020 to 2026, see Table 3.5below). This model specification would allow the forecast trend to be steeper (or flatter) than the historical trend but would not impose a jump on the assumed relationship (from 2019 to 2020).

Table 3.5: Correction to the Time Trend Variables

Year	14/ 15	15/ 16	16/ 17	17/ 18	18/ 19	19/ 20	20/ 21	21/ 22	22/ 23	23/ 24	24/ 25	25/ 26	26/ 27
Ofgem Time Variable for Historical Period	1	2	3	4	5	6	0	0	0	0	0	0	0
Ofgem Time Variable for Forecast Period	0	0	0	0	0	0	1	2	3	4	5	6	7
Corrected Time Variable for Historical	1	2	3	4	5	6	7	8	9	10	11	12	13
Corrected Time Variable for Forecast	0	0	0	0	0	0	1	2	3	4	5	6	7

Source: NERA analysis.

Re-estimating the OLS1 model using this alternative approach, we find the time trends are not statistically significant (see column (2) in Table 3.6 below), although they are jointly statistically significant. Therefore, there is in fact no evidence in the data that the time trend for the forecast period is different from the time trend for the historical period. In Column (3), we show the result of a model with a single time trend, which we find is statistically significant.

Table 3.6: Regression Coefficients for Time Trend Sensitivity Regressions

	OLS1 with Data Corrections	OLS1 with Corrected Time Trend	OLS 1 with Single Time Trend
	(1)	(2)	(3)
CSV Totex (Smoothed)	0.823***	0.825	0.825***
Historical Trend	-0.005		
Forecast trend	- 0.019	-0.007	
Time Trend		-0.007	-0.011***
Constant	-0.337	0.131	-0.326
Adjusted R-squared	0.902	0.901	0.901
RESET	FAIL	FAIL	FAIL
No. of observations	104	104	104

Source: NERA analysis of Ofgem data.
Note: These sensitivities use the corrected dataset described in Table 3.1 above.

As Table 3.7 shows, the effect of this correction is to decrease allowances for Cadent by around 0.17 per cent over the GD2 period, relative to the scenario shown in Section 3.2.1 in which we correct data errors in Ofgem's modelling.

Table 3.7: OLS1 Allowances Before and After Time Trend Correction (GD2 allowances in 2018/19 £ million)

	NERA Correction of Data in Ofgem's OLS1		Additional Effect of Correcting Time Trend		Difference	
Network	Allowed Cost (£m)	Efficiency Score	Allowed Cost (£m)	Efficiency Score	Allowed Cost (£m)	Allowed Cost (%)
EoE	1,988	1.01	1,986	0.98	-2	-0.09%
Lon	1,486	1.13	1,481	1.10	-5	-0.31%
NW	1,531	1.00	1,529	0.97	-3	-0.17%
WM	1,137	1.04	1,136	1.01	-1	-0.13%
NGN	1,607	0.90	1,607	0.87	-1	-0.05%
Sc	1,102	1.01	1,099	0.98	-3	-0.28%
So	2,511	1.04	2,507	1.01	-4	-0.14%
WWU	1,587	1.00	1,587	0.97	0	-0.01%
85th Percentile		1.00		0.97		

Cadent Total	**6,142**	**6,132**	**-10**	**-0.17%**
Total	**12,949**	**12,931**	**-18**	**-0.14%**

Source: NERA analysis of Ofgem data.
Note: These sensitivities use the corrected dataset described in Table 3.1 above.

3.2.3. Ofgem is inconsistent in its application of workload adjustments, leading to biased allowances

Ofgem applies 'workload adjustments' to both the costs and the drivers submitted by companies for the RIIO-GD2 period. These adjustments involve Ofgem removing the costs and workloads associated with programmes of work companies have proposed for the RIIOGD2 period that Ofgem has assessed to be inadequately justified. Ofgem disallows these expenditures and removes them from the forecast data before estimating the regression equations.[64] For instance, for a number of GDNs, Ofgem has removed elements of repex from both the repex component of totex and the repex synthetic workload driver.

In its draft determination document, Ofgem recognises that it should adjust both drivers and associated costs when it disallows workload, to ensure consistency:[65]

> "Where we have disallowed workloads, we have not included the volumes in the calculation of the synthetic cost driver and we have also removed the corresponding costs from company submitted totex, prior to running the regression."

However, in practice, while Ofgem uses workload-adjusted costs, it uses submitted (i.e. nonworkload adjusted) drivers in its regression analysis. Ofgem then uses workload adjusted drivers to calculate modelled costs in order to calculating the 85th percentile adjustment and to calculate allowances. The inconsistency between costs and driver data used to calibrate the regression represents an error in Ofgem's analysis:

[64] See for example Ofgem (9 July 2020), RIIO-2 Draft Determinations - Cadent, pp. 42-51.

[65] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 103.

- Because Ofgem's cost data excludes expenditure that is included in its workload drivers, Ofgem's regression equation will systematically underestimate the costs associated with delivering a given level of workload. By inconsistently regressing the (lower) workloadadjusted costs on the (higher) submitted drivers, Ofgem's regression will estimate lower coefficients. When these coefficients are used to predict modelled costs, Ofgem's biased model will tend to understate the costs of delivering any level of the understated drivers.
- Put differently, Ofgem has introduced measurement error in its explanatory variable through its inconsistent treatment of costs and driver data. Measurement error in the explanatory variable means that the coefficient on the CSV as estimated by Ofgem is subject to attenuation bias. With attenuation bias, the estimated coefficient will in expectation be closer to zero than the "real" coefficient that represents the true relationship between costs and the CSV. This creates in a downwards bias in the estimated coefficient, and accordingly an upwards bias in the constant term.[66]
- The consequence of this bias is to inflate the modelled costs of companies with a lower CSV (improving their efficiency scores) and reduce the modelled costs of companies with a higher CSV (worsening their efficiency scores). The company with the lowest CSV, therefore subject to the greatest negative bias in its efficiency score, is SGN Scotland. As Scotland sets the efficiency benchmark in Ofgem's model, measurement error that biases its efficiency score downwards results in a more stringent adjustments for all companies.

The inconsistency between the driver and cost data in Ofgem's model therefore biases allowances downwards across the industry, with a particularly detrimental effect on companies with a higher CSV.

In addition, when calculating allowances Ofgem also appears to make an error related to the regional adjustment it applies to the costs disallowed due to the workload adjustment. Mechanically, Ofgem reverses regional adjustments before it removes the costs it disallows due to the workload adjustments.[67] However, in doing so, Ofgem appears to overstate the workload adjustment that it removes from companies' allowed costs, since it adds the workload adjustment based on the difference between modelled and normalised submitted costs, rather than subtracting it.

Table 3.8 below shows the modelled costs resulting from running the regression using workload adjusted drivers and correcting for the error in Ofgem's treatment of disallowed workload when calculating allowances. Addressing these errors reduces Cadent's allowed costs by £21 million and reduces allowed costs across the industry by £30 million, when

[66] See for example, Wooldridge, Jeffrey M. (2002), Econometric Analysis of Cross Section and Panel Data, p. 74.

[67] Hence, Ofgem converts its workload adjustment based on normalised modelled costs into a workload adjustment based on region-specific costs. See sheet "Cal_Totex", row 32 and 33, in the "(8) PostAnalysis" file for each company.

compared to the modelling scenario in Section 3.2.2 in which we correct both the data in Ofgem's OLS1 model and the time trend.

Table 3.8: Modelled GD2 Allowances and Efficiency Scores Using Workload Adjusted Drivers

	NERA Correction of Data and Time Trend (OLS1)		Additional Effect of Correcting Workload Adjustments		Difference	
Network	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Allowed Costs (%)*
EoE	1986	0.98	1976	0.98	-10	-0.48%
Lon	1481	1.10	1468	1.09	-14	-0.93%
NW	1529	0.97	1528	0.97	0	-0.02%
WM	1136	1.01	1139	1.00	3	0.26%
NGN	1607	0.87	1605	0.87	-2	-0.10%
Sc	1099	0.98	1103	0.97	4	0.40%
So	2507	1.01	2497	1.01	-10	-0.41%
WWU	1587	0.97	1585	0.97	-2	-0.12%
85^{th} Percentile		0.97		0.97		
Cadent Total	**6132**		**6111**		**-21**	**-0.34%**
Industry Total	**12931**		**12901**		**-30**	**-0.23%**

Source: NERA Analysis of data received from Cadent.

3.2.4. The effect of correcting errors in the data, the time trend variable and workload adjustments

Table 3.9 shows that the effect of correcting all the errors identified above in sections 3.2.1, 3.2.2 and 3.2.3 increase allowances for Cadent by £284 million (or 4.87 per cent of totex) and across the industry by £334 million (or 2.66 per cent).

Table 3.9: Modelled GD2 Allowances and Efficiency Scores Using Workload Adjusted Drivers

	Ofgem Draft Determination (OLS1)		Ofgem DD with All Corrections Applied		Difference	
Network	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Efficiency Score*	*Allowed Costs (£m)*	*Allowed Costs (%)*
EoE	1839	1.10	1976	0.99	137	7.47%
Lon	1414	1.17	1468	1.09	54	3.83%
NW	1463	1.04	1528	0.97	65	4.45%
WM	1111	1.04	1139	1.00	27	2.45%
NGN	1567	0.89	1605	0.87	37	2.39%
Sc	1105	0.95	1103	0.97	-2	-0.15%
So	2525	0.98	2497	1.01	-28	-1.11%
WWU	1542	1.00	1585	0.97	43	2.76%

85th Percentile		0.95		0.97		
Cadent Total	**5827**		**6111**		**284**	**4.87%**
Industry Total	**12566**		**12901**		**334**	**2.66%**

Source: NERA Analysis of data received from Cadent.

3.3. Mis-specification of Ofgem's Model

3.3.1. Ofgem's model fails the RESET test, an important test for model misspecification

Ofgem's chosen model (OLS1) fails the Ramsey RESET test for model specification. As a result, the coefficient estimates it obtains from its chosen models and its estimated efficiency gaps are likely to be biased.[68]

The RESET test involves re-running the original model to generate fitted values, then running a second version of the same model that includes squared and cubed fitted values as explanatory variables in the regressions. If the coefficients on these explanatory variables are found to be statistically significant, the model fails the Ramsey RESET test for model specification.

As Ofgem explains, the RESET test assesses "whether there are any omitted non-linearities in the model. If this test fails, it might be appropriate to test a different model specification (eg inclusion of a quadratic term in case of univariate regression or a translog specification)".[69] Ofgem's academic advisor, Professor Andrew Smith, also suggests that, if a model fails the RESET test, Ofgem should consider an alternative functional form, specifically a translog specification, which captures non-linearities and interaction terms between variables (in contrast with the Cobb-Douglas, log-log model Ofgem uses in its preferred specification).[70]

3.3.2. Ofgem's consideration of alternative models due to OLS1 failing the RESET test does not address this evidence of mis-specification

While failure of the RESET test does not provide the practitioner with any particular alternative model, standard econometric textbooks explain that failure of the RESET test means alternative functional forms may be more appropriate, e.g. adding different drivers, adding non-linear terms, and making different returns to scale assumptions.[71]

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[68] We find that Ofgem's chosen model specifications continue to fail the RESET test after correcting for errors in Ofgem's cost and driver data (see Section 3.2).

[69] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 15.

[70] Prof Andrew Smith (June 2019), Note for Ofgem on the computation of CSV weights, p. 9.

[71] The Ramsey RESET test is specified in Ramsey (1969), Tests for Specification Errors in Classical Linear Least Squares

Hence, as Ofgem and Professor Smith prescribe, Ofgem has estimated sensitivities that include quadratic terms. However, it then dismisses this quadratic model on grounds that:[72]

> "The signs of the coefficients are reasonable from an economic perspective (positive for the logarithm of totex CSV and negative for its square), indicating a U-shaped relationship between totex and totex CSV (ie at first totex increase with the driver, then they decrease). However, coefficients are not all statistically significant and model fit does not improve substantially compared to our main model. Moreover, we obtained similar results to OLS3 when we estimated a translog functional form to check for additional non-linearities in the model. Thus, we didn't have strong reasons to discard the selected model OLS1 based on the RESET test results."

Hence, Ofgem concludes the OLS3 model including the quadratic term is no more reliable than OLS1. Indeed, we find that Ofgem's OLS3 model also fails the RESET test.

Professor Smith suggests, that "beyond [testing a translog model], it is not clear what else can reasonably be done if a model fails a RESET test and having tested the translog form it would seem overly cautious to reject simply based on the RESET test alone".[73]

However, this statement should not lead Ofgem simply to accept the results of a demonstrably deficient model:

- The RESET test is designed to detect that the assumed model specification is wrong. If the model specification is wrong, the estimated coefficients will be biased, and the cost forecasts for individual companies inaccurate. It does not necessarily seem "overly cautious" to reject a model for which there is objective evidence of bias in the resulting allowances provided to regulated companies.
- Professor Smith is also incorrect to say "it is not clear what else can reasonably be done" in these circumstances. As Ofgem's candidate models fail the RESET test, Ofgem could have considered alternative approaches or drivers,[74] and if these also fail to yield a credible model, it should consider the failure of this important test when evaluating the limited reliability of the model and how much weight it places on it when setting allowances.

The regulatory process should not simply place full weight on one econometric model which is demonstrably unreliable, simply because Ofgem has neglected to identify alternative, potentially more reliable approaches to modelling GDNs' costs. As we discuss in Section

Analysis, Journal of the Royal Statistical Association, Series B, 71, 350–371 and summarised by Wooldridge, Jeffrey M. (2013), Introductory Econometrics, A Modern Approach – RESET as a General Test for Functional Form Misspecifcation, Fifth Edition, p.306.

[72] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 16.

[73] Prof Andrew Smith (June 2019), Note for Ofgem on the computation of CSV weights, p. 9.

[74] While the RESET test is not a general test for omitted variables, one possible explanation for the failure of the RESET is that the model does suffer from omitted factors, and other drivers would lead to a more robust model specification.

4.2.4, Ofgem's proposed approach to set an 85th percentile efficiency standard places significant reliance on a model which the RESET test shows to be unreliable.

3.3.3. Ofgem's dismissal of the RESET test contradicts regulatory precedent

Ofgem's dismissal of the RESET test contradicts its own use of the test at recent price reviews (as well recent Ofwat price reviews). At RIIO-ED1, Ofgem explained that "some […] tests are more critical than others, particularly the Ramsey RESET test because it is directly relevant in assessing the validity of a given model specification".[75] Therefore, in evaluating the outcomes of the statistical tests during the ED1 process Ofgem "re-specified models when the RESET test failed… reviewed the functional form of the model and tested different drivers".[76] In its Final Determination for RIIO-ED1 Ofgem re-stated that the "key statistical tests are the RESET and the pooling test".[77]

Ofgem has a limited ability to try alternative functional forms using the same drivers, given its use of a CSV and the small number of companies. However, a more balanced approach would have been to consider the results from a range of models when setting allowances. This approach would have recognised the inherent limitations of relying on any one model, especially when statistical tests show that one model to be mis-specified.

3.4. Ofgem's Use of a Composite Scale Variable

3.4.1. The CSV combines a number of drivers into an index using predetermined weights

As described above, Ofgem's favoured OLS1 regression model controls for two time variables, a constant (i.e. the intercept), and a CSV. Since the time trend variable is the same for each company in any given year, the CSV is the only variable with which Ofgem attempts to explain variation in costs from company-to-company.

As Ofgem explains, a CSV includes many different drivers within a single explanatory variable, thus preserving degrees of freedom for the regression model: [78]

> "In presence of limited sample size, the inclusion of a relatively high number of drivers in the model specification is normally not considered appropriate. However, missing out

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[75] Ofgem (30 July 2014), RIIO-ED1: Draft determinations for the slow-track electricity distribution companies Business plan expenditure assessment Supplementary annex to RIIO-ED1overview paper, para.A.3.4.

[76] Ofgem (30 July 2014), RIIO-ED1: Draft determinations for the slow-track electricity distribution companies Business plan expenditure assessment Supplementary annex to RIIO-ED1overview paper, para.A.3.3.

[77] Ofgem (28 November 2014), RIIO-ED1: Final determinations for the slow-track electricity distribution companies - Business plan expenditure assessment, para. A3.24.

[78] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 7.

relevant drivers of costs might limit the explanatory power of the model itself. A way to conveniently address this issue is to use a composite scale variable (CSV)".

Ofgem defines its CSV as the weighted average of a number of different drivers, as follows:

$$CSV = (Driver_1)^\wedge(Weight_1)* (Driver_2)^\wedge(Weight_2)*\ldots* (Driver_n)^\wedge(Weight_n)$$

Or in logarithmic form:

$$Log(CSV)=Weight_1*Log(Driver_1)+ Weight_2*Log(Driver_2)+\ldots+ Weight_n*Log(Driver_n)$$

3.4.2. Ofgem's disaggregated modelling suggests that its assumptions about the variables that drive costs within the CSV are incorrect

Ofgem calculates the CSV weights set out in Table 3.10 below based on companies' expenditure on different activities (i.e. the share of different cost categories in totex) and assumptions about which drivers explain which categories of costs. For instance, Ofgem assumes that maintenance activities are driven by the subset of Modern Equivalent Asset Value (MEAV) including above-ground assets (the "Maintenance MEAV").[79]

Table 3.10: The Components of Ofgem's CSV and Their Weight

Totex CSV component	Weight	Cost activities
Emergency CSV	0.05	Emergency
Maintenance MEAV	0.08	Maintenance
Total external condition report	0.06	Repairs
Repex synthetic cost	0.39	Repex
Mains reinforcement synthetic cost	0.02	Mains reinforcement
Connections synthetic cost	0.06	Connections
MEAV	0.34	Work Management, Business Support, Other Direct Activities, Training and Apprentices, Other Capex

Source: Ofgem, RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 8.
Note: The Emergency CSV is a CSV of customer numbers (with a weight of 80%) and total external condition reports (with a weight of 20%).

However, these relationships between specific cost categories and drivers that inform Ofgem's CSV are just assumptions imposed by Ofgem and are not supported by evidence. The only way in which Ofgem has tested its assumptions is through its disaggregated ("bottom-up") modelling. However, Ofgem dismissed these bottom-up models in its DD because it has found that "some of the bottom-up models' fit wasn't satisfactory" and because it had concerns "over the statistical robustness of some of the models".[80]

We have estimated "log-log" regression models for each category of cost listed in Table 3.10 using the driver Ofgem assumes explains each category of costs as a regressor. Table 3.11

[79] Ofgem, RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 7-9.
[80] Ofgem, RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 5.

below shows the detailed regression results, which are run after applying the data corrections listed in Section 3.2.1. We find that:

- All of the models show evidence of mis-specification due to the failure of the RESET test;
- As Ofgem also acknowledges, some of the models have a relatively low R-squared, suggesting that Ofgem's drivers do not explain much of the variation in expenditure in the given cost categories. In particular, Ofgem's models for reinforcement has an adjusted Rsquared of 57 per cent.
- Ofgem does not demonstrate that MEAV is an appropriate driver for the residual cost categories in totex, for example, 'other capex' which accounts for 36 per cent of costs. Ofgem does not report a bottom-up model for these costs explained by MEAV, but replicating Ofgem's approach in other cost categories, we find MEAV explains only 51 per cent of the variation in companies' costs.

Table 3.11: NERA Replication of Ofgem's Disaggregated Models (Using Corrected Data)

	Disaggregated Modelling Regression Results						
	1	*2*	*3*	*4*	*5*	*6*	*7*
Dependent Variable	Repex	Reinforcement	Conn-ections	Emergency	Repairs	Maintenance	Residual Costs
Constant	0.7623705	0.2108848	1.258425	-10.69061	-4.46417	-5.326976	-1.990718
Historical Trend							
Forecast Trend							
Repex Synthetic	0.829***						
Capex Synthetic - Mains		0.616***					
Capex Synthetic - Connections			0.619***				
CSV Emergency				0.956***			
Total External Conditions					0.734***		
Maintenance MEAV						0.978***	
MEAV							0.659***

Adjusted R squared	0.803	0.573	0.900	0.747	0.776	0.720	0.511
RESET	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
No. of Observations	104	104	104	104	104	104	104

Source: NERA analysis of Ofgem data.

Ofgem's own finding of the lack of robustness of its bottom-up models and our analysis of Ofgem's models using corrected data suggests that many of Ofgem's assumptions on the drivers that explain certain cost categories may be incorrect. Hence, Ofgem's CSV variable is not reliable either, because it relies on assumptions about the relationships between costs and drivers that the disaggregated modelling cannot support.

3.4.3. Ofgem imposes pre-determined weights on composite drivers based on industry spend proportions

As explained above, Ofgem defines its CSV weights based on industry spend proportions for the disaggregated cost activities which it assumes each driver explains. Ofgem argues that this approach to weights is "intuitive and able to take into account the relative importance of each cost driver based on knowledge of GDNs' costs".[81] However, if Ofgem were able to control for the individual drivers included in the CSV as separate regressors, it would allow

[81] Ofgem (9 July 2020), RIIO-GD2: Step-By-Step Guide To Cost Assessment, p.8.

the model itself to 'identify' the appropriate weight for each driver, rather than imposing weights without any statistical evidence that the correct weights have been selected.

Ofgem's academic advisor (Professor Andrew Smith) suggests an alternative approach to defining a CSV, by allowing the weights of the components of the CSV to be estimated directly using an econometric model, thus allowing "the data [to] reveal the underlying cost impacts of the different activities included within the CSV composite variables.".[82]

Professor Smith explains that Ofgem's approach places restrictions on the relative elasticities of individual drivers (which may not hold). For instance, Ofgem's CSV assumes that a 1 per cent increase in the external condition reports driver has the exact same impact on costs as a 1 per cent change in the connections synthetic costs driver, because both drivers have the same weight in Ofgem's CSV. This, and the relationships assumed between the relative elasticities of the other components of the CSV imposed by the weights assigned by Ofgem, may or may not hold in practice.

According to Professor Smith, a model which uses econometric weights (an 'unrestricted model') allows the regression to "reveal" the "underlying relative marginal cost of the different outputs/activities" according to the coefficient on individual drivers; whereas Ofgem's 'restricted model' forces the weights of each driver to equal the relative unit (or average) cost for that output/activity.[83]

Professor Smith concludes:[84]

> "Therefore the use of a single CSV measure in the Totex cost model is overly restrictive because the relative elasticities are based on the relative unit (average) costs of the two outputs, rather than the relative marginal costs, which may well be different (or at least, the model should permit the possibility that they are different)."

3.4.4. Ofgem found it could not estimate weights on drivers using econometric models

The restriction imposed by Ofgem's approach can be tested statistically by estimating weights directly using an econometric model and comparing these weights to those assumed by Ofgem. Professor Smith explains that: [50]

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[82] Prof Andrew Smith (January 2020), Note for Ofgem on the computation of CSV weights, p. 6.

[83] Prof Andrew Smith (January 2020), Note for Ofgem on the computation of CSV weights, pp. 2-3.

[84] Prof Andrew Smith (January 2020), Note for Ofgem on the computation of CSV weights, p. 3. [50]

Prof Andrew Smith (January 2020), Note for Ofgem on the computation of CSV weights,

p. 4.

> "If this restriction is rejected, it could imply that a less restrictive model ought to be considered. In other words, such an outcome might suggest that the industry cost share weights used are not appropriate and that an unrestricted model, including all the components of the CSV separately, would let the data speak about the relationship between costs and the components (thus revealing effectively a different set of weights). That said, including all of the components of the CSV directly in the model in an unrestricted way might lead to problems of multi-collinearity, and produce elasticities on the individual components that are considered implausible or hard to interpret. It is important not to overplay this latter problem, however, as it is a standard problem / trade-off in all cost modelling work".

As a robustness check of its analysis, Ofgem has estimated weights using "an econometric method", and found these to produce very different and likely counterintuitive weights than the industry spend proportions that it has used in the DD (see Table 3.12 below). For instance, the econometric approach found a weight of 43 per cent for the emergency CSV (despite emergency costs accounting for only 5 per cent of regressed totex), and negative weights for MEAV, external condition reports and connections synthetic costs. Ofgem states that it found similarly implausible results after removing drivers which were closely correlated with MEAV (Emergency CSV and Maintenance MEAV).[85]

Table 3.12: CSV Weights Based on Industry Spend and Econometric Method

Totex CSV component	Weights based on industry spend	Weights based on econometric method (Ofgem estimate)
Emergency CSV	0.05	0.43
Maintenance MEAV	0.08	0.13
Total external condition report	0.06	-0.19
Repex synthetic cost	0.39	0.09
Mains reinforcement synthetic cost	0.02	0.02
Connections synthetic cost	0.06	-0.04
MEAV	0.34	-0.26

Source: Ofgem, RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 19.

In its DD, Ofgem does not explain the implications of its findings in this sensitivity; but appears to conclude that this finding supports the use of weights based on industry spend.[86]

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[85] Source: Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p 18. Note: Ofgem does not describe its econometric method for calculating the CSV weights in Table 3.12 in any detail. However, we assume it used the method advocated by Professor Smith and which was used at RIIO-ED1, i.e. running the totex model with the CSV components as separate (logged) drivers, and basing the weights on the coefficients of each driver.

[86] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 18-19.

3.4.5. Scaling drivers based on the elasticities estimated in the disaggregated modelling would improve robustness

As described above, Ofgem was unable to identify plausible weights for individual components of the CSV using an econometric model. However, as an alternative, Ofgem could improve its CSV by drawing on the elasticities estimated in its disaggregated modelling.

The rationale for this is that, even if Ofgem has selected appropriate cost drivers for each disaggregated category of expenditure, it is likely that efficient costs in each cost category have different ratios of fixed and variable costs. In some cases, the elasticity (i.e. the slope coefficient in a log-log regression) could be close to zero for a disaggregated cost category, suggesting costs are largely invariant to changes in the driver, whereas in other cost categories the elasticity could be higher.

Placing all drivers in the CSV and weighting only by expenditure share therefore masks such differences across cost categories. An alternative would be to recalculate the CSV from the following:

$$\text{Ln (CSV)} = \text{Share}_1 \text{ x Ln (Driver}_1) + \text{Share}_2 \text{ x Ln (Driver}_2) + \ldots$$

To the following alternative, where the "b" terms emerge from a regression of costs in each category on the driver Ofgem assumes it explains:

$$\text{Ln (CSV)} = b_1 \text{ x Share}_1 \text{ x Ln (Driver}_1) + b_2 \text{ x Share}_2 \text{ x Ln (Driver}_2) + \ldots$$

$$\text{Ln (Driver}_1) = a_1 + b_1 \text{ x Ln (Driver}_1)$$

$$\text{Ln (Driver}_2) = a_2 + b_2 \text{ x Ln (Driver}_2)\ldots$$

We have re-estimated Ofgem's OLS1 model using this new CSV, with the weight on each driver normalised such that all weights add up to 1. As Table 3.13 shows, these results produce slightly higher allowances for the four Cadent GDNs (by 0.5 per cent), while producing similar allowed costs for the industry as a whole, when compared to Ofgem's corrected DD model).

Table 3.13: Efficiency Scores and Allowances using Elasticity Weighted CSV

	Ofgem DD with All Corrections Applied		Ofgem DD with All Corrections Applied & Elasticity Weighted CSV		Difference	
Network	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Allowed Costs (%)
EoE	1976	0.98	1988	1.01	12	0.61%
Lon	1468	1.09	1486	1.12	18	1.23%
NW	1528	0.97	1531	0.99	3	0.19%

WM	1139	1.00	1137	1.03	-1	-0.13%
NGN	1605	0.87	1595	0.90	-10	-0.62%
Sc	1103	0.97	1092	1.01	-11	-0.95%
So	2497	1.01	2502	1.04	4	0.18%
WWU	1585	0.97	1576	1.01	-8	-0.52%
85^{th} Percentile		0.97		0.99		
Cadent Total	**6111**		**6143**		**32**	**0.52%**
Industry Total	**12901**		**12908**		**7**	**0.06%**

Source: NERA analysis of Ofgem data.

3.4.6. Ofgem's results are distorted by using common, industry-wide weights in the CSV

As we described in Section 3.4.2, by basing weights on industry average spend, Ofgem imposes assumptions about the relative elasticities of different activities and their cost drivers. In doing so, Ofgem imposes an assumption about the efficient mix of activities across all companies.

However, in practice, companies have different mixes of activities for reasons beyond their control.[87] Put differently, the efficient mix of activities for a given company depends on exogenous factors, such as historical network design, environmental conditions, and customer based requirements, which all vary from company to company.

Given Ofgem's approach to comparing companies' costs using a CSV with industry average weights, differences in the mix of activities conducted across companies (even if they imply the same level of totex) may result in changes in companies' apparent efficiency.

We have constructed a simplified simulation to illustrate the effect of using industryweighted rather than company-weighted CSV on GDNs' modelled costs. We have simulated 50 fictitious GDNs with three cost drivers. Each driver for each GDN is drawn from a uniform distribution between 100 and 200. We assume that each GDN's costs in each category is equal the driver for that category.[88] The GDNs' totex is the sum of drivers across all categories.

[87] If the workloads included in Ofgem's CSV were under companies' control, Ofgem's regression modelling would suffer from endogeneity, meaning that the drivers it has selected to control for companies' cost conditions are in fact operational decisions made by companies. This flaw would mean its regression model would have no ability to assess companies' efficiency, as it would control for decisions taken by companies that may or may not be efficient.

[88] That is, we assume a cost function in which Cost per Category = $\alpha + \beta$ x Driver per Category, setting α equal to 0 and β equal to 1.

Given the assumed one-for-one relationship between costs and drivers, all companies in our simulation are equally efficient. Any variation in estimated efficiency results from modelling errors and inaccuracies.

We derive modelled costs for the 50 simulated GDNs using Ofgem's RIIO-GD2 methodology, which involves regressing the natural logarithm of costs on the natural logarithm of the CSV.[89] However, we use two alternative approaches to weighting drivers when constructing each company's CSVs:

- We construct one CSV by weighting each driver according to the total share of industry costs corresponding to that driver; and
- We construct the second CSV by weighting each driver according to the share of the company's costs corresponding to that driver.

We then calculate modelled costs for each company based on the regression coefficients for both the industry-weighted and company-weighted CSVs.[90]

Our simulation shows that using an industry-weighted CSV shows companies with spend proportions close to the industry average to be relatively efficient (see Figure 3.2), whereas companies with spend proportions very different from the average appear less efficient.

- Each data point on the scatter plot represents one of the 50 simulated GDNs.
- The vertical axis shows the difference in modelled costs using industry weights vs. company weights.
- The horizontal axis shows the absolute value[91] of the difference between industry spend in a cost category and the GDN's spend on that category, summed across all three categories. Higher numbers indicate that the GDN's expenditure proportions differ more from the industry average.

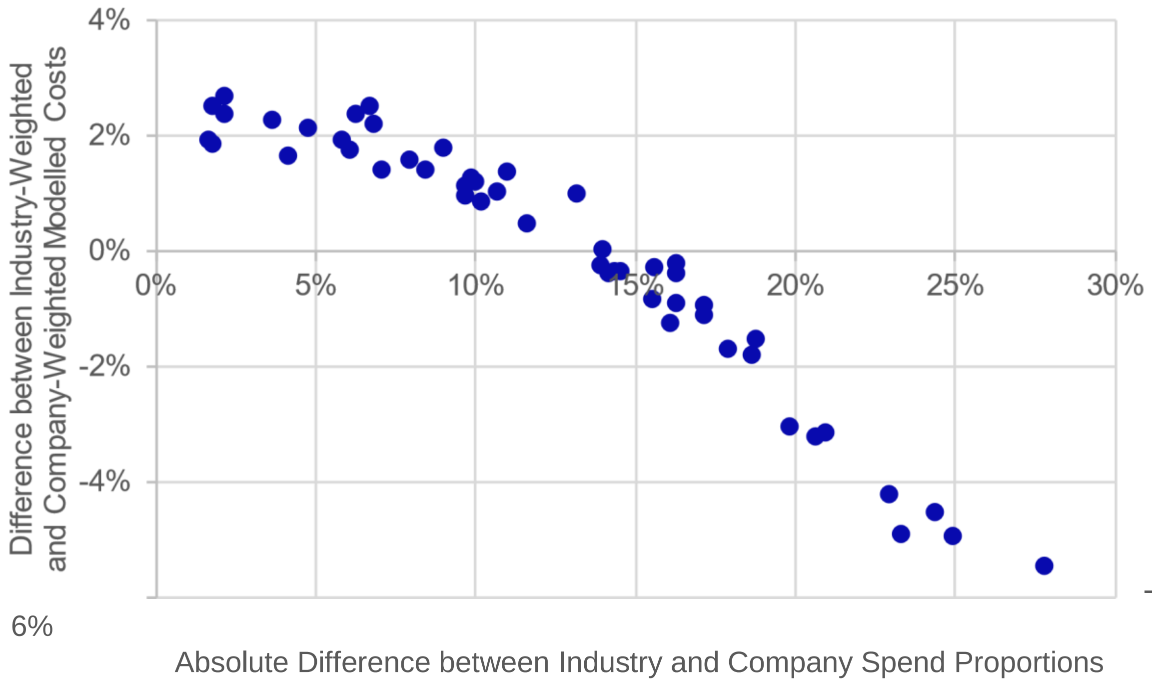
The companies with higher modelled costs under the industry weights approach (i.e. in the top left of the chart) appear more efficient using this approach to weighting the CSV, while companies in the bottom left appear less efficient. However, any such differences are entirely artificial. In our example, the simulated GDNs' costs are (by construction) equally efficient. The only difference between them relates to differences in workload proportions, which we assume result from uncontrollable factors.

[89] As our simulation does not contain several periods, this is the same specification Ofgem uses in its chosen OLS1 specification.

[90] Modelled costs in our simulation do not contain an alpha correction factor.

[91] The approach of taking the absolute value of differences is intended to treat negative differences and positive differences equivalently.

Figure 3.2: Difference in Modelled Cost by Deviations from Industry Spend Proportions



Source: NERA simulation.

The clear negative relationship shown in Figure 3.2 shows that using an industry-weighted CSV disadvantages companies with atypical proportions of spend on each category relative to a company-weighted CSV. This reduction in modelled costs does not capture inefficiency among companies with cost proportions differing from the industry average. Instead, the penalty is an artifice of using an industry-weighted CSV.

3.4.7. Ofgem's data shows the use of industry weights in its CSV is a material determinant of companies' efficiency scores

Table 3.14 below shows the variation in companies' expenditure shares in each of the categories of cost considered in Ofgem's CSV. Given these differences between companies, the illustrative example demonstrated above in Section 3.4.6 shows that Ofgem's use of industry weights may distort companies' efficiency scores.

Table 3.14: Activity Weights by Company (percentage)

Cost Activity	*Industry*	EoE	Lon	NW	WM	NGN	Sc	So	WWU
Repex Synthetic	*39*	36	39	41	39	40	36	46	34
Capex Synthetic - Mains	*2*	2	1	1	1	2	2	2	2
Capex Synthetic – Connections	*6*	5	3	4	4	7	9	7	9
CSV Emergency	*5*	5	6	5	5	5	4	5	5
Total External Conditions	*6*	5	7	6	6	7	4	5	4

Maintenance MEAV	*8*	12	7	7	7	7	8	7	9
MEAV	*34*	35	37	34	39	33	37	28	36

Source: NERA analysis of Ofgem data.

An alternative approach that addresses this problem, which Ofgem has not considered, would be to weight together drivers within the CSV based on companies' own shares of expenditure in each category, i.e. using different weights for different companies.

We have therefore re-run Ofgem's model using each company's own weights over the full modelling period from Table 3.14 above. As Table 3.15 shows, this model has superior statistical properties to Ofgem's preferred model (using the corrected data), in the sense that it passes the RESET test. However, the model with industry weights has a lower R-squared.

Table 3.15: Regression Results using Company-Specific Weights

	Industry & Elasticity Weights	**Company-& Elasticity weights**
Totex CSV Smoothed	0.829***	0.671***
Forecast Trend	-0.005	-0.002
Time Trend	-0.019	-0.005
Constant	-0.539	0.585
R-squared	0.911	0.597
RESET	Fail	Pass

Source: NERA analysis of Ofgem data.

This modelling approach also suggests markedly different allowances and efficiency gaps, when compared to Ofgem's modelling, as Table 3.16 and Table 3.17 show (respectively, with and without the application of elasticities within the CSV, as discussed in Section 3.4.5).

Table 3.16: Efficiency Scores and Allowances using Company-Specific Weights

	Ofgem DD with All Corrections Applied		**Ofgem DD with All Corrections Applied & Company-Specific Weights**		**Difference**	
Network	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Allowed Costs (%)
EoE	1976	0.98	1866	0.96	-111	-5.60%
Lon	1468	1.09	1565	0.87	98	6.66%
NW	1528	0.97	1517	0.88	-11	-0.72%
WM	1139	1.00	1179	0.85	40	3.55%
NGN	1605	0.87	1423	0.95	-182	-11.33%
Sc	1103	0.97	1028	0.97	-75	-6.76%
So	2497	1.01	1969	1.42	-528	-21.16%

WWU	1585	0.97	1429	1.03	-156	-9.83%
85th Percentile		0.97		0.87		
Cadent Total	**6111**		**6128**		**17**	**0.27%**
Industry Total	**12901**		**11977**		**-924**	**-7.16%**

Source: NERA analysis of Ofgem data.

Table 3.17: Efficiency Scores and Allowances using Company-specific Weights, with CSV Weights Scaled by Elasticities

	Ofgem DD with All Corrections Applied		Ofgem DD with All Corrections Applied with Elasticities & Company-Specific Weights		Difference	
Network	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Allowed Costs (%)
EoE	1976	0.98	1924	0.94	-52	-2.64%
Lon	1468	1.09	1568	0.89	101	6.87%
NW	1528	0.97	1523	0.89	-6	-0.38%
WM	1139	1.00	1176	0.87	38	3.32%
NGN	1605	0.87	1438	0.96	-166	-10.37%
Sc	1103	0.97	1041	0.97	-62	-5.60%
So	2497	1.01	1992	1.42	-505	-20.22%
WWU	1585	0.97	1478	1.00	-106	-6.72%
85th Percentile		0.97		0.89		
Cadent Total	**6111**		**6192**		**81**	**1.32%**
Industry Total	**12901**		**12141**		**-759**	**-5.88%**

Source: NERA analysis of Ofgem data.

Using company weights advantages some companies while disadvantaging others that happen to have a mix of workload different from the industry average. Modelled costs for London, Southern and NGN seem particularly sensitive to this modelling choice. These differences between Ofgem's approach and this alternative approach arise because some companies have workloads very different from the industry mean, making Ofgem's CSV inappropriate in some cases. The differences are entirely unrelated to GDNs' efficiency.

While there is wide variation in results across these two methods for constructing a CSV (as Table 3.16 and Table 3.17 show), there is no definitive case that one is more reliable than the other. We would therefore recommend computing the modelled costs implied by both methods, selecting the maximum of modelled costs for each GDN under the two approaches, and then applying an efficiency target to this alternative definition of modelled costs. This approach prevents the allowances GD2 costs for a particular GDN being biased downwards by arbitrary choices in the construction of the CSV.

Applying this alternative approach to setting allowances results in the allowances shown below in Table 3.18.

The tables show that, despite calculating allowances based on "maximum" approach across two methods, which would on the face of it seem to set more generous allowances for companies, in fact this approach reduces industry allowances by £410m, although increasing Cadent's modelled allowances by £17m (0.3 per cent).

Because the "maximum" calculation takes place before setting the cost target for the industry at the 85th percentile, there is not necessarily any gain for the industry. The only effect is to reduce reliance on downwardly biased estimates of modelled costs from modelling approaches that disadvantage particular GDNs.

This approach of combining results from different models would also bring Ofgem's DD more into line with regulatory precedent, which is to rely on results from a range of different methods:

- Ofgem's decision to rely on a single model to explain 84 per cent of costs is unusual amongst recent regulatory precedent. UK energy and water regulators tend to rely on the 'triangulated' result of a number of models.
- For instance, at RIIO-ED1 and GD1, Ofgem relied on a mix of top-down and disaggregated models. At PR19 Ofwat used a mix of different regression models considering different levels of aggregated of cost, which reflected guidance from the CMA following the 2014 Bristol Water reference.

Table 3.18: Efficiency Scores and Allowances using Max of Modelled Costs from Regressions Using Company-Specific and Industry Weights

	Ofgem DD with All Corrections Applied		Allowances Based on Max of Modelled Cost Predicted by Industry / Company Weights		Difference	
Network	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Allowed Costs (%)
EoE	1976	0.98	1904	0.94	-72	-3.64%
Lon	1468	1.09	1551	0.89	84	5.69%
NW	1528	0.97	1508	0.89	-21	-1.35%
WM	1139	1.00	1164	0.87	26	2.25%
NGN	1605	0.87	1501	0.88	-104	-6.45%
Sc	1103	0.97	1029	0.98	-74	-6.71%
So	2497	1.01	2348	1.01	-149	-5.98%
WWU	1585	0.97	1484	0.98	-100	-6.32%
85th Percentile		0.97		0.88		
Cadent Total	**6111**		**6128**		**17**	**0.27%**
Industry Total	**12901**		**12490**		**-410**	**-3.18%**

Source: NERA analysis of Ofgem data.

3.5. Ofgem's Approach to Controlling for Difference in Operating Environment

MEAV and 'synthetic cost' variables make up over 80 per cent of Ofgem's totex CSV. Ofgem calculates MEAV and synthetic costs in similar ways, multiplying unit replacement costs for a particular asset by the number of assets, and summing up across assets. MEAV represents a stock variable, i.e. the sum of the replacement cost of all assets on the network in any year, whereas Ofgem's synthetic cost variables multiply the assumed unit cost of replacing/installing assets by the number of assets replaced/installed in any year.

3.5.1. The CSV drivers make no attempt to explain variation in GDNs' unit costs due to environmental factors or outputs delivered

Across the industry, the MEAV and synthetic costs variable is based on the same unit cost value for all assets of the same type. As such, Ofgem assumes that all differences in costs are caused by the asset-by-asset composition of companies' network stock (for MEAV) and workload (for synthetic costs). This approach may introduce bias and inaccuracy into modelled costs, where external factors affect companies' unit costs of delivering defined levels of workload.

First, it is widely accepted that there are efficient differences in unit cost for different companies. For instance, Ofgem controls for these to some extent using regional wage factors and its urbanity and sparsity adjustments. However, the econometric model itself makes no attempt to control for differences in companies' unit costs of operation, or the fact that different companies may need to incur higher levels of expenditure in some areas because of the nature of their operating environment. We discuss this failing further in Section 3.5.2, and examine a sensitivity in which we include a density driver in the regression in place of the urbanity and sparsity adjustments.

Secondly, there are efficient reasons which may lead a company to carry-out work on highcost assets rather than cheap assets of the same class. This may bias results if some companies make more efficient choices than others. For example, two companies could have the same repex workload (and therefore the same repex synthetic cost), but the efficient company replaces expensive mains in a city centre which have a high risk of failure, whereas the inefficient company replaces low-risk mains in the countryside that are cheap to replace.

Ofgem's models also make no attempt to control for differences in the outputs delivered to customers. The exclusion of shrinkage gas costs from Ofgem's totex model is a particular example of this problem, which we discuss further in Section 4.1.1 below.

3.5.2. Ofgem does not consider models which control for regional differences using econometric methods

Ofgem attempts to explain differences in companies' operating conditions using three types of pre-modeling normalisations: "Sparsity Adjustments", "Urbanity Adjustments" and an

"Urbanity Productivity" uplift. Ofgem also makes a pre-modelling adjustment to control for regional variation in labour costs.

Despite applying normalisations to London's costs to account for regional specific factors, Ofgem finds a 17 per cent gap to modelled costs, far larger in magnitude than the second largest gap (of 11 per cent for NGN). Ofgem also finds a far larger gap for the London network than other Cadent networks, which is surprising given we would expect each group to follow similar management practices across its regions. These results therefore suggest that Ofgem's pre-modeling adjustments may not adequately capture Cadent London's regional factors in full.

We have therefore tested models which calculate the effect of sparsity and urbanity within model by controlling for density (measured as customers per length of network) as a cost driver. In the table below, we report the results of a simple model controlling for density and density squared, alongside Ofgem's totex CSV.

For these models we have 'turned off' Ofgem's pre-modelling sparsity and urbanity adjustments, allowing the regression procedure to control for these effects by comparing the differences in density across the more rural and urban GDNs to the density indices. We include both density and density squared variables to control for possible non-linearity in the relationship between costs and density.

This model produces credible regression results, including intuitive coefficients (with reasonable magnitude) and a high adjusted R-squared value (0.97), as shown in Table 3.19.

Table 3.19: Regression Results for Alternative Model Including Density as a Driver (No Regional Factors for Sparsity / Density)

	Error Corrected DD Model	**Error Corrected DD Model with Density Drivers**
Constant	-0.224	-16.444***
CSV Totex Smoothed	0.808***	0.837***
Forecast Trend	0.0002	0.001
Time Trend	-0.007	-0.008
Density (Customers / Network Length)		6.567***
Density ^2		-0.665***
Adjusted R squared	0.904	0.979
RESET	FAIL	FAIL
No. of Observations	104	104

Source: NERA analysis of Ofgem data.

As Table 3.20 shows, these results increase London's modelled allowances over GD2 by £131 million, and move London from eighth ranked in terms of efficiency to first. These results suggest Ofgem has materially understated the effect of London-specific effects on

Cadent's costs. Hence, while London appears to be an outlier in Ofgem's modelling, including density seems to resolve this issue, suggesting this sensitivity is a more reliable guide to assessing London's costs that Ofgem's OLS1 model.

To address this error, Ofgem could either place weight on regressions which adequately control for density within model. For instance, it could use the difference in predicted values from this regression and the OLS1 regression to re-calibrate London's special factor. Alternatively, Ofgem could re-evaluate Cadent's bottom-up special factor evidence, in light of the drivers Ofgem has selected in its chosen specification(s).

Table 3.20: Allowed Costs According to Alternative Specification using Density Drivers

	Ofgem DD with All Corrections Applied		**Ofgem DD with All Corrections Applied (Inc. Density Variable)**		**Difference**	
Network	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Efficiency Score	Allowed Costs (£m)	Allowed Costs (%)
EoE	1976	0.98	1995	0.98	18	0.92%
Lon	1468	1.09	1598	0.96	131	8.92%
NW	1528	0.97	1529	0.98	1	0.06%
WM	1139	1.00	1160	0.98	21	1.88%
NGN	1605	0.87	1496	0.98	-109	-6.76%
Sc	1103	0.97	1071	1.03	-32	-2.86%
So	2497	1.01	2449	1.06	-48	-1.93%
WWU	1585	0.97	1546	1.02	-39	-2.43%
85th Percentile		0.97		0.98		
Cadent Total	**6111**		**6282**		**171**	**2.80%**
Industry Total	**12901**		**12845**		**-56**	**-0.43%**

Source: NERA analysis of Ofgem data.

3.6. Suggested Remedies to the Regression Modelling

For the reasons set out above, Ofgem's models exhibit a range of serious statistical and conceptual flaws. Ofgem's data and models include various errors, there is statistical evidence that its chosen "OLS1" model is mis-specified, and Ofgem has failed to consider alternative approaches which lead to more reliable estimates of GDNs' expenditure requirements over the GD2 control period.

Correcting the errors we have identified in Ofgem's data and modelling, we find that Cadent's allowances for GD2 have been understated in Ofgem's DD by around £284m.

In particular, we have shown that Ofgem's modelling seems to materially understate the "London effect" on GDNs' costs by £131 million over the GD2 period.

We have also identified an improvement to the CSV calculation, which comes from scaling weighting factors using elasticity estimates from the disaggregated regressions. This approach better controls for the ratio of fixed to variable costs in disaggregated cost categories. Ofgem's failure to control for this feature of GDNs' costs disadvantages Cadent, we estimate by £17 million over the GD2 period.

And we have shown that Ofgem's approach to constructing the CSV will materially affect the modelled efficiency position of companies with shares of workload materially different from the industry average. Combining results from two modelling approaches that use (1) industry average weights (as per Ofgem), and (2) company-specific weights (as per our alternative) increases allowances for Cadent, we estimate by £17 million over the GD2 period.

4. Flaws in Ofgem's Approach to Setting Allowances

4.1. The Application of Ofgem's Regression Model

4.1.1. The intention of totex modelling is to better capture trade-offs between cost categories

Ofgem's rationale for introducing totex benchmarking as part of its "RIIO" reforms was that it better accounts for trade-offs between operating and capital costs, reducing the potential for misleading results from disaggregated modelling, where the combination of cost targets set on a line-by-line basis are infeasible in the round. In its RPI-X@20 review, Ofgem argued that using a totex model would address both these problems, as "it is not affected by cost categorisation issues" and "it captures cross-activity trade-offs relatively well".[92]

In its GD2 DD, Ofgem relies heavily on totex modelling, and places no weight on the results of disaggregated models. However, Ofgem argues that by using a bottom-up CSV (based on Ofgem's RIIO-GD1 disaggregated modelling cost drivers), that its approach "embodies bottom-up considerations":[93]

> "By using the drivers from the disaggregated models we have retained the information that we used in the bottom-up analysis, while allowing the model to solve the tradeoffs between the expenditure on different activities."

As Ofgem suggests, a key (conceptual) benefit of modelling costs at an aggregated level is that this kind of modelling can capture trade-offs between expenditure on different activities which deliver the same outcomes, and similarly, avoid any biases caused by differences between companies' allocation of costs to one category over another.

4.1.2. Ofgem's exclusion of controllable costs from its 'totex' model prevents it from capturing efficient trade-offs between cost categories

Ofgem classifies several categories of costs as non-controllable opex, including network rates, NTS exit costs, and shrinkage.[94] Ofgem excludes the costs it considers noncontrollable from its econometric benchmarking modelling.[95] However, while it may be appropriate to remunerate these cost items using pass-through mechanisms in some cases, it is not the case that all are entirely non-controllable. For example:

- Ofgem has recognised that companies can avoid shrinkage costs, as demonstrated by its decision to use an incentive mechanism to encourage companies to reduce shrinkage.[62] We understand from Cadent that it has incurred both maintenance and repex costs to reduce its shrinkage. Since Ofgem excludes the direct cost of shrinkage from its

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[92] Frontier Economics (May 2010), "RPI-X@20: The future role of benchmarking in regulatory reviews", p. 17.

[93] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 5 and p. 7.

[94] See for example Ofgem (9 July 2020), RIIO-2 Draft Determinations - Cadent, p. 60.

[95] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 40. [62]

Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex,

p. 82.

benchmarking, but includes repex and maintenance costs, Ofgem's model will estimate a lower efficiency score for companies that have invested most to reduce their shrinkage.

Flaws in Ofgem's Approach to Setting Allowances

- Likewise, Ofgem excludes "separately assessed" costs from its regression analysis, such as Growth Governors despite potential trade-offs between these and some of the regressed cost categories (e.g. including alternative solutions to Growth Governors).[96]

In general, excluding costs from the benchmarking model will bias estimated efficiency scores if:

- The excluded categories of cost are (at least in part) controllable; or
- There are trade-offs between the cost categorised included in its regression analysis and either outputs or other categories of cost; and
- The exclusion of a controllable cost category is not mitigated through other means, such as including an explanatory variable in the model to control for the effect of the omitted cost.

To explain this problem further, suppose that companies are able to reduce expenditure in a category of cost classified as non-controllable, at the expense of incurring additional costs in a different category. Consider a company that efficiently incurs more costs in a category considered controllable to reduce costs considered non-controllable. Ofgem's model will assess such a company to be less efficient as the costs it efficiently incurs are included in Ofgem's benchmark, while the costs it efficiently avoids are not. Ofgem's benchmarking will therefore underestimate the efficiency of companies that take more extensive measures to reduce the costs Ofgem classifies as non-controllable, and vice versa.

Ofgem also excludes capex related to historical large projects.[97] This aligns with Ofgem's decision to assess large projects separately for RIIO-GD2. However, Ofgem's totex model then fails to capture past trade-offs between capex on large projects and cost categories such as opex, repex, or capex on smaller projects where these expenditures may substitute for capex on large projects.

Ofgem's model therefore risks overestimating the efficiency of companies that have chosen large capex projects over alternative solutions. Conversely, Ofgem's approach may penalise companies that have incurred efficient opex, repex or capex on smaller projects instead of

[96] Ofgem (9 July 2020), RIIO-2 Draft Determinations - Cadent, p. 37.

[97] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 3.

capex on larger projects. For such a company, the costs it has incurred are included in Ofgem's benchmarking, while the costs it avoids are not. This difference in treatment for difference categories of costs will tend to bias Ofgem's efficiency benchmarking in favour of companies that have incurred capex on historical large projects.

Ofgem also excludes some categories of cost when "normalising" data. For example, we understand from Cadent that several GDNs's costs have been adjusted to exclude work on expensive short lengths of Tier 1 main attached to larger mains, known as "stubs". The larger mains are outside the repex programme and only need replacing if they are sufficiently high risk. We understand from Cadent that it has historically replaced more of these expensive sections of main, and therefore now has stubs that are shorter and do not need replacing. If Cadent's increased repex from this work is included in Ofgem's benchmarking, while other companies' costs for stubs replacements during RIIO-GD2 is not, then benchmarking will favour companies that have delayed stubs replacements.

4.1.3. Ofgem's use of "smoothed" historical workload to set allowances, not forecast workload over RIIO-GD2

Ofgem smooths both costs and drivers when conducting its regression modelling. Ofgem considers that it is necessary to smooth capex "to make sure the lumpy nature of these activities didn't bias the econometric results".[98] As such, Ofgem uses a seven-year rolling average of capex costs and drivers to estimate its regression equations, instead of contemporaneous values.

Using a rolling average of costs and drivers can be appropriate for the econometric analysis that establishes the relationship between costs and drivers, e.g. where capex is lumpy and its impact on outputs is persistent. Using one-year of data rather than smoothed data might fail to identify the true relationship between capex and outputs across years.

However, using smoothed, historical drivers to forecast costs for the future period means that companies will not be not correctly remunerated for their capex and achieved outputs during RIIO-GD2. By using smoothed drivers, Ofgem sets allowances based on the value of drivers observed historically over the past seven years, so its modelled costs will not reflect the workloads required during RIIO-GD2.

The result of this error is that a company that increases its capex and achieves greater outputs during RIIO-GD2 than it did during RIIO-GD1 will not be fully compensated for its increased costs during the coming period because the increase affects its drivers only with a lag. Conversely, a company that scales back its capex and achieves lower outputs will be over-remunerated because Ofgem bases its modelled costs on the earlier, higher drivers.

Ofgem can correct for this error by instead basing allowances using capex workload in-year, rather than the seven-year trailing average variable that Ofgem uses in its draft determinations.

[98] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 107.

4.2. Catch-up Efficiency Adjustment

4.2.1. Ofgem justifies its choice based on the level of stretch it intends to set companies

Ofgem sets the catch-up efficiency challenge based on an 85th percentile of company efficiency scores.[99] Ofgem multiplies the efficiency score at the 85th percentile with each company's modelled costs to determine allowances. This adjustment results in an efficiency challenge, i.e. reduced allowances, for any company Ofgem assesses to be less efficient than the company whose efficiency score sets the 85th percentile.

The 85th percentile is a more demanding target than the upper quartile (75th percentile) benchmark Ofgem used for RIIO-GD1, and which regulators have commonly used at other price reviews.

[99] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 88.

Ofgem attempts to justify the 85th percentile benchmark based on the level of stretch it intends to set companies rather than any methodological considerations. It considers that the 85th percentile benchmark, and the resulting allowances, "sets high but achievable expectations for the less efficient GDNs, building on the improvements they were funded to deliver over RIIO-GD1". It also observes that setting the benchmark at the 85th percentile results in a total totex allowance 20 per cent lower than GDNs'RIIO-GD2 submissions.[100]

However, Ofgem does not explain why it believes that the 85th percentile sets a correct level of stretch for companies, only noting that the 85th percentile benchmark results in a 2 per cent reduction in allowances compared with an upper quartile benchmark.[101]

4.2.2. Ofgem's decision to set an 85th percentile target seems to be an attempt to clawback GD1 outperformance retrospectively

Ofgem makes a number of observations regarding GDN's past outperformance, explaining that "actual totex over the period 2013-14 to 2018-19 is on average 14% lower than proposed allowed costs for RIIO-GD2, and 25% lower than RIIO-GD1 final Business Plan submissions".[102]

Ofgem also discusses its decision to apply an 85th percentile target in the RIIO-ED2 sectorspecific methodology consultation, published after the GD2 DD. Ofgem explains that the "Justification for changing this approach in RIIO-GD2 to the 85th percentile centred on sector wide outperformance of cost allowances throughout RIIO-GD1, and the better data, and improved robustness in modelling available in RIIO-GD2".[103][104]

Ofgem therefore acknowledges that its decision on the efficiency target is based on historical outperformance. This approach constitutes a retroactive decision to claw back the benefits of outperformance to a greater extent than Ofgem agreed to in its GD1 determination. Retrospective decision-making is bad regulatory practice that dilutes companies' incentives to reduce costs, undermines investment incentives, and is therefore detrimental to the interests of customers.

4.2.3. Regulatory precedent highlights the importance of setting the target by assessing the reliability of modelled costs; Ofgem fails to do so

Comparative benchmarking models, including those that Ofgem uses in its DD, cannot separately identify genuine inefficiency from data error, omitted factors, and differences in cost allocation across companies. As such, Ofgem's estimated efficiency scores may conflate company inefficiency and model or statistical errors.

[100] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 88.

[101] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 88.

[102] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 88.

[103] Ofgem (30 July 2020), RIIO-ED2 Sector Methodology Consultation: Annex 2 Keeping bills low for consumers, para [104] .24.

Given these limitations, setting a target at the modelled frontier (i.e. based on the efficiency score of the company which ranks as the most efficient) could result in unachievable cost targets. If translated into allowed levels of revenue, such cost targets would compromise companies' ability to finance their licensed activities.

To mitigate this problem, regulators tend to set an efficiency target at a less demanding level than the frontier company, as an acknowledgement that not all the variation in costs between companies left unexplained by econometric models represents inefficiency.

Precedent from past regulatory decisions recognises this principle. For example, in its redetermination of Bristol Water's PR14 price control, the CMA found that Ofwat's modelling was not robust enough to set an upper-quartile benchmark, and so applied a cost target based on the median company:[105]

> "Besides Ofwat's approach to PR14, there is regulatory precedent from Ofgem, as well as the CC's Northern Ireland Electricity price determination in 2014, for an approach that sets price control expenditure allowances on a basis that requires a greater level of efficiency than industry-average efficiency. Ofwat's PR14 price control framework, including its approach to the cost of capital, was developed in this context. The regulatory precedent from Ofgem and the CC has also recognised that a less demanding benchmark than the upper quartile may be appropriate in cases where there was less confidence in the modelling results. The effect of modelling error and limitations will tend to mean that an upper quartile benchmark will require levels of efficiency that are, in practice, greater than the upper quartile."

> "We were concerned that an efficiency benchmark based on an upper quartile efficiency concept would be overly demanding if applied to the results of the econometric models that we used. This was a judgment in the light of the issues we had identified both from our review of Ofwat's econometric models and from our development of alternative models".

Ofgem has itself acknowledged that the efficiency benchmark should be set based on the reliability of the benchmarking model. For RIIO-GD1, Ofgem justified the choice of the upper quartile rather than the frontier by the imperfection of its statistical models: [106]

> "We defined efficient costs equal to the upper quartile (UQ) GDNs' costs rather than the frontier allowing for other factors that may influence the companies' costs. We also assumed that GDNs would close only 75 per cent of the assessed gap between their forecasts and the UQ. The use of the UQ is identical to previous price reviews (eg GDPCR1, and more recently the electricity distribution price review, DPCR5). Our

[105] CMA (6 October 2015), Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991 Report, para 4.221, 4.222, and 4.224.

[106] Ofgem (17 December 2012), RIIO-GD1: Final Proposals – Supporting Document – Cost Efficiency, p. 7.

> proposed approach to closing the gap and the use of the UQ rather than the frontier acknowledges that a part of the difference in costs across the GDNs relates to factors other than GDNs' relative efficiency (eg statistical errors)."

For RIIO-GD2, Ofgem acknowledges in a technical annex that the choice of efficiency benchmark should account for the fact that part of the difference in modelled costs relates to factors other than relative efficiency.[107] Despite this, Ofgem only briefly alludes to the reliability of its modelling in its justification for its proposed benchmark:[108]

> "In previous price controls, we used benchmarking tools to drive cost efficiency in the sector. For RIIO-GD2, we further developed our approaches, building on more detailed and extensive data collection via BPDTs submissions. We have undertaken significant work to normalise GDNs data submissions through the use of adjustments and regional factors. We consider this has delivered improved comparability across GDNs, which in turn has enabled us to develop robust models, better reflecting industry cost structures."

This passage summarises some of the changes Ofgem has made to its modelling since RIIOGD1 but does not amount to a substantive assessment of its model. It does not assess the core statistical properties of Ofgem's model, failing to acknowledge the fundamental problems that we identify in Chapter 3 of this report.

As explained above, we have identified numerous data errors impacting Ofgem's modelling and its modelling (by its own admission) is less reliable than at GD1, as we discuss below in Section 4.2.4.

4.2.4. The robustness of Ofgem's modelling does not justify an 85th percentile adjustment

Ofgem's choice of an 85th percentile benchmark is a stronger efficiency challenge than all comparable regulatory decisions, which tend to set the benchmark at the upper quartile (75th percentile). In cases where the regulator deems the cost modelling to be less accurate, established practice is to set a less demanding benchmark to avoid penalising companies for estimated efficiency gaps that result from modelling errors rather than inefficiency. For example, when the CMA identified weaknesses in its benchmarking models at the Bristol Water PR14 determination, it selected an adjustment at the median company (i.e. 50th percentile).[109]

Setting the stronger 85th percentile benchmark for RIIO-GD2 would therefore only be appropriate if Ofgem can demonstrate that its modelling meets a higher standard of reliability

[107] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 3.

[108] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 87.

[109] CMA (6 October 2015), Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991 Report, para 4.221, 4.222, and 4.224.

and accuracy than the modelling that supported comparable regulatory decisions, most importantly GD1.

In fact, Ofgem's regression modelling is probably less reliable than at GD1. Our findings in Chapter 3 describe each of the problems with Ofgem's modelling in detail. Among other flaws:

- Ofgem's modelling contains multiple, material data errors;
- Ofgem has misspecified the functional form of the time trends in its regression model;
- Ofgem's regression model fails the RESET test; and
- Ofgem's construction of a single CSV contains a series of problems described in Section 3.4.

Given these and other problems with Ofgem's modelling, the model does not meet the high standard of reliability that would justify a stronger benchmark than other regulatory decisions. Ofgem's 85th percentile benchmark is therefore unreasonably high when compared with regulatory precedent.

Specifically, Ofgem's model appears weaker than the suite of models it relied upon at RIIOGD1. Ofgem implicitly acknowledges this by choosing not to rely on its disaggregated models for RIIO-GD2. Given a weaker model, the benchmark at RIIO-GD2 should correspondingly be less, not more demanding than the benchmark at RIIO-GD1. At RIIOGD1, Ofgem assessed that the accuracy of its modelling warranted a 75th percentile benchmark.[110]

Setting a demanding 85th percentile benchmark is especially vulnerable to errors because it is based on a small number of companies. Ofgem acknowledges that its choice of the 85th percentile "is approximately equivalent to setting it at the level of the 2nd most efficient company".[111] Any modelling or statistical errors are liable to result in greater errors for individual companies than for the industry average. By setting the challenge effectively based on the efficiency scores of only the two top-ranked companies, it is particularly vulnerable to being affected by company-specific errors. This increases the likelihood that the 85th percentile benchmark results in an unreasonably demanding challenge.

We therefore recommend that Ofgem should use a benchmark that is no higher than the upper quartile percentile at RIIO-GD2. Indeed, the reduction in reliability of its modelling since RIIO-GD1 may justify a less stringent benchmark, such as the median level of performance which the CMA used in the Bristol Water PR14 decision.

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[110] Ofgem (17 December 2012), RIIO-GD1: Final Proposals – Supporting Document – Cost Efficiency, p. 7.

[111] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 87.

4.2.5. Ofgem applies the catch-up adjustment to non-regressed costs without justification

Ofgem calculates the efficiency scores that set the catch-up efficiency challenge based only on costs included in its regression analysis. This excludes two categories of separatelyassessed costs:[112]

- Non-regression modelled costs, amounting to around 10 per cent of Cadent's submitted costs; and
- Technically assessed costs, amounting to around 6 per cent of Cadent's submitted costs.

While Ofgem does not include non-regression costs when calculating the efficiency adjustment, it still applies the adjustment to non-regression costs.[113] This inconsistency between the cost base from which Ofgem calculates the adjustment and the cost base to

[112] Ofgem (9 July 2020), RIIO-2 Draft Determinations - Cadent, p. 37.

[113] Ofgem (9 July 2020), RIIO-GD2: Step-by-Step Guide to Cost Assessment, p. 4.

which it applies it creates errors both in Ofgem's allowance for non-regression costs, and for its efficiency benchmarking.

Ofgem makes no attempt to demonstrate that the efficiency scores calculated for each company based on regressed costs are also appropriate for the same company's non-regressed costs. There is no reason to impose a catch-up efficiency adjustment to a company's nonregressed costs without a credible assessment that its non-regressed costs include an element of inefficiency. By applying a catch-up adjustment based on regressed costs to non-regressed costs, Ofgem arbitrarily reduces allowances for non-regressed costs, without even attempting to demonstrate inefficiency.

Ofgem also makes no attempt to justify that the same efficiency benchmark that is appropriate for regressed costs should also be appropriate for non-regressed costs. As we explain in Section 4.2.3, the benchmark should be set to reflect the reliability and accuracy of the efficiency modelling. While Ofgem does not successfully justify its choice of an 85th percentile benchmark for regressed costs, it does not even attempt to justify this benchmark for non-regressed costs. Ofgem has no basis for its assumption that its non-regressed cost modelling has the same degree of confidence, and therefore should have the same benchmark, as regressed costs.

Moreover, as we explain in Section 4.1, by setting a target for efficiency improvement by benchmarking a subset of costs, the target Ofgem identifies will tend to be set by the companies that achieve particularly low costs in that category. If there are trade-offs between cost categories, those companies may have higher costs in other areas. This "partial benchmarking" will lead to a target for efficiency improvement that overstates the potential for companies to reduce their total costs.

4.3. Double Count in Frontier Shift Adjustment

Ofgem adjusts allowances to account for changes in GDNs' expected productivity over time, known as "ongoing efficiency".[114] Ofgem applies an adjustment at the final stage of calculating allowances based on its view of ongoing efficiency. However, the costs submitted by companies already embed each company's assumption on ongoing efficiency.[115]

Companies have different views on ongoing efficiency. Each company's submitted costs therefore embed a different downwards adjustment to account for its assumed productivity

[114] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 83.

[115] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 83. [82]

Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p.

89.

growth. Specifically, SGN's submitted costs embed a higher ongoing efficiency assumption than the costs submitted by other companies, as Ofgem explains:[82]

> "GDNs submitted a range of ongoing efficiency assumptions in their business plans. These included both the companies' views on suitable level for ongoing efficiency. Cadent, NGN and WWU were all broadly similar at 0.53%, 0.5% and 0.5% across all cost categories, while SGN indicated 1.4% for opex and 0.7% for capex[sic.] and repex."

Ofgem does not adjust submitted costs to remove embedded ongoing efficiency before estimating its regressions and assessing non-regressed costs. Ofgem therefore bases its analysis on costs that contain different ongoing efficiency assumptions. This inconsistency lowers SGN's submitted costs relative to what they would be if the analysis had used the same ongoing efficiency assumption across all companies, thereby reducing the estimated efficiency scores of SGN's companies. As SGN Scotland is the 2nd ranked company and effectively sets the 85th percentile target, its higher ongoing efficiency assumption results in a more demanding target for all companies.

Therefore, by using cost data with companies' own ongoing efficiency assumptions in its cost assessment, Ofgem sets a catch-up efficiency challenge that embeds SGN's particularly high view of ongoing productivity improvements. Ofgem does not account for this when applying its own view of an appropriate ongoing efficiency challenge.

Instead, Ofgem applies an ongoing efficiency adjustment equal to the difference between its view of ongoing efficiency and the average ongoing efficiency forecast across all companies:[116]

> "We propose to estimate the embedded ongoing efficiency in our view of proposed costs using a blended average of the values the GDNs provide in their BPDT. Our approach is based on taking a simple average of ongoing efficiency over the RIIOGD2 period across GDNs and calculate the average compound annual growth rate (CAGR) over this period."

Ofgem adds the difference between Ofgem's view and the average of companies' views on top of SGN's particularly high view (as embedded in its catch-up efficiency challenge) of ongoing efficiency. This results in a total ongoing efficiency challenge that is higher than Ofgem's stated view. Ofgem could correct its analysis by adjusting companies' submitted costs to remove embedded ongoing efficiency before applying its regression and benchmarking model.

4.4. Suggested Remedies to the Calculation of Allowances

As we explain above, Ofgem has made a series of errors in its application of its econometric models. By conducting "partial benchmarking", i.e. applying a regression to only 84 per cent of GDNs' totex, its analysis will ignore cost trade-offs with the remaining 16 per cent of totex, and tend to underestimate the efficient costs GDNs can achieve.

[116] Ofgem (9 July 2020), RIIO-2 Draft Determinations – Gas Distribution Annex, p. 89.

Ofgem has also incorrectly applied "smoothed" cost drivers to forecast GDNs' efficient costs for the GD2 control period, which links allowances to their workload in the past, not their workload in the future.

In addition to these flaws in the use of the regression analysis, the level of Ofgem's 85th percentile efficiency target is not justified with reference to the reliability of its models and data, as regulatory precedent suggests it should be. Rather, Ofgem's decision to set the efficiency target at the 85th percentile reflects its aspiration regarding the level of allowances it considers appropriate for GD2. Its published statements also indicate this proposal

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represents a thinly veiled attempt to claw back the benefits of historical outperformance during the GD1 control period.

Ofgem's data and models exhibit a number of flaws, suggesting it is less robust than at GD1, meaning its decision to apply an extremely demanding efficiency target at the 85th percentile creates a significant risk that Ofgem's allowances will be distorted by outliers, modelling error and data error. Given its econometric modelling cannot robustly identify the efficient level of companies' expenditure requirements, we recommend setting a less demanding efficiency target. For instance, in its redetermination of Bristol Water's PR14 price control the CMA applied a median cost target to reflect the limitations on the data and models available to it; we recommend Ofgem applies this same approach at RIIO-GD2. Ofgem also fails to justify the application of the 85th percentile challenge to non-regressed costs; since these costs are not included in the benchmark used to calculate the 85th percentile level of efficiency, these costs should not be subject to an efficiency challenge above and beyond that implicit in the various non-regression methods Ofgem employs.

Finally, we recommend that Ofgem should change its approach to removing the ongoing productivity improvement already embedded in the costs used to estimate econometric models when setting allowances. Its current approach double-counts these future productivity savings. For example, Ofgem could achieve this by re-estimating its econometric models after subtracting the ongoing productivity improvement already embedded into companies' business plan cost forecasts.

5. Conclusions

We have identified a series of errors in Ofgem's modelling, and its application of its regression model to set allowances.

Through our review of Ofgem's DD Excel files and discussions with Cadent, we have identified a number of data and calculation errors. While not all the errors we identified disadvantage Cadent, we find that correcting these errors alone increases modelled allowances rise for Cadent by £284 million over the GD2 period. These material errors also highlight the uncertainty and imprecision with which Ofgem's comparative analysis of GDNs' costs can forecast "efficient" costs for the GD2 period.

Ofgem has also made a series of methodological errors. Ofgem materially underestimates the effect on costs of operating in London, as demonstrated by replacing Ofgem's pre-modelling sparsity and urbanity adjustments with controls for density drivers in its regression model. Replacing Ofgem's pre-modelling sparsity and urbanity adjustments with controls for density and density squared within the model, increases Cadent's London GDN's costs by £131 million over the GD2 period.

We find that Ofgem's regression is mis-specified, failing the important key Ramsey RESET test for model specification. This suggests Ofgem's modelling does not accurately estimate accurately the functional form of the relationship between GDNs' costs and drivers.

Also, Ofgem has made an error in the construction of its CSV by assuming that the CSV components explain 100 per cent of the costs within each driver category. We have developed an alternative approach scales the weighting factors using elasticity estimates from the disaggregated regressions. This approach better controls for the ratio of fixed to variable costs in disaggregated cost categories. Ofgem's failure to control for this feature of GDNs' costs disadvantages Cadent, we estimate by £17 million over the GD2 period.

Ofgem's approach to constructing the CSV also materially affects the modelled efficiency position of companies with shares of workload materially different from the industry average. Differences in activity weights may be efficient or caused by exogenous factors, as recognised by Ofgem's use of workload drivers within its CSV. Ofgem could instead calculate its CSV using company-specific weights, based on each company's expenditure across the different activities that make up Ofgem's 'regressed costs' variable.

We find that the model using company weights has superior statistical properties to the model using industry weights, although using company weights advantages some companies while disadvantaging others, for reasons unrelated to their efficiency. Since there is no definitive case that one approach is more reliable than the other, it may be appropriate for Ofgem to combine results from two modelling approaches that use (1) industry average weights (as per Ofgem), and (2) company-specific weights (as per our alternative) increases allowances for Cadent, in both cases multiplied by the elasticities in Ofgem's disaggregated regressions, as described above. We estimate that this approach would also increase

Cadent's allowances by £17 million over the GD2 period compared to the corrected version of Ofgem's OLS1 model.

We also have found a number of flaws in Ofgem's approach to setting allowances, in particular around its use of its regression model. Firstly, Ofgem conducts "partial benchmarking" by only including only 84 per cent of GDNs' totex in the regression model.

This leads Ofgem's modelling to ignoring trade-offs with the remaining 16 per cent of totex, e.g. on expenditure targeted at reducing gas leakage (included in the model) and the direct cost of gas lost (i.e. shrinkage, excluded from the model).

Ofgem also incorrectly uses "smoothed" cost drivers to forecast GDNs' efficient costs for the GD2 control period when calculating allowances, which links allowances to their workload in the past, not their workload in the future.

In addition to these flaws in the use of the regression analysis, the level of Ofgem's 85th percentile efficiency target is not justified with reference to the reliability of its models and data, as regulatory precedent suggests it should be. Rather, Ofgem's decision to set the efficiency target at the 85th percentile reflects its aspiration regarding the level of allowances it considers appropriate for GD2. Its published statements indicate this proposal represents a thinly veiled attempt to claw back the benefits of historical outperformance during the GD1 control period.

Ofgem's data and models exhibit a number of flaws, suggesting it is less robust than at GD1, meaning its decision to apply an extremely demanding efficiency target at the 85th percentile creates a significant risk that Ofgem's allowances will be distorted by outliers, modelling error and data error. Given its econometric modelling cannot robustly identify the efficient level of companies' expenditure requirements, we recommend setting a less demanding efficiency target. For instance, in its redetermination of Bristol Water's PR14 price control the CMA applied a median cost target to reflect the limitations on the data and models available to it; we recommend Ofgem applies this same approach at RIIO-GD2. We estimate that setting allowances based on the median would increase Cadent's allowances by an additional £49 million over GD2, and increase industry allowances by £98 million, in addition to the effect of correcting for data errors described above.

Ofgem also fails to justify the application of the 85th percentile challenge to non-regressed costs; since these costs are not included in the benchmark used to calculate the 85th percentile level of efficiency, these costs should not be subject to an efficiency challenge above and beyond that implicit in the various non-regression methods Ofgem employs.

Finally, we recommend that Ofgem should change its approach to removing the ongoing productivity improvement already embedded in the costs used to estimate econometric models when setting allowances. Its current approach double-counts these future productivity savings. For example, Ofgem could achieve this by re-estimating its econometric models after subtracting the ongoing productivity improvement already embedded into companies' business plan cost forecasts.

Appendix A. Detailed Regression Results

In the table below, we report coefficients for all regression models discussed in Section 3.2.

Table A.1: Regression Results 1

	Ofgem DD OLS1	**Data Corrected OLS1**	**Data Corrected OLS2**	**Data Corrected OLS3**	**Data & Time Trend Corrected OLS1**	**Data Corrected & Single Time Trend**
Constant	0.322	-0.337		-1.039	0.131	-0.326
CSV Totex Smoothed	0.727***	0.823***	0.823***	-1.039	0.825***	0.825***
Historical Trend	-0.006**	-0.005**		-0.005***		
Forecast Trend	-0.018***	-0.019***		-0.019***	-0.007	
Time Trend					-0.007	-0.011**
CSV Totex Smoothed ^2				0.132		
Adjusted R squared	0.865	0.901	0.893	0.902	0.901	0.901
RESET	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
No. of Observatio ns	104	104	104	104	104	104

Source: NERA analysis.
*Note: * P<0.1, **P<0.05, ***P<0.01. Note that OLS2 also includes time dummies, although we do not report these coefficients in the table above. All variables are logged, except the constant and time trends.*

Appendix A

In the table below, we report coefficients for all regression models discussed in Section 3.4 and 3.5.

Table A.2: Regression Results 2

Error

	Error Corrected DD Model	Corrected DD Model With Company & Elasticity Weighted CSV	Ofgem DD All Corrections Company Weighted CSV	Error Corrected DD Model With Industry & Elasticity Weighted CSV	Error Corrected DD Model with Density Drivers
Constant	-0.224	0.585	0.985	-0.539	-16.444***
CSV Totex Smoothed	0.808***	0.671***	0.632***	0.829***	0.837***
Forecast Trend	0.0002	-0.002	-0.002	-0.005	0.001
Time Trend	-0.007	-0.005	-0.0005	-0.019	-0.008
Density (Customers / Network Length)					6.567***
Density ^2					-0.665***
Adjusted R squared	0.904	0.597	0.56	09.11	0.979
RESET	FAIL	PASS	PASS	FAIL	FAIL
No. of Observations	104	104	104	104	104

Source: NERA analysis.

*Note: * P<0.1, **P<0.05, ***P<0.01. All variables are logged, except the constant and time trends.*

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