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RIIO GD1

Decision on strategy for the next gas distribution price control - RIIO-GD1 Tools for cost assessment

Document Type: Supplementary Annex (RIIO-GD1 Overview paper)

Date of Publication: 31 March 2011

Target Audience: Consumers and their representatives, transmission companies, Generators, offshore gas producers/importers, suppliers, shippers, investors, environmental organisations, distribution network companies, government policy makers and other interested parties.

Overview:

The next gas distribution prices controls will be the first to reflect the new RIIO model. RIIO is designed to drive real benefits for consumers; providing network companies with strong incentives to step up and meet the challenges of delivering a low carbon, sustainable energy sector at a lower cost than would have been the case under our previous approach. RIIO puts sustainability alongside consumers at the heart of what network companies do. It also provides a transparent and predictable framework, with appropriate rewards for delivery.

Having consulted on our initial strategy for the next gas distribution price control, this supplementary annex to the main decision document sets out our latest thinking on the tools that we will use for cost assessment. This document is aimed at those seeking a detailed understanding of our proposals. Stakeholders wanting a more accessible overview should refer to the main decision document.

Contact name and details: Chris Watts, Head of Network Costs and Outputs

Tel: 020 7901 7333

Email: RIIO.GD1@ofgem.gov.uk

Team: Smarter Grids and Governance

Associated Documents

Main decision paper

- Decision on strategy for the next gas distribution price control - RIIO-GD1
  http://www.ofgem.gov.uk/Networks/GasDistr/RIIO-GD1/ConRes/Documents1/GD1decision.pdf

Links to supplementary annexes

- Decision on strategy for the next gas distribution price control - RIIO-GD1 Outputs and incentives
  http://www.ofgem.gov.uk/Networks/GasDistr/RIIO-GD1/ConRes/Documents1/GD1decisionoutput.pdf

- Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Business plans, innovation and efficiency incentives
  http://www.ofgem.gov.uk/Networks/Trans/PriceControls/RIIO-T1/ConRes/Documents1/T1decisionbusplan.pdf

- Decision on strategy for the next transmission and gas distribution price controls -RIIO-T1 and GD1 Financial issues
  http://www.ofgem.gov.uk/Networks/Trans/PriceControls/RIIO-T1/ConRes/Documents1/T1decisionfinance.pdf

- Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Uncertainty mechanisms
  http://www.ofgem.gov.uk/Networks/Trans/PriceControls/RIIO-T1/ConRes/Documents1/T1decisionuncert.pdf

- Glossary for all the RIIO-T1 and GD1 documents:
  http://www.ofgem.gov.uk/Networks/Trans/PriceControls/RIIO-T1/ConRes/Documents1/T1decisiongloss.pdf

Links to other associated documents

- Decision on strategy for the next transmission price control - RIIO-T1
  http://www.ofgem.gov.uk/Networks/Trans/PriceControls/RIIO-T1/ConRes/Documents1/T1decision.pdf

- Consultation on strategy for the next gas distribution price control - RIIO-GD1 Overview paper (160/10)
  http://www.ofgem.gov.uk/Networks/GasDistr/RIIO-GD1/ConRes/Documents1/RIIOGD1%20overview.pdf

- Consultation on strategy for the next gas distribution price control - RIIO-GD1 Outputs and incentives
  http://www.ofgem.gov.uk/Networks/GasDistr/RIIO-GD1/ConRes/Documents1/GD1%20outputs%20and%20incent.pdf

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1. Introduction

Chapter Summary
This chapter sets out how cost assessment analysis contributes to the overall RIIO price control work. It also introduces the later chapters in this document.

Introduction

1.1. The next transmission and gas distribution price controls, RIIO-T1 and GD1, will be the first to reflect the new RIIO model. In December 2010, we consulted on our initial strategy for the two price control reviews. The overview document of our initial strategy for RIIO-GD1 included a supplementary annex which set out the tools that we intend to use for cost assessment.

1.2. Following consideration of responses received to the initial strategy consultation, this document sets out our latest thinking on the tools that we will use for cost assessment. We will use the tools set out in this paper both as part of the initial review of the companies' forecasts, including the assessment of eligibility for fast-tracking or a lighter touch approach and for our more detailed analysis of companies' forecasts.

1.3. This document is aimed at those seeking a detailed understanding of our latest thinking. Stakeholders wanting a more accessible overview should refer to the RIIO-GD1 overview paper[1]. The price control will be set for an eight-year period from 1 April 2013 to 31 March 2021.

1.4. This document includes an update on our assessment of the GDNs' historical costs using the toolkit approach[2] we set out in the December document. The purpose of the benchmarking presented in the document is to provide an indication of which GDNs are higher cost both overall and on an individual activity basis.

1.5. At this stage we have only applied adjustments for labour regional factors and have not adjusted for other factors. We consider that the onus is on the companies to present appropriate evidence quantifying such factors before we reflect them in our analysis.

1.6. We expect the gas distribution networks (GDNs) to consider the analysis presented in this document as part of their well-justified business plan submissions. In the event that their costs are higher than the other GDNs, they should provide

[1] http:www.ofgem.gov.uk/Networks/GasDistr/RIIO-GD1/ConRes/Documents/GD1decision.pdf
[2] Chapter 2 (Approach to cost assessment) Consultation on strategy for the next gas distribution price control - RIIO-GD1 Tools for cost assessment - Supplementary Annex (RIIO-GD1 Overview paper) http://www.ofgem.gov.uk/Networks/GasDistr/RIIO-GD1/ConRes/Documents1/GD1%20costs%20assess.pdf

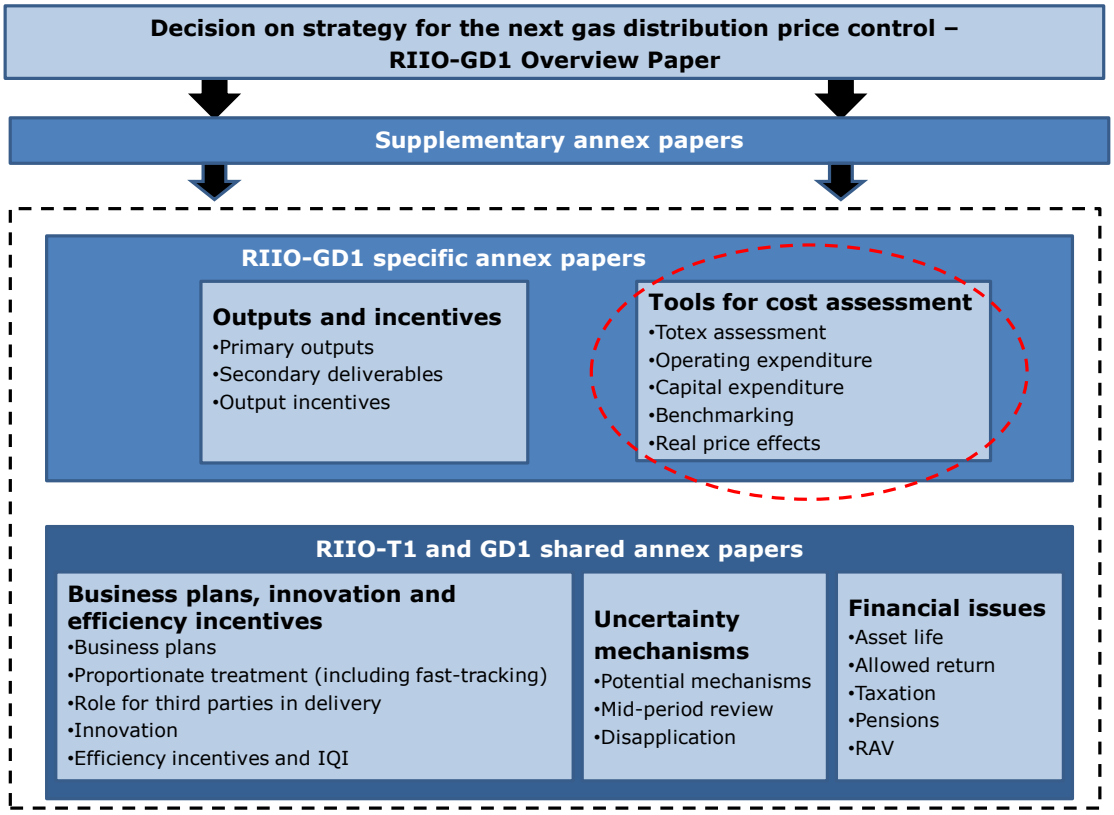
evidence explaining why their costs are higher, or alternatively to explain how they are intending to close any efficiency gap.

1.7. The assessment contained in this document is not a full or final efficiency assessment of the GDNs.

1.8. We will develop our cost assessment and refine our tools over the forthcoming months ahead of the companies submitting their plans at the end of July 2011. We will set out our updated cost assessment approach including how we have benchmarked GDNs' forecasts as part of our October publication on fast-tracking.

Figure 1.1 provides a map of the RIIO-GD1 documents published as part of the suite of decision documents.

Figure 1.1: RIIO-GD1 Supplementary appendix document map*



***Document links can be found in the 'Associated documents' section of this paper.**

Summary of latest thinking

1.9. In this section we set out a summary of the latest thinking contained in each section of this document.

Cost assessment overview

1.10. In our December document on RIIO Strategy, we outlined our intention to make use of aggregated or top-down approaches, such as total expenditure (totex) benchmarking, within an overall assessment toolkit. This type of top-down assessment would be used alongside other more disaggregated or bottom-up analysis to inform our views on the reasonableness of the overall costs proposed in the GDNs' business plans.

1.11. Since the publication of our December document, we have continued to shape our toolkit to reflect both developments in our own thinking and views expressed by stakeholders. We have decided that it is appropriate, as proposed, to apply a toolkit approach to cost assessment, taking into account a mixture of high level and more disaggregated cost analysis.

1.12. In particular we have continued to review the analysis with the GDNs and have revised a number of the specific activity cost drivers within the analysis which have been identified as more accurately reflecting the costs for each of the areas.

1.13. There was a mixture of views on how the benchmarking should be used. Some GDNs felt that the regression should be used as a directional tool or starting point for our analysis. Others felt that greater weight should be placed on this analysis. We consider that benchmarking analysis should inform but not determine our assessment of the companies' forecasts. The robustness of the companies' narrative and evidence will be a key factor in deciding whether their forecasts are appropriate or whether we should seek to adjustment them.

1.14. Looking ahead to July, our assessment toolkit will include inter GDN benchmarking, use of UK wide statistics, eg construction indices and regional factor assessment, and GDN specific analysis. We will draw on a blend of analytical techniques from our toolkit to conduct our assessment of cost requirements, whilst recognising the limitations of each of our options for specific analysis.

1.15. We will be looking to finalise the core elements of our toolkit ahead of the July 2011 business plan submissions. In particular we will be looking to finalise the driver selection and composition for each of the areas of analysis. We will publish further details together with the October 2011 document on fast-tracking.

1.16. This supplementary annex discusses the methods we will use to assess the costs proposed by the GDNs and the quality, robustness and objectivity of their cost justifications. We will apply a proportionate, output focussed approach to cost assessment using a toolkit of methodologies such as:

- a review of the justification for expenditure and evidence on efficiency
- total expenditure (totex) benchmarking
- disaggregated benchmarking

- historical trend analysis
- a review of asset volumes
- unit cost analysis
- expert review
- project by project review.

Real price effects and ongoing efficiency

1.17. When we assess the GDNs' business plan forecasts we will consider whether they incorporate a reasonable level of productivity improvement which we would expect an efficient company to make (ongoing efficiency improvements). We will also assess whether they have robust justification for the level of changes in input prices (eg wages) relative to the retail price index (RPI), which we refer to as real price effects (RPEs).

1.18. We consider that our proposal to set an ex ante allowance for RPEs remains appropriate. Our assessment of the GDNs' forecasts will be informed by a range of evidence including the analysis of the relationship between RPI and relevant input price indices.

Total expenditure analysis

1.19. Totex benchmarking is an important part of the overall toolkit. Before July 2011, when we receive the companies business plans, we will look to develop our benchmarking further, where appropriate, with the GDNs, our academic advisor and the help of technical consultants. Stakeholder's views on totex are very mixed with some respondents supporting the high level approach, whilst others highlight that caution is needed in applying the totex approach. Given the mixed views expressed by stakeholders, we will balance our approach to cost assessment across both totex assessment and disaggregated cost assessment techniques in RIIO-GD1 and will not rely solely on one technique.

Direct operating expenditure

1.20. Our assessment of the efficient direct operating expenditure (opex) required by GDNs will primarily be based on our assessment of the forecasts in their business plans. This will require each GDN to demonstrate that its forecasts are consistent, reliable and justifiable in terms of the volume of the planned work, the unit cost of delivery and the impact of the spend on the output measures. We expect the GDNs to provide evidence that their proposal is efficient through their own benchmarking.

1.21. We will employ a toolkit approach to carry out an initial assessment of the appropriateness of the GDNs' forecasts including trend analysis, inter GDN comparisons, disaggregated benchmarking, volume and unit cost analysis as well as expert assessment by our technical consultants.

Business support costs

1.22. As proposed in our December document, we will use a toolkit approach to assess the GDNs' forecasts of business support costs. Our assessment will be based on an analysis of historical and forecast costs for the various activities defined within business support. Where appropriate, we will compare the activities across gas distribution, electricity distribution and gas/electricity transmission companies, as well as other external comparators.

1.23. As per direct opex we would expect the GDNs to provide their own benchmark analysis as part of their well-justified business plan to support their submission and provide evidence that their processes for managing this work are efficient.

Capital expenditure

1.24. We will assess the efficient capital expenditure (capex) costs required by a network company largely based on our analysis of the forecasts in each company's business plan. This approach will place an onus on the companies to demonstrate that their forecast costs are reasonable and are linked to the delivery of outputs.

1.25. For local transmission network related capex and other operational capex, we will work closely with our engineering consultants to assess baseline expenditure based on GDNs' future business plans and historical performance. We will carry out a range of assessment approaches including disaggregated benchmarking between GDNs, variance analysis, unit cost comparisons and spot checks on selected schemes during our initial sweep.

1.26. We expect the GDNs' business plans to demonstrate that the planned volumes and unit costs of capex work are efficient. We plan to use historical trend analysis and unit cost analysis to assist in the assessment of the GDNs' plans.

1.27. Unit cost assessment remains a key element in our cost assessment, in particular for local transmission system (LTS) and governor expenditure. We will review the GDNs' unit costs and expect GDNs to explain and justify any variations in unit costs between historical costs reported for the first gas distribution price control review (GDPCR1) and RIIO-GD1. Our views on efficient unit costs will build on our analysis, expert views from engineering consultants and market intelligence.

1.28. In assessing mains reinforcement and connections costs we will continue to use the regression analysis tools developed during GDPCR1. We have worked closely with the GDNs to consider adjustments to our analysis to improve the consistency of the reported data used in the analysis and to review the particular activity drivers. Once again we would expect the GDNs to clearly identify the need for this works within the business plans, and explain how the investment fits in with their wider network strategy approach.

Replacement expenditure

1.29. We will assess the GDNs' mains replacement forecast performance using a range of tools, including regression analysis, and assessment of the programme's efficiency in relation to the benefits it brings to other directly related activities. Our proposed assessment methodology includes benchmarking of the companies' mains and services replacement expenditure (repex) through the use of regression analysis driven by a weighted workload adjusted driver. We will continue to assess LTS repex projects on a project specific basis given the low volume of such work. We expect the GDNs to provide additional evidence to support both timing and need of the project. Finally, we will assess the GDNs' expenditure forecasts for risers replacement together with the relevant asset health information.

1.30. In our December document we identified the key output from the repex is ultimately a reduction in risk to customers. We expect the GDNs to articulate this as part of their well-justified business plan and link proposed repex to both workload and the proposed primary and secondary safety outputs for mains replacement.

Updated cost assessment results

1.31. As set out above we have updated our cost assessment analysis to inform the development of well-justified business plans. This cost assessment work only takes into account labour regional factors at this stage and we recognise that as well as differences in efficiency there will be other factors explaining differences in performance. It is important that the companies set out these differences in their well-justified business plans.

1.32. Our assessment of 2008-09 and 2009-10 costs suggests that Northern Gas Networks (Northern) is the frontier performer in both totex assessments and the high level matrix assessment. They also consistently appear in the top four least cost GDNs for all activities. Wales and West Utilities (WWU) are benchmarked as second lowest cost in both totex and the high level matrix assessment. They appear in the top four least cost GDNs for most of the benchmarked activities. At the totex and total cost level the London and Southern GDNs are the highest cost and this message is reinforced in a number of the more material cost activities including mains replacement. London, however, appear to be much lower cost for mains reinforcement and Southern for work management, emergencies and mains reinforcement.

Context

1.33. Under the RIIO model, we will continue to set price controls using a building block approach incorporating incentives to encourage network companies to deliver outputs and value for money over the longer term. However, the way the building blocks will be set will be different to our previous approach. This is due the output-led nature of RIIO.

1.34. Our assessment of the outputs that the GDNs are required to deliver and the associated revenues they may collect from consumers will be informed, to a large degree, by the business plans they put forward. GDNs will need to set out in their business plans what they intend to deliver for consumers over time and what revenue they need to earn from existing and future consumers to ensure delivery is financeable. The onus is on the GDNs to justify their view of required expenditure and the associated outputs, supporting this with appropriate information on how stakeholders' views have been taken into account, detailing what alternative options are appropriate and demonstrating that their proposed costs are efficient.

1.35. We expect a GDN to consider a range of options for delivering primary outputs and explain why its proposal is the best way forward. When making the case for its preferred proposal, we expect the GDN to demonstrate that it has considered the long-term costs and benefits of the most viable options. The GDNs will also need to demonstrate that their proposals are cost efficient over the long term.

1.36. The GDNs submitted indicative high level expenditure forecasts in September 2010 to assist the development of the RIIO-GD1 process. Whilst these forecasts are only indicative, the significance of the proposed expenditure is an indicator of the work required in RIIO-GD1 to consider whether proposed costs are efficient and linked to outputs. For a number of GDNs there will be a significant shift away from load related expenditure toward investment driven by network integrity and asset health. We will be looking to the business plans to provide robust, objective evidence to demonstrate both of these requirements. This emphasises the importance of effective assessment of the costs proposed by the GDNs for RIIO-GD1.

Structure of this document

1.37. The remainder of this document sets out our toolkit approach for cost assessment. It provides an update on our assessment of GDNs' historical costs taking into account further work on cost drivers and updated cost information from the GDNs. The document is structured as follows:

- Chapter 2 provides an overview of our position relating to our cost assessment toolkit and approach
- Chapter 3 outlines our position on real price effects and ongoing efficiency
- Chapter 4 summarises our position in respect of total expenditure analysis
- Chapter 5 sets out our direct operating expenditure
- Chapter 6 provides our position in respect of business support cost assessment
- Chapter 7 explains our position for the assessment of capital expenditure
- Chapter 8 details our methodology for assessing replacement expenditure (repex) driven by primarily by the HSE's 30/30 programme.

2. Overall approach to cost assessment

Chapter Summary
In this chapter we discuss our approach to cost assessment. In particular, we set out our proposed toolkit approach, including the use of totex supported by a more detailed review of underlying activities. We also set out the updated results of our cost assessment work.

Summary of Consultation Proposals

2.1. In our December document we set out our proposals for cost assessment in RIIO-GD1. We highlighted the change in methodology from GDPCR1 in which we set baselines for GDNs' individual activities and their overall costs based on an efficiency review of historical performance and an assessment of their forecasts.

2.2. In line with our RIIO handbook[3], we indicated our assessment of the efficient costs required by a network company for RIIO-GD1 will be largely based on our assessment of the company's business plans. However, other information, eg information in other companies' business plans, benchmarking evidence and information on historical performance will also be used to inform this assessment.

2.3. We presented our proposed toolkit approach for cost assessment, including bottom-up cost assessment, higher level matrix analysis (where we will to compare companies' performance across different activities), and our proposal for totex.

2.4. We set out how we expected the fast-tracking assessment to operate at a higher level relying on the companies' forecasts and our analytical tools set out in the December document. We highlighted that where companies forecasts and historical costs are shown to be high this should be adequately justified within their business plans. We set out that where insufficient evidence is provided it is unlikely that a company will be considered suitable for fast-tracking and hence the company will be subject to a more detailed, but proportionate, review of costs and outputs.

Summary of Responses

Totex benchmarking

2.5. There was significant support for the use of totex analysis amongst the GDNs in principle but also concerns about its robustness and how it might be applied. One GDN believed that a broader set of 'tools' to assess efficiency including bottom-up, totex, matrix analysis and specialist review would overcome some of the consistency issues experienced during GDPCR1 (eg bottom-up vs. top-down).

3 http://www.ofgem.gov.uk/Networks/rpix20/ConsultDocs/Documents1/RIIO%20handbook.pdf

2.6. There was a mixture of views on how the benchmarking should be used. Some GDNs felt that the regression should be used as a directional tool or starting point for our analysis. Others felt that greater weight should be placed on this analysis.

Direct opex

2.7. In general respondents agreed with our approach for assessing direct opex in the companies' business plans although one GDN suggested that, due to the limited number of independent data points, the results of the regression analysis may have limited benefit.

2.8. Two GDNs believed that benchmarking should be both top-down and bottom-up, with one stating that bottom-up should be used as a cross-check. There was a mixture of views on how the benchmarking should be used. Some GDNs felt that the regression should be used as a directional tool or starting point for our analysis. Others felt that greater weight should be placed on this analysis.

Business support costs

2.9. We received a small number of comments in relation to our proposed approach for assessing business support costs. The responses received related to the techniques contained within our cost assessment toolkit and the associated cost drivers.

2.10. Respondents highlighted the need to identify appropriate cost drivers for business support costs within the gas distribution businesses and to ensure that costs are consistent and normalised across networks to allow meaningful assessment to be undertaken. A number of respondents highlighted that differences in the definitions of business support activities in existing regulatory reporting structures would make cross-company comparison difficult.

Capex

2.11. There was broad support for our overall approach to the assessment of capex in the companies' business plans, using cost analysis and project specific review. Although responses were limited, most of the comments made were in support of our proposals in the December document.

Repex

2.12. Whilst the majority of respondents, including the GDNs, supported the move to a risk removed driver there were concerns raised over the practicality of using such a measure.

2.13. The GDNs in particular raised concern over the volatility of the proposed driver and questioned the link between risk removed, length abandoned and hence the cost of the works.

2.14. The GDNs were generally supportive of our approach for assessing mains and service replacement costs but made some suggestions about separating out some of the larger diameter works which are more atypical.

Latest Thinking

2.15. In the light of consultation responses, we intend to apply a toolkit approach to the assessment of the cost requirements in the GDNs' business plans taking into account a mixture of high level and more disaggregated cost analysis.

2.16. The development of annual cost reporting data over the past three years means there is now much more comparable cost and driver information available both across activities and companies as well as, in some cases, across industries.

2.17. Since our December document we have continued to work with the GDNs to review the cost reporting categories currently reported on by the GDNs in the regulatory reporting packs (RRPs). We have looked to identify areas of inconsistency between GDN reporting and provided greater clarity within the regulatory instructions and guidance (RIGs) to improve the consistency of cost and workload reporting and hence comparative benchmarking going forward.

2.18. In addition, we have held a number of working groups to develop and enhance the cost drivers we use in each of the areas subject to cost assessment.

2.19. In a number of the particular cost assessment areas we continue to propose the use of composite scale variables (CSV) that encompass a wider range of the factors influencing costs than can be captured by a single driver. This is particularly important in the area of repex where the diameter of mains to be replaced is a significant variable cost driver.

2.20. For both totex assessment and a number of the bottom-up cost assessment tools we have proposed a driver around modern equivalent asset value (MEAV). The MEAV for the GDNs has been derived by identifying the cost of constructing an equivalent new network and essentially captures a weighted average of the asset volumes. The use of MEAV will require further review and investigation to ensure the drivers used are correct and appropriate. The specific details around the composition of the MEAV are set out in Chapter 4.

2.21. Table 2.1 below sets out our proposed cost assessment approach and drivers for the activities where we are using regression as a tool to assist in the assessment of the companies plans.

Table 2.1: Drivers for regression cost assessment techniques

Toolbox approach	Drivers	
Totex (single model) *Chapter 4*	MEAV, capex CSV, repex CSV, total reports	
Totex (aggregated capex, repex, opex) *Chapter 4*	Capex	MEAV, capex CSV
	Opex	MEAV, PREs, total reports
	Repex	Length of less than 7bar metallic network, repex CSV
Matrix assessment *Chapter 4*	Based on individual years' disaggregated panel regressions	
Bottom up regressions *Chapters 5, 7 and 8*	Top down opex	CSV of MEAV and PREs
	Work management	MEAV
	Emergency	PREs
	Repair	Total mains and service condition external reports
	Maintenance	MEAV
	Connections	Number of connections
	Mains reinforcement	CSV of length of main laid above and below 180mm
	Repex	CSV of length of main by diameter band

2.22. In addition to the regression analysis set out above we have proposed a number of complementary assessment tools to assess the GDNs' business plans. In particular our approach will make use of the following techniques for given areas of expenditure:

- a review of the justification for expenditure and evidence on efficiency
- historical trend analysis
- unit quantity analysis
- asset unit cost analysis
- output unit cost analysis
- expert review
- project specific review.

2.23. Our use of these tools and approaches will be proportionate to the level of expenditure and detail of explanation in the companies' well-justified business plans.

Initial Cost Assessment Results

2.24. In the RIIO handbook we indicated that we would present an updated assessment of the historical costs reported by the GDNs. The purpose of this assessment is to identify where a GDN's costs are higher than others and hence the areas in which GDNs will need to show, as part of their well-justified business plans, that they have put solutions in place to address the gap. Some of the gap may be explained by reference to a GDN specific issue but, some may have to be considered as part of the GDN's proposed efficiency improvements.

2.25. We have based our assessment of historical costs on reported cost data from the companies for 2008-09 and 2009-10. We have adjusted this data for regional labour cost differentials using Building Cost Information Service (BCIS) data, but we have not taken any other potential regional factors into account in this assessment. The calculation of these regional factors is explained further in Chapter 4.

2.26. In Table 2.2 we present the GDN rankings for 2009-10 for each of the assessment tools we set out in the December document. It presents the results of the cost benchmarking rather than a direct efficiency assessment.

2.27. As we develop our tools and techniques between now and July 2011 we will take account of ongoing developments to inform our assessment of the GDNs' efficiency.

Table 2.2: Initial results of proposed comparative cost benchmarking tools for 2009-10 (using panel data for 2008-09 and 2009-10)

Cost Assessment rankings	National Grid Gas (NGG)				Scotia (SGN)		NGN	WWU
	East of England (EoE)	London (Lon)	North West (NW)	West Midlands (WM)	Scotland (Sc)	Southern (So)	Northern (No)	Wales & West (WW)
Totex (single model) *Figure 4.2*	6	8	5	3	4	7	1	2
Totex (Aggr. Cap+Rep+Opex)	6	8	5	4	3	7	1	2
Matrix Assessment Figure 4.3	4	8	5	5	3	5	1	2
Total Opex (incl shrinkage; excl SIUs & xoserve) *Figure 5.1*	6	8	7	5	2	3	1	4
Work Management *Figure 5.2*	7	6	8	5	1	2	3	4
Emergency *Figure 5.3*	6	4	5	8	1	2	3	7
Repair *Figure 5.4*	3	7	5	1	6	8	2	4
Maintenance *Figure 5.5*	5	4	6	3	8	7	2	1
Mains Reinforcement *Figure 7.1*	3	1	8	7	4	2	5	6
Connections *Figure 7.2*	7	8	1	3	2	5	4	6
Repex *Figure 8.1*	3	8	4	5	6	7	1	2

2.28. Based on our assessment, of the 2008-09 and 2009-10 period, Northern is the frontier performer in both totex assessments and the high level matrix assessment. They also consistently appear in the top four least cost GDNs for all activities. WWU is benchmarked as second lowest cost in both totex and the high level matrix assessment. They appear in the top four least cost GDNs for most of the benchmarked activities. At the totex and total cost level, London and Southern are the highest cost and this message is reinforced in a number of the more material cost activities including mains replacement. London, however, appear to be much lower cost for mains reinforcement and Southern for work management, emergencies and mains reinforcement.

Scotland is the lowest cost provider when looking at the provision of emergency services and work management activities for 2009-10. They also perform well on the totex and the high level matrix assessment, ranking third overall. National Grid Gas (NGG) appears to be higher cost than the independent GDNs in a number of the cost areas. In the totex assessments and top-down opex assessment NGG are three of the four highest cost GDNs.

3. Real price effects and ongoing efficiency

Chapter Summary
This chapter sets out the type of analysis that we expect to carry out to assess the forecasts submitted by the GDNs for input price inflation and ongoing efficiency improvements. It also outlines some of the issues that we expect the GDNs to take account of in their business plans when justifying their proposals.

Summary of consultation proposals

3.1. Our December document outlined how we expect to reflect ongoing efficiency improvements and RPEs within our assessment of the forecasts submitted by the companies.

3.2. In this chapter we set out a summary of the proposals outlined in the December document, the responses received and our final proposals.

Ongoing efficiency

3.3. To capture expected efficiency improvements by frontier companies, it is necessary to include an assumption for ongoing efficiency improvements within RIIO-GD1. As in previous price controls, in the December document we proposed that analysis of data from productivity datasets such as EU KLEMS growth and productivity accounts would be used to inform the ongoing efficiency assumption. This dataset contains input (capital (K), labour (L), energy (E), materials (M) and services (S)) and output data for the different sectors in the economy.

3.4. In addition, we suggested that we would refer to other sources such as:

- the Office of National Statistics (ONS) measures of productivity for the electrical, gas and water industries referenced in the 2010 Bristol Water inquiry by the Competition Commission
- output/tender price data for capital projects such as the construction output price index (COPI) used by Ofwat as part of its price controls.

3.5. We indicated that the comparative competition effect from the sale of four gas distribution networks by NGG in 2005, included as part of efficiency assumptions at GDPCR1, are still expected to be material during RIIO-GD1. We noted that GDNs should take account of the comparative competition effect in their productivity assumptions that they submit as part of their well-justified business plans.

RPEs

3.6. We proposed to include an ex ante allowance for RPEs based on forecast differences between the RPI and input price inflation, ie there would be no indexation of allowed revenues with respect to actual input price inflation. We proposed that our assumptions would be based on analysis of historical trends of relevant price indices relative to the RPI. Table 3.1 outlines the indices we had identified for consideration as part of our assessment.

Table 3.1: - Data sources considered at recent price controls

Source	Description
ONS Average Weekly Earnings (AWE)	General labour cost index. Replaces the Average Earnings Index.
ONS Annual Survey of Hours and Earnings (ASHE)	Sector specific data on earnings and hours paid
ONS Producer Price Indices (PPI)	Input and output indices by sector
Joint Industry Board (JIB)	Labour costs for the electrical contracting industry
Building Cost Information Services (BCIS)	Various cost indices for the construction industry, eg Price Adjustment Formulae Indices (PAFI) (previously known as Baxter Indices), tender price indices
Bloomberg	Commodity prices (historical and forward prices)
Royal Institute of Chartered Surveyors (RICS)	Commercial rent forecasts

3.7. We set out that network companies could outline a case for implementing input price indexation of allowed revenues as part of their business plan submissions or they could set out an alternative uncertainty mechanism which we would consider against a set of defined criteria for inclusion in the price control. We consider that the onus is still on the companies to meet these criteria for input price indexation. We further discuss the possible inclusion of additional uncertainty mechanisms in 'Supplementary Annex - Uncertainty mechanisms'.

Consultation responses

Ongoing efficiency

3.8. One respondent emphasised the importance of using forward looking data alongside analysis of past trends when conducting our assessment of future efficiency assumptions. They argued that this is necessary due to the significant period of change the network companies face.

3.9. Two respondents raised the issue of possible 'double counting' of efficiency improvements, from the ongoing efficiency assumption outlined in this chapter and the efficiency target derived using benchmarking techniques.

3.10. One respondent suggested that where industry specific data exists, eg ONS productivity data, it should be relied on more than economy wide indices or data for other European countries. Another respondent commented that we should be taking into account independent and factual studies when making our final proposals.

3.11. One respondent had strong views on our proposal to include a comparative competition effect. They believed that all benefits from the sale of GDNs by NGG have been realised and that no further efficiency gains can be made in RIIO-GD1.

3.12. Respondents did not identify any further sources of data that we should investigate.

RPEs

3.13. Respondents questioned whether an ex ante allowance was the most appropriate mechanism for dealing with RPEs. In this respect, they made reference to current uncertainty over the path of the economy and the increase to an eight-year price control which would both add to forecasting difficulties. One respondent highlighted that they were already facing skills shortages with the increasing demand from renewable energy companies for similar skills and noted that the increased volatility in commodity prices is causing difficulties in forecasting. A number of respondents suggested greater consideration should be given to managing this risk through an uncertainty mechanism whereby large increases over and above the ex ante allowance could be shared with consumers or a premium could be included in the regulatory return.

3.14. One respondent noted the importance of looking at forward contract rates along with historical trends in our analysis, but highlighted that forward-looking data is not available in all areas and can be contradictory. They highlighted the difficulties they have faced during the fourth transmission price control review (TPCR4) due to the volatility in commodity prices that would not have been forecast if they had been based solely on historical trend analysis.

3.15. Some respondents noted the need to set the right input mix, including understanding how contractor rates play a part, and the correct pass through of oil and energy costs. One respondent suggested that reinstatement and street works costs, eg Traffic Management Act 2004 (TMA) costs, should be included as inputs.

3.16. Two respondents agreed with assessing forecasts on a notional structure but felt there was a need to allow some variation due to regional factors, eg labour costs that may make up a larger proportion of costs in some areas.

3.17. Respondents have noted that using indices closely related to the utilities sector and based on UK data will be the most appropriate. One respondent highlighted that relying on construction industry indices will not correctly identify cost pressures faced by the network companies due to the varying degree to which the sectors have been impacted by the recession.

3.18. Further data sources suggested include forward prices for commodities and energy, and indices for labour in the renewable industries.

Latest thinking

Ongoing efficiency

3.19. Ongoing efficiency improvements are expected from the more efficient network companies that have been identified in our benchmarking. Benchmarking analysis identifies the efficiency improvements that we expect to be achieved by the relatively inefficient companies, in order to catch-up with those network companies identified as being more efficient. As such we do not consider there is any double counting.

3.20. In addition to this catch-up we expect the industry as a whole to make efficiency improvements and we expect GDNs, within their business plan submissions, to include an ongoing efficiency assumption for their cost forecasts. We encourage them to define within their submissions the data sets used to come to these assumptions. In assessing business plans, for ongoing efficiency improvements, we will be analysing the growth and productivity accounts of the EU KLEMS dataset as well as the evidence put forward by the GDNs. We will use UK data from a range of industrial sectors that share similarities to the network companies. We believe it is necessary to look at industries outside of the energy sector due to the privatisation effect inherent in any data relating to the energy sector and other privatised utilities.

3.21. The EU KLEMS data set begins in 1970 and extends to 2007 for some sectors, and 2005 for others. We propose to examine data from 1970 onwards as we believe using the longest time period available provides the best estimate of long-term trends.

3.22. The EU KLEMS dataset presents data on two different types of industry output that can be used to estimate productivity and unit cost trends.

- Gross output: This measures the value of the output in an industry, ie the combined turnover of the companies in that industry. Changes in the volume of gross output for an industry are calculated by examining changes in constant prices. The inputs for gross output are capital, labour, energy, materials and services.
- Value added: This is the value of gross output minus the value of intermediate inputs (energy, materials and services) required to produce the

final output. The inputs for value added are therefore just labour and capital. Growth in the volume of value added is the change in value added at constant prices.

3.23. The value added approach and the gross output approach both have pros and cons. For example, the gross output measure would provide a measure of the productivity improvements from a combination of labour, capital and intermediate inputs whereas value added will only provide a measure for labour and capital. Changes in measures based on gross output may reflect changes that have occurred in the vertical structure of organisations within an industry, eg if there was a merger of firms within an industry the measure of gross output may reflect this, as well as productivity improvements and input price changes. The value added measures of productivity are not affected by such reorganisations.

3.24. We intend to examine data using both approaches to come to our final conclusions.

3.25. The EU KLEMS dataset allows us to analyse both partial and total factor productivity measures. Partial productivity measures are most relevant when examining particular costs such as opex as they can capture the relevant component of the production process. When examining these partial productivity measures we propose to analyse productivity on the basis of constant capital input, where appropriate. This is necessary to eliminate any capital substitution effect. For example, labour productivity growth within a sector may only have been possible due to a substitute of labour for capital inputs. We will also examine total factor productivity (TFP) measures which will be more relevant to totex.

3.26. We will examine other productivity data where this complements the EU KLEMS data. For example, the Competition Commission examined ONS data on sectoral productivity which we will consider.

3.27. We will crosscheck our separate analyses of RPEs and ongoing efficiency with indices that combine the two effects. For example, the COPI will provide evidence on unit cost trends for capital projects which will be relevant to the assessment of capex activities.

3.28. In proposing that a comparative competition effect from the sale of GDNs still exists, we have examined evidence provided in the run up to the sale in 2005. As part of the sale an impact assessment was conducted[4] This quantified the benefit to customers, from the sale of the four GDNs, as £225m (in net present value terms) from 2005-06 to 2022-23. Studies conducted at the time showed that the path of the efficiency improvements were unlikely to be flat as it would take time for companies to make changes that would allow them to realise the efficiency benefits, and that benefits would diminish over time. At GDPCR1 an improvement rate of 1.3 per cent was included as part of the ongoing efficiency assumption.

[4] 'National Grid Transco - Potential Sale of gas distribution network businesses. Final impact report': http://www.ofgem.gov.uk/Networks/GasDistr/otherwork/Documents1/8895-25504a.pdf

3.29. We think there are efficiency savings to be made by the GDNs, from the sale of four of NGG's GDNs, during RIIO-GD1 and expect their business plan submissions to be compatible with this. In forming our assessment of this factor we will review the analysis undertaken during the Distribution Network (DN) sales as part of the impact assessment, evidence from GDPCR1 on the efficiency improvements that have been made, and any evidence from other sectors where similar factors may have been present. We welcome evidence from the GDNs as part of their business plan submissions on how much of this comparative competition effect remains in the sector.

RPEs

3.30. We propose to base our assumptions for RPEs on a range of evidence:

- analysis of historical trends of relevant price indices relative to the RPI
- historical correlation of price indices with RPI combined with forecasts of RPI to produce RPE forecasts (our consultants, CEPA, used this approach in their analysis for us at the fifth electricity distribution price control review (DPCR5)
- examining analysts' forecasts of input price growth where available (eg the HM Treasury publication 'Forecasts for the UK Economy')
- any other well-justified evidence provided by the network companies as part of their business plan submissions.

3.31. The responses to our consultation did not identify any further sources of data; we will continue to look at the sources, outlined in Table 3.1 above, for our analysis. We acknowledge that historical trends do not always best represent future movements, but we think this is a sound approach particularly over an eight-year horizon. Where forecast indices and future contract price data are available, eg for commodity and energy prices, we will examine this to help aid our decision process.

3.32. As set out in the December document we will assess the forecasts received on a notional structure rather than the weights proposed by the individual companies. We will only revisit this assumption if the network companies present strong evidence as part of their business plans to suggest that an alternative approach is required. We will seek to avoid setting allowances based on companies' individual structures that may be inefficient. For example, it may be justified to include a higher weighting for labour in the input mix in London where wages are higher than the rest of GB. We do not at this stage see any strong arguments for including a regional RPE premium (eg assuming higher wage growth in some parts of GB).

4. Total expenditure analysis

Chapter Summary
This chapter explains the approach that we intend to take when conducting totex benchmarking and how we expect to apply this analysis within our overall cost assessment. It also sets out the initial results of our totex analysis.

Summary of consultation proposals

4.1. In our December document we outlined our intent to use totex benchmarking as an important part of our toolkit in assessing GDNs' costs. We emphasised that there would not be a mechanistic link between the benchmarking assessment and our view of base revenue for a company. We stressed that this would be a starting point for assessing the companies' forecasts and targeting questions on their performance.

4.2. We proposed to benchmark companies' forecast total costs due to the potential for historical costs to bear less relevance to future plans. We also noted that this will reflect expected innovation and the impact of other changes such as the shift in expenditure from building new capacity to improving asset integrity. We suggested the need to benchmark historical totex as a tool to assess GDNs' forecast plans.

4.3. We highlighted that we were still developing cost drivers for the totex analysis. We presented key measures that we could use including activity cost workload drivers, and sought views and suggestions from our stakeholders.

4.4. We considered the appropriate level at which to carry out more disaggregated analysis ranging from the overall level of expenditure (totex) to activity groups and individual activities. We proposed the use of totex as a measure of the total costs, and highlighted two potential approaches to smoothing the lumpy expenditure, ie using a moving average or removing the lumpy expenditure from totex.

4.5. We proposed the use of panel data, using a time specific effects model to improve the robustness of our analysis, and suggested implementing adjustments similar to those we made for GDPCR1.

Consultation responses

Use of totex analysis

4.6. There was significant support for the use of totex analysis amongst the GDNs in principle but also concerns about its robustness and how it might be applied. One GDN suggested that a broader set of tools to assess efficiency including bottom-up, totex, matrix analysis and specialist review could overcome some of the consistency issues experienced during GDPCR1 (eg bottom-up vs. top-down).

4.7. Two GDNs considered that totex analysis should be used as a directional tool and as a starting point for discussing the company's forecasts together with other techniques, rather than as a mechanistic means of setting allowances.

Benchmarking historical totex vs. benchmarking forecasts

4.8. One GDN did not support historical totex benchmarking at the highest level as the totex pool is too wide and has too many drivers to support a regression in its own right. The respondent suggested continuing to separate totex into opex, capex and repex but noted that it supported the use of totex regressions for benchmarking business plan forecasts, provided appropriate drivers can be found.

Definition of totex

4.9. Two GDNs expressed concerns about the definition of totex. One GDN suggested that a totex approach should cover all controllable costs rather than most controllable costs, as the former approach could potentially lead to arguments over whether certain costs (eg non-routine maintenance) should be excluded from the analysis. The second GDN suggested that the expert analysis of property costs should be reflected in the totex analysis.

4.10. One GDN and one distribution network operator (DNO) supported Ofgem's proposal to use totex in the analysis. The DNO argued that totex analysis avoids providing an incentive for the regulated firms to alter the timing of capex so as to benefit from the way it affects the setting of their prices. The GDN supported using totex rather than a measure of depreciation. In this respect, the GDN highlighted the negative impacts that the latter approach could have given that adjustments to the regulatory asset value (RAV) for these types of reasons can mean that the RAV does not provide an accurate reflection of a GDN's assets.

Smoothing lumpy expenditure

4.11. One GDN was concerned that the lumpy nature of repex and capex has the ability to significantly distort the analysis if totex is measured as the sum of opex, repex and capex. The GDN proposed using a moving average over a significant period of time to smooth the expenditure, rather than excluding some costs entirely.

Adjustments

4.12. One GDN and one DNO raised concerns about adjustments for regional and company specific environmental factors. The GDN pointed out that the December document did not specify whether costs in the totex regressions will be adjusted for regional factors. The GDN suggested that regional factor adjustments are required in order to arrive at a reasonable answer and to be consistent with the bottom-up approach. The DNO proposed the use of disaggregated cost data to capture the effects on costs of aspects of the operating conditions under which companies work.

4.13. Two GDNs were concerned about other adjustments. One GDN suggested that Ofgem should adjust totex costs to reflect the different outputs and output levels

proposed by respective GDNs, in line with the views of their stakeholders. They noted that if this was not the case, companies that responded to stakeholder wishes could be financially disadvantaged. The second GDN suggested a totex adjustment should be made for networks within a group in order to overcome intra-group allocation issues for business support costs.

Cost drivers

4.14. Two GDNs raised concerns that achieving appropriate regression analysis/ benchmarking of totex will be difficult, especially given the issues currently being experienced with performing regression analysis over individual areas of spend. They were concerned that the appropriate regression drivers for totex may not be properly identified and that such drivers may not adequately take account of differences between networks, such as geographic spread/separation and scarcity.

4.15. One GDN suggested that a number of separate high level drivers should be used for the totex analysis rather than combining them into a CSV. The GDN identified network length, customer numbers, throughput, repex weighted workload and MEAV as potential high level drivers.

Estimation approach

4.16. One GDN and one DNO raised concerns about the estimation approach. The GDN was concerned about the limited number of independent data points (eight GDNs in four ownership groups), which can affect the robustness of the results of the regression analysis. The DNO suggested an analysis based on panel data with due allowance for shifts in cost relationships over time. It also suggested that even if Ofgem does not estimate company fixed effects, it should allow for their presence in estimating cost relationships and in calculating the accuracy of their estimates.

Other factors

4.17. One DNO expressed concerns about economies of scale effects. It suggested that Ofgem should consider the effect of scale of operation on company costs. The DNO argued that these effects may be complex with increasing returns to scale at some level and decreasing returns at other levels. The DNO suggested that scale effects are likely to be understood using aggregated data, possibly corrected for variations in operating conditions.

Latest thinking

Key messages

4.18. Our latest thinking on our approach to the totex analysis is that we shall:

- use this analysis alongside other techniques as a directional tool and as a starting point for assessing company's forecasts, rather than as a mechanistic means of setting allowances

- use both top-down and bottom-up approaches to enable us to reach a more informed view of the efficiency level of the companies
- benchmark companies' future business plans
- carry out historical benchmarking to cross-check forecast business plans.
- use total controllable expenditure (controllable opex (plus shrinkage) + capex + repex) as a measure of totex
- use a moving average to smooth the lumpy expenditure
- apply adjustments to remove xoserve and independent network costs for Scotland's totex, and to adjust for direct labour and contract labour regional factors (GDNs will need to provide appropriate evidence for other adjustments)
- use a combination of a scale variable (for those models where our engineering knowledge suggests that the scale of operation drives costs) and workload variables as cost drivers in our regression models to enable us to arrive at the results presented in Chapter 2
- use the Cobb-Douglas function as the functional form of our models.
- run our regressions using panel data estimated with a time fixed-effects model using the ordinary least squares (OLS) technique
- carry out further work with our academic advisor to ensure that our methodology is appropriate for the benchmarking we are undertaking.

Use of totex analysis

4.19. As set out in our December document, we intend to use the totex analysis alongside other techniques as a directional tool and as a starting point for assessing company's forecasts, rather than as a mechanistic means of setting allowances.

4.20. We intend to use the following approaches for the totex analysis.

- A top-down (a single totex model) approach, which uses aggregate totex costs in a single regression.
- A bottom-up (an aggregate totex model) approach, which comprises three separate regressions, one for each of the three components (opex, capex and repex) of totex. Totex efficiency scores will be computed as a ratio of total actual costs to the aggregate efficient costs of the three separate regressions.
- We may also consider an additional bottom-up approach, which comprises aggregation of activity level cost' regressions.

4.21. We stated in our December document that we planned to adopt an alternative approach of combining bottom-up regressions and to introduce matrix analysis for GDNs' relative performance. We have further developed the matrix to include capex. We have also updated the matrix using the regressions published in Chapters 5, 7 and 8 of this paper. We will use the matrix, as part our toolkit approach to cost assessment.

4.22. The results of the matrix assessment and totex assessment are presented at the end of this chapter.

Benchmarking historical totex vs. benchmarking forecasts

4.23. We have carried out historical benchmarking using panel data techniques using two years (2008-09 and 2009-10) and will add a third year when the 2010-11 data becomes available in July 2011. We shall also carry out forecast business plan benchmarking once the data becomes available in July 2011. In addition, we shall use historical benchmarking to cross-check forecast business plans.

Definition of totex

4.24. We consider that a totex approach which includes actual or proposed controllable opex plus capex and repex is more robust than the total costs approach. However, we intend to include shrinkage in the opex. This approach relates more closely to the current state of technology, government regulation and environmental concerns, as well as the operator's level of efficiency.

Smoothing lumpy expenditure

4.25. Our December document proposed two approaches of smoothing GDNs' lumpy expenditure. We intend to use a moving average instead of removing the lumpy costs and will also seek to cross-check the results.

Adjustments

4.26. We have decided at this stage to only apply adjustments to remove xoserve, to remove independent network costs from Scotia's totex, and to adjust for direct labour and contract labour regional factors. The GDNs will need to provide appropriate evidence for other adjustments.

4.27. As part of our historical data analysis, we have calculated direct and contract labour indices for both London and Southern GDNs using an approach similar to that used in GDPCR1. However, unlike the GDPCR1 approach which used only London as a high cost region, we have identified and used two high cost regions, London and the South East. We have applied a single weighted average to all the other regions, excluding London and the South East, so that the national average is equal to one. We have updated the contract labour indices using BCIS and Building Information Services (BIS) Tender Price indices for the respective years, 2008-09 and 2009-10.

4.28. We have also updated the direct labour indices for the above periods using the mean wages published by the ONS in the ASHE. The GDNs provided us with a list of work professions/skills categories that are relevant to the gas distribution industry. We were then able to calculate London and the South East regions' indices using the methodology described in Appendix 1.

4.29. As part of this approach we estimated the percentage of work done in specific regions and the work needing to be done locally. We used population estimates published by the ONS as a proxy for work done in specific regions, and made an assumption that 40 per cent of work management costs and 100 per cent of each of the remaining direct labour cost activities need to be done locally. We then calculated

the indices for London and Southern GDN's using the methodology described in Appendix 1.

4.30. The regional factor indices we have used for each GDN are presented in Table 4.1.

Table 4.1: Direct labour and contract labour indices

	Direct Labour		Contract Labour	
	2008-09	2009-10	2008-09	2009-10
London	1.20	1.19	1.11	1.11
Southern	1.09	1.08	1.06	1.07
Elsewhere	0.95	0.95	0.97	0.97

4.31. We will continue to develop this approach further in the coming months. We expect GDNs to provide appropriate evidence of why their costs are different to the national average and to identify and justify alternative data sources.

4.32. In our assessment of business plans and forecasts we will update our approach for setting regional factor adjustments and share this updated work with the GDNs.

Cost drivers

4.33. Our December document emphasised the need for benchmarking models to take account of the key cost drivers of the business. Cost drivers should ideally reflect external conditions rather than variables over which the company has influence. The December document considered two options for selecting totex drivers.

4.34. After consultation with the GDNs and other stakeholders, we have come to a conclusion that the first option, a high level approach which utilises one or two overall cost drivers is not realistic as this would not adequately capture the reasons for changes in company costs. It is not feasible to get one or two drivers that represent a cross-section of drivers from individual disaggregated cost activities. We consider that it is more appropriate to identify cost drivers from disaggregated and/or grouped cost activities.

4.35. We have developed the following additional cost drivers since our December consultation:

- MEAV - the cost of creating an equivalent new network
- maintenance hours of work - the total number of hours spent annually on maintaining assets
- emergency hours of work - the total number of hours spent annually on emergency work
- repairs hours of work - the total number of hours spent annually on repairs work.

4.36. We estimated MEAV using data reported in the RRPs and the new build unit costs identified in technical reports written for Ofgem by CEPA, SKM, GL Nobel Denton[5], and by Rune Associates[6] for the following assets:

- LTS assets
- capacity and storage assets
- mains and governor assets.

4.37. We used an approach developed by NGG to calculate maintenance hours. We estimated emergency hours using information on the industry average number of hours spent by full time equivalents (FTEs) and the number of public reported escapes (PREs). We estimated repair hours using information on the average number of repair hours for each of the four categories (mains condition, mains damage, service condition and service damage).

4.38. We have considered using MEAV as one of the scale drivers for various cost activities. MEAV recognises size, asset base and complexity of a network. This approach has not been used previously in gas distribution, but was adopted for the more aggregated costs in DPCR5. However, we do not have confidence to use the repairs, maintenance and emergency hours' drivers due to significant variations between the GDNs.

4.39. We are considering combining cost drivers that represent scale (when engineering knowledge suggests that the scale of operation drives costs) with workload drivers as an appropriate approach for selecting drivers for our models. Our view is to use a workload driver from each of the broadly aggregated costs (opex, capex and repex) for the single totex model. We intend to use the following cost drivers for the respective cost categories:

- totex - MEAV, repex weighted workload, capex weighted workload, and total condition reports
- opex - MEAV, total external condition reports, and PREs
- capex - MEAV and capex weighted workload
- repex - metallic pipeline length and repex weighted workload

4.40. We propose to construct a CSV to estimate the weights for each driver when:

- the sample is too small to handle multiple drivers, and/or
- some of the explanatory variables are statistically insignificant, but both our engineering knowledge and other industry understanding gives us good reason to believe that combining them into one variable could account for changes in costs better.

[5] The Economic Lives of Energy Network Assets, A Report for Ofgem dated December 2010.
[6] Appendix 5 to http://www.ofgem.gov.uk/Networks/GasDistr/GDPCR7-13/Documents1/EoE-CAP-GDPCR%20v1.2.pdf

Model functional form, model specification, and statistical tests

4.41. We used the Cobb-Douglas functional form in both DPCR5 and GDPCR1. It is one of the most common cost functions employed in empirical cost research and its simplest form is represented as:

$$Log(Y) = C + \beta * log(X) + \varepsilon$$

Where: Y is the measure of costs – eg totex or opex; X is the cost driver – eg network length; β is the slope value; ε is the error term (unexplained costs), and log is the natural logarithm.

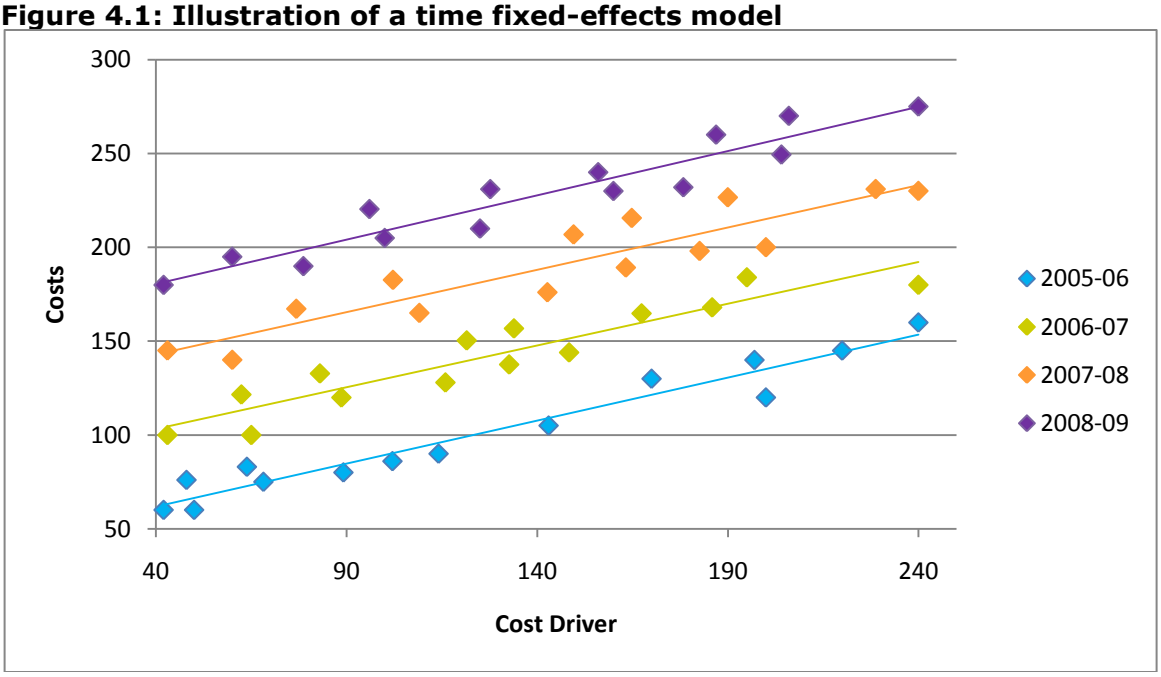
4.42. The above functional form can also be adapted and used with data in their level format by removing the log function. We are considering using the set of criteria discussed in Appendix 1 for selecting the best functional form for each model we estimate.

4.43. We intend to use the statistical tests which Ofgem developed for DPCR5. These tests provide an indication of the robustness of the modelled results and also indicate where some of the outputs from the regressions might be biased and require an adjustment to avoid misleading results. They are discussed in Appendix 1.

Estimation approach

4.44. Our regressions will use panel data estimated with a time fixed effects model using the OLS technique. When a time fixed-effects model is estimated, one can calculate the expected/average cost of performing an activity in a given year. Where companies' actual costs lie relative to this average level provides an indication of their efficiency relative to this average. This is illustrated in Figure 4.1.

Figure 4.1: Illustration of a time fixed-effects model



4.45. The following can be seen from this illustration.

- The cost driver has the same effect in all years. In this example an extra unit of the cost driver coincides with an extra unit of costs.
- There are year specific effects that lead to different average costs in each year. In this example average costs have increased from year to year.
- An indication of the relative efficiency of a GDN can be obtained by comparing the actual costs with the average costs in that year for a given cost driver. For example, companies that lie above the fitted line have higher than average costs for that level of cost driver and this indicates that we might expect them to be less efficient than average.

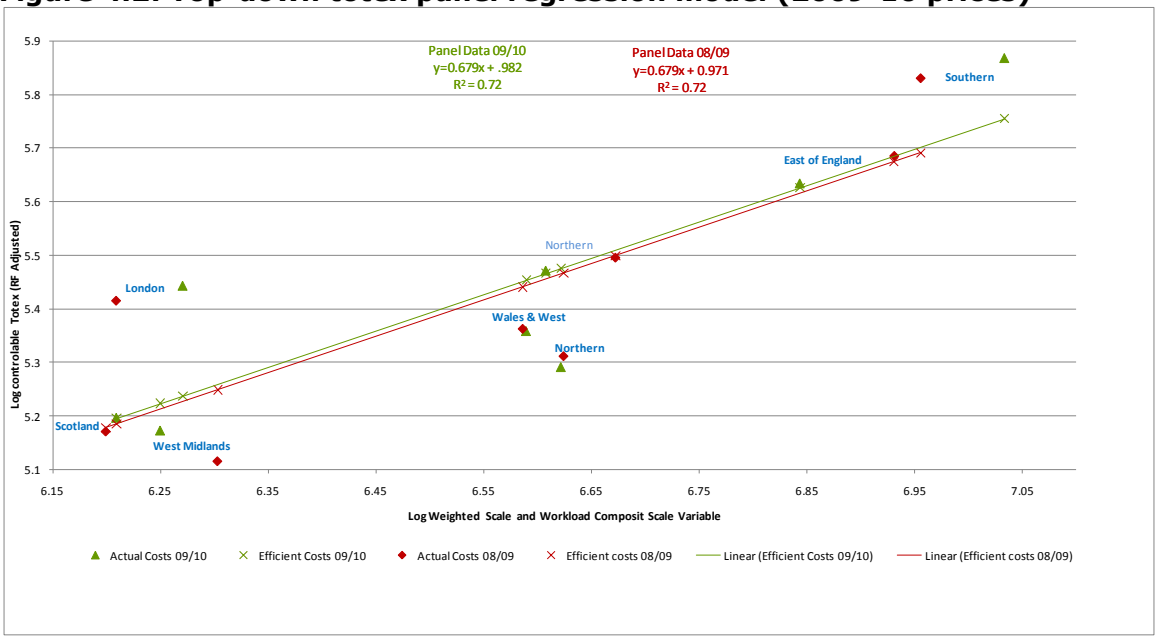
Initial totex cost assessment

4.46. We have carried out our initial totex cost assessment using two approaches.

- a top-down (a single totex model) approach, which uses aggregate totex costs in a single regression.
- a bottom-up (an aggregated totex model) approach, which comprises three separate regressions, one for each of the three components (opex, capex and repex) of totex. We calculated the totex efficiency scores as a ratio of total actual costs to the aggregated estimated costs of the three separate regressions.

4.47. The top-down results are presented in graphic format in Figure 4.2. The rankings for our two approaches are presented in Table 4.2.

Figure 4.2: Top-down totex panel regression model (2009-10 prices)



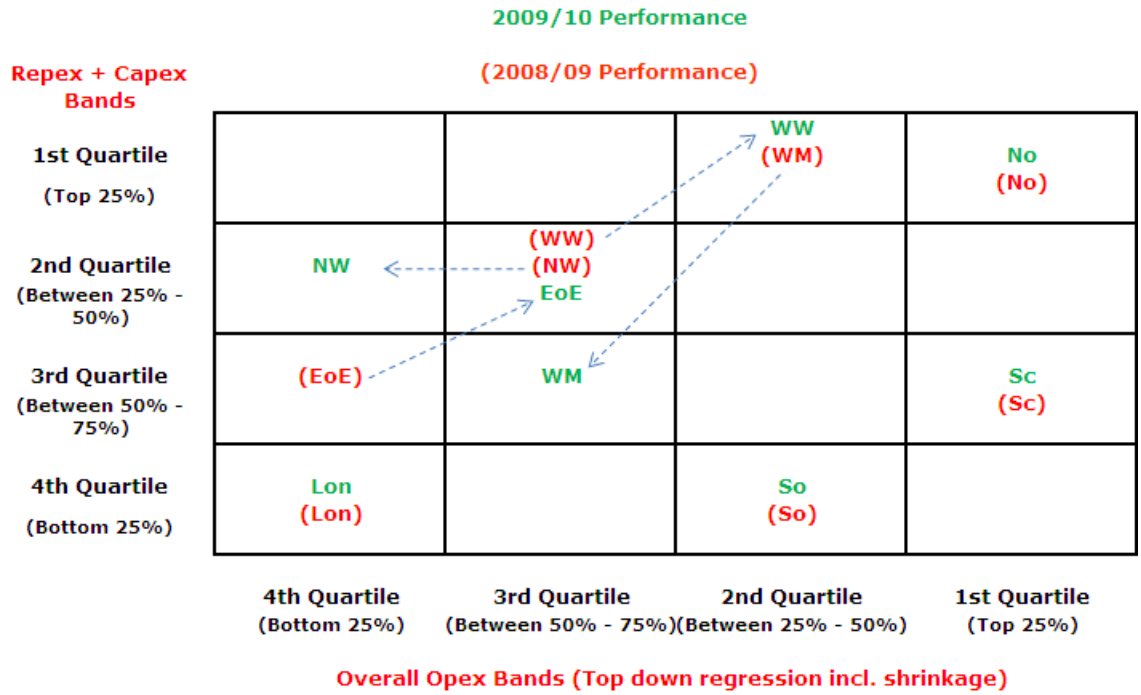
4.48. Tables 4.2 shows that the ranking for the two approaches is identical, with the exception of Scotland and the West Midlands where the ranking is switched across the two approaches.

Table 4.2: Cost rankings for top-down and bottom-up totex models

	Totex model		
GDN	Topdown	Bottom-up	Difference in ranking
East of England	6	6	0
London	8	8	0
North West	5	5	0
West Midlands	3	4	-1
Northern	1	1	0
Scotland	4	3	1
Southern	7	7	0
Wales & West	2	2	0

4.49. In the December document we set out the use of matrix analysis which considers the GDNs performance in multiple activities by providing an assessment of the capex + repex/opex trade-off. Figure 4.3 presents the updated 2008-09 and 2009-10 matrix assessment results for opex, capex and repex models. The arrows indicate the movement of the GDNs between quartiles from 2008-09 to 2009-10.

Figure 4.3: Relative GDN assessment for on repex/capex and total controllable opex - 2008-09 and 2009-10



4.50. The matrix identifies Northern as the lowest cost performer across capex/repex and opex and highlights they continue to be the frontier performing GDN in both years. Scotland and Southern are both ranked as first or second quartile for opex, but are high cost on the combined capex and repex assessment. WWU have shown improvement in both their capex/repex and opex relative performance between the two years. The companies' relative cost performance highlighted in the matrix assessment supports the totex results.

5. Direct operating expenditure

Chapter Summary
This chapter outlines our intended approach for assessing direct opex using our toolkit of assessment techniques, updated to take account of consultation responses. It also includes an updated assessment of the GDNs direct opex, using panel data analysis and revised regional factors.

Summary of consultation proposals

5.1. Our December document set out the overall trends in direct opex, by activity, showing the latest industry historical performance against the baselines for the first two years of GDPCR1. As part of this we recognised that there were inconsistencies in the reporting across the GDNs which had potentially distorted comparability. To address this we requested that the GDNs resubmit the RRPs for 2008-09 and 2009-10 based on improved guidance.

5.2. We set out in detail the performance of the GDNs in the four key areas of direct opex: work management; emergency; repairs; and maintenance. We proposed the removal of the revenue driver for loss of meterwork and changing the cost driver for repairs to include the risk associated with repairs. We also described a number of composite drivers for maintenance based on assets numbers, weighted by the number of annual maintenance hours per asset group.

5.3. We also provided details of how we intend to carry out regression analysis for historical efficiency and to assess the efficiency of RIIO-GD1 submissions. This included discussions of alternative cost drivers, combining or separating out activities and the use of panel data. We have carried out further development of the analysis in these areas, with support from the GDNs.

Consultation responses

5.4. In general the GDNs agreed with our approach for assessing direct opex in the companies' business plans although one GDN suggested that, due to the limited number of independent data points, the results of the regression analysis may have limited benefit. It suggested that more consideration should be given to economies of scale associated with different group structures.

5.5. Two of the GDNs believed that we should use both top-down and bottom-up benchmarking; with one stating that bottom-up should be used as a cross-check. The GDNs recognised the need for consistency of reporting to enable comparability of data, with one concerned about the limited time available to resolve these issues before the publication of this paper. They also recognised that robust and appropriate cost drivers are fundamental for regression analysis. In some cases GDNs suggested alternative cost drivers, such as a wider basket of drivers required

for routine maintenance and the use of data on number of repairs rather than reports for the repair regression (although one GDN disagreed with this). One GDN stated that if a suitable driver could not be found for the routine maintenance regression then it should be subject to expert review.

5.6. Two GDNs noted that we did not adjust the base data in the regressions for the non-labour regional factor adjustments applied in GDCPR1. One of these GDNs also believed a further adjustment should be made for TMA costs. Another GDN was concerned with the limited references to regional factors in the December document and believed that comparative analysis for regional factors should be sought from both high and low cost networks.

5.7. There was a mixture of views from the GDNs on our proposal to remove the loss of meter work revenue adjustment, but all stated that it was essential that GDNs were fully funded for providing the emergency service efficiently. A GDN highlighted that they are obliged to maintain an emergency service to meet the one and two hour response standards for uncontrolled and controlled escapes irrespective of the level of activity. Another GDN, whilst preferring a fully funded emergency service, suggested a move to an outputs based symmetrical incentive mechanism around a baseline level of performance. One GDN believed that the emergency regression is distorted as a result of loss of meter work and the GDNs affected are carrying higher costs. It suggested that the actual costs used in the emergency regression should be adjusted based on the loss of meter work revenue adjustment applied during GDPCR1. They felt that this would be the most robust, consistent and simple basis for such an adjustment.

5.8. One GDN suggested combining both emergency and repairs for benchmarking purposes as the two areas are inextricably linked and highlighted that GDNs have different points at which the two activities interface. Another GDN disagreed with this believing that combining them would be superficial and granularity would be lost. They suggested that an output measure for repairs that measures risk associated with gas escapes needs to be developed over the course of the next price control.

5.9. One GDN thought we should continue with the GDPCR1 approach of setting allowances based on the second best performer. They also questioned the fact that some R^2 values are very low and queried the functional form estimated. They noted that some of the residuals show patterns that suggest that the equation may be mis-specified. They highlighted that the regressions take the logs of both dependent and independent variables and questioned whether this is the correct approach and whether consideration should be given to alternative functional forms.

Latest thinking

Key messages

5.10. We intend to base our analysis of the efficient direct opex required by a network company primarily on our assessment of the forecasts in the company's future business plan.

5.11. We consider that our approach to analysing direct opex set out in the December document remains broadly appropriate. We will carry out a mixture of top-down and disaggregated activity analysis initially using three years' data but extending this as more data becomes available.

5.12. We have carried out significant work with the GDNs to refine the robustness of the data and address queries regarding comparability. We have updated our work on regional factors for direct and contractor labour to take into account the latest ONS and BCIS information. We consider that it is appropriate to apply only these regional factors at this stage. Where companies are shown to be higher cost, the onus will be on them as part of their well-justified business plans to provide evidence of specific factors that impact their costs and how they will address inefficiencies.

5.13. We have developed a number of new costs drivers and identified our preferred drivers for each activity. We have considered companies' concerns with our proposal to discontinue the revenue driver for loss of meterwork but think this mechanism provides perverse incentives. We propose to set an appropriate allowance for GDNs to meet their emergency obligations whereby they will need to take all reasonable steps to find alternative fill in work for emergency staff. We recognise that companies will not be able to fully offset the loss of meterwork but this will provide strong incentives for them to identify additional work for these staff under the information quality incentive (IQI) sharing factor.

5.14. Based on historical analysis, Northern and Scotland appear to be at the frontier in terms of direct operating activities, with NGG's GDNs the highest cost.

Approach

5.15. As part of our toolkit approach to cost assessment, we will use various methods to assess GDN forecasts. This will include benchmarking of top-down opex and the key opex activities, trend analysis, comparisons against historical cost, comparisons with other GDNs and with the submitted business plan. Our disaggregated analysis for each of the main opex activities will form a key part of this analysis.

5.16. We have run regression analysis for work management, emergency, repairs and maintenance using two years' historical data for 2008-09 and 2009-10 in panel data format. We will extend this to include 2010-11 when we receive the July 2011 submissions. We will also run the analysis on the companies' forecast submissions to

understand the appropriateness of their forecasts. Where it is appropriate to pool the data, we will use panel data techniques.

Development in the data

5.17. Since publication of the December document we have continued to work with the GDNs to improve the robustness of the regressions. We have done this by seeking to improve the consistency of reporting and therefore the comparability of data, making the adjustments to the primary cost data as suggested by the GDNs and developing alternative and more suitable cost drivers.

5.18. To help improve the comparability of data we have held various workshops with the GDNs and, with their agreement, improved the definitions for reporting as part of the RIGs. Following these workshops, we requested the GDNs resubmit their RRPs for 2008-09 and 2009-10. The new definitions will also be used to complete the RRPs for 2010-11 and for the submission of business plans for RIIO-GD1.

5.19. We have done further work to consider the appropriate normalisation adjustments to the resubmitted cost data to make the costs more comparable. We have considered the adjustments both individually and in combination. These have included:

- regional factors for direct and contract labour
- non-labour regional factors
- TMA adjustment
- loss of meterwork revenue adjustment.

5.20. We have also updated the regional factors for direct and contract labour as stated in Chapter 4.

5.21. Following the resubmission of the RRPs we were expecting to see a broadly similar ratio between GDNs for routine and non-routine maintenance. However, the ratios in this area range from between 1:1 to 5.7:1 for 2008-09 and 1:1.1 to 4.4:1 for 2009-10. As a result of these inconsistencies, we have carried out our benchmarking using total costs for maintenance.

5.22. We considered separating the work management regression into separate analysis for each of the four activities. However, the inconsistency in reporting across the GDNs would not allow any meaningful results.

Development of cost drivers

5.23. We have tested alternative drivers and different weightings for each of the regressions and, again, these have been shared with the GDNs. For each of the areas we have used scatter plots to consider the correlation between the costs and each of the cost drivers and where we plan to use CSV we have identified the appropriate

weightings using regression analysis. From this, we have found that the most appropriate and robust drivers are as follows:

- top-down - CSV of MEAV, PREs and total mains and service conditioned external reports
- work management – MEAV
- emergency - PREs
- repairs - total mains and service external condition reports
- maintenance – MEAV.

5.24. We have also tried to combine the emergency and repair regression using a CSV of PRE and external reports as a driver. This has produced a relatively good R^2, but we agree that the required level of granularity of the two activities would be lost and are not convinced that there is a good engineering argument to combine them.

Loss of meter work revenue adjustment

5.25. We have not been convinced that there is a requirement to continue with the loss of meter work revenue adjustment and will remove this for RIIO-GD1. We expect that as part of a well-justified business plan, the assumption for setting allowed revenue will be based on the efficient costs of the GDNs' activities including an efficient emergency service making best use of the labour time freed up from the loss of meter work. Additionally, the evidence provided by the GDNs will have to take into account the impact that the smart metering roll out may have on emergency workload and service alterations.

Revised analysis and view on costs

5.26. We have rerun our regression analysis following the resubmission of the RRPs for 2008-09 and 2009-10. We have also run a top-down regression for opex. The results of this analysis is set out in Figures 5.1 - 5.5.

5.27. We have applied adjustments using updated labour (direct and contract) regional factors as outlined in Chapter 4. We have not made any adjustment for non-labour regional adjustments used as part of GDPCR1. These additional allowances were £2.0m per annum for WWU, £1.0m for Scotland, £1.9m for London and £1.2m for Southern (2005-06 prices). These were awarded in light of the additional cost of operating the emergency service in the WWU region and in Scotland, and for London and Southern for both their emergency and repair activity. We have made no adjustment for TMA costs in the historical benchmarking as there appears to be an inconsistency in how the GDNs have reported these costs. We do not consider that it is appropriate to make adjustments for these other factors at this stage as the onus is on the companies to provide further justification of what adjustments are appropriate rather than for us to embed adjustments from GDPCR1 into our analysis.

5.28. As part of our benchmarking of forecast controllable costs we will include an adjustment for labour regional factors. GDNs will be expected to justify any non-labour regional factor in their business plan and justify any additional costs associated with streetworks in their regions. These should reflect costs associated with new legislation and should not be a result of local authorities applying strict use of previously existing legislation, unless GDNs can demonstrate the incremental change in costs over business as usual or a change of policy in applying the legislation.

Top-down

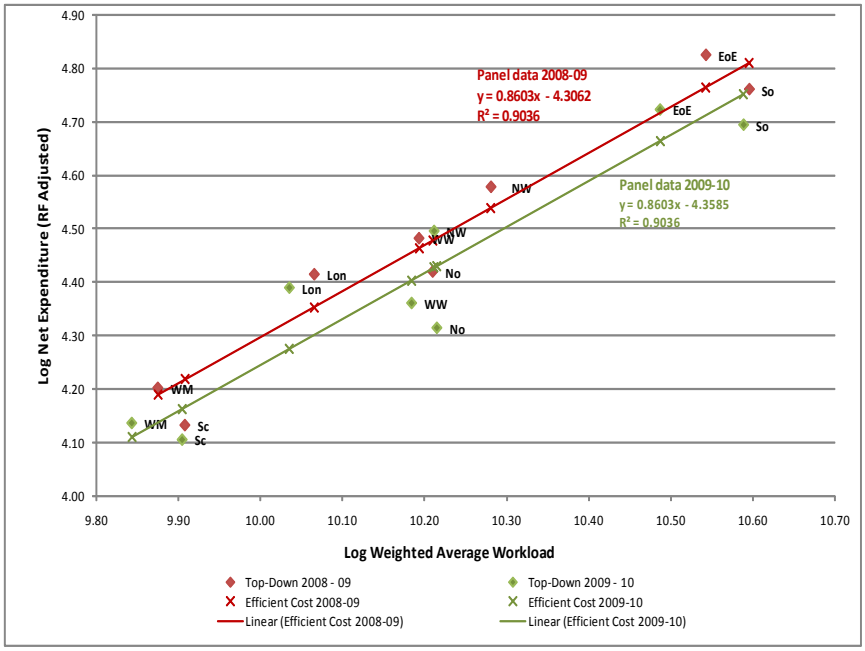
5.29. We have run a top-down regression on total controllable opex (direct and indirect) and shrinkage to address possible weaknesses of the bottom-up regressions and inconsistencies in cost allocation issues amongst the GDNs. In addition, we have removed the costs for the Scottish independent undertakings (SIU) for Scotland and for xoserve. The top-down regression measures the overall performance of GDNs based on their opex.

5.30. We have used alternative drivers from those used as part of the December document. We have used a CSV of MEAV, PREs and total mains and service external condition reports. We consider MEAV recognises the size, asset base and the complexity of the network. We think the number of PREs and total mains and service external condition reports are technically appropriate drivers which take into account a range of the GDN activities.

5.31. The top-down regressions indicate that there has been a decrease in opex for the industry over the past two years. Based on the panel data, Northern and Scotland appear to be the lowest cost GDNs for both years whilst, for 2009-10, London and North West appear to be the highest cost and, for 2008-09, London and East of England appear to be the highest cost.

Figure 5.1: Top down regression 2008-09 and 2009-10 (2009-10 prices)

	Panel Data Rankings	
GDN	2008-09	2009-10
EoE	7	6
Lon	8	8
NW	6	7
WM	4	5
No	2	1
Sc	1	2
So	3	3
WW	5	4



5.32. As part of the assessment of the GDNs business plans and forecast costs we plan to use panel data regression for top-down opex costs. We will expect the GDNs to explain any material movement in the costs in their business plans.

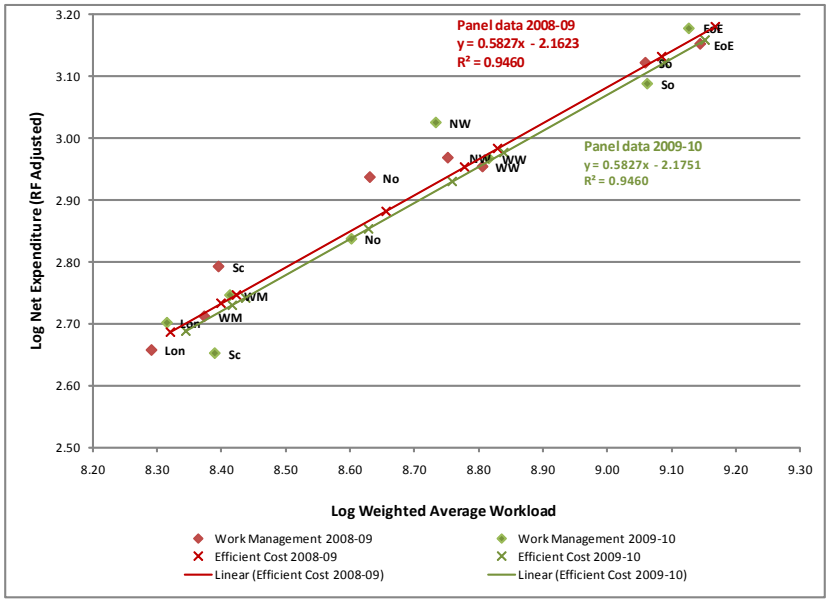
Work management

5.33. We have used MEAV as an alternative driver from the December document. This measures the size and complexity of the networks and we consider it a good driver of costs for the four work management cost categories. The regressions indicated that there is a strong relationship between the costs and the cost drivers for both years.

5.34. Work management costs have increased for all of NGG's GDNs and the WWU region over the two years and decreased for the remainder of the GDNs. This has caused significant movement in the rankings. Scotland and Southern appear to be the lowest cost GDNs based on panel data for 2009-10, with the North West and East of England the highest cost. For 2008-09 the lowest costs GDNs were WWU and London, with Northern and Scotland the highest cost.

Figure 5.2: Work management regression 2008-09 and 2009-10 (2009-10 prices)

	Panel Data Rankings	
GDN	2008-09	2009-10
EoE	3	7
Lon	2	6
NW	6	8
WM	4	5
No	8	3
Sc	7	1
So	5	2
WW	1	4



Emergency

5.35. We have used the number of PREs[7] as an alternative single cost driver. The number of PREs was considered an appropriate cost driver for emergencies as there is a direct relationship between the number of attendances at an emergency to the cost of providing the service. PREs as a cost driver worked well for both 2008-09 and 2009-10 and also increased the R^2 values for both years.

5.36. We considered the impact of loss of meter work on emergency costs as we recognise that the GDNs affected by this are carrying higher costs than those that are not. We tested the regression with an adjustment based on the revenue received from the loss of meter work revenue driver which was introduced in GDPCR1. However, this adjustment did not produce robust estimates and skewed the emergency costs significantly. As part of the business plans we expect the GDNs to justify any higher costs as a result of the stranded labour and how they have sought to mitigate these.

5.37. The new regressions indicate that there has been an increase in the costs of emergency for the industry, which relate to the impact of loss of meter work. Emergency costs have increased between 2008-09 and 2009-10 for all companies apart from Northern Gas Networks.

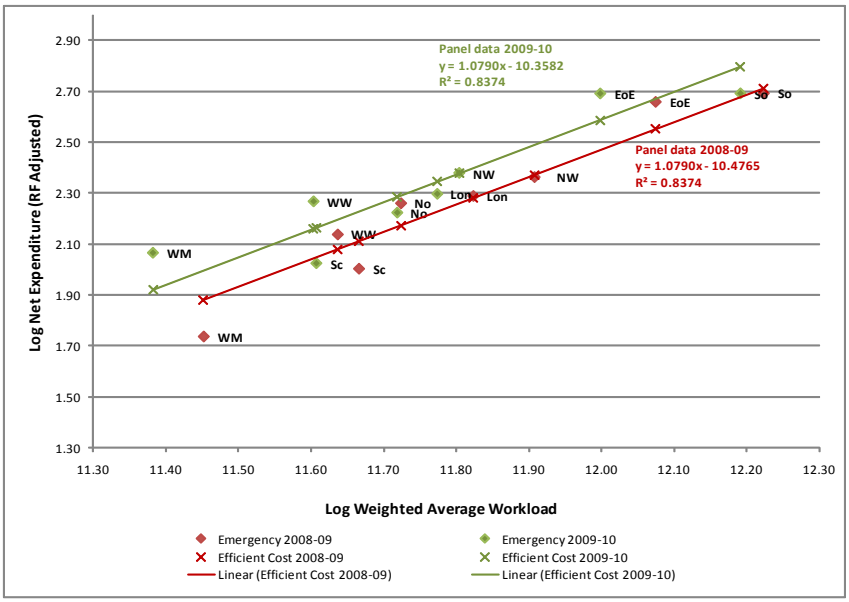
5.38. Scotland and Southern appear to be the lowest cost GDNs based on the panel data for 2009-10, with West Midlands and WWU the highest cost. For 2008-09 West Midlands and Scotland are the lowest cost GDNs, with East of England and Northern

7 PREs as defined in latest RIGs include external reports, internal reports, no trace and ingress of water incidents.

the highest cost. The movement between years in rankings can be attributed to the impact of loss of meter work, with Northern affected most in both years, although they have adapted to this well in 2009-10. The regressions do not take into account the higher cost that GDNs may be carrying. Some GDNs have demonstrated that they can find alternative activities for their stranded labour following the loss of meter work. During our cost visits, Northern highlighted that some of their stranded labour was used for repex purge and relights instead of using contract labour.

Figure 5.3: Emergency regression 2008-09 and 2009-10 (2009-10 prices)

	Panel Data Rankings	
GDN	2008-09	2009-10
EoE	8	6
Lon	5	4
NW	4	5
WM	1	8
No	7	3
Sc	2	1
So	3	2
WW	6	7



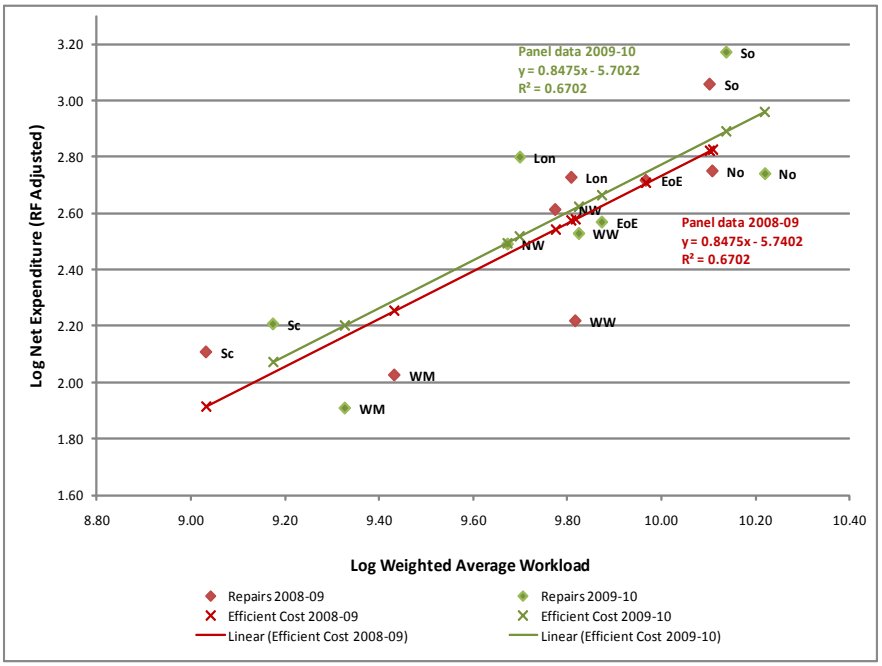
Repairs

5.39. We considered repair hours and the number of repairs as an alternative cost driver for the repairs regression. However, we are not satisfied that these have been reported sufficiently consistently to allow us to produce robust results. We believe that the use of a single driver of the total mains and service condition reports is appropriate for the repair activity as this drives the amount of repairs that may be required. We will seek additional information in the forecast template that will be submitted in July 2011 which will allow us to investigate the potential use of repair hours and/or the number of repairs.

Based on panel data the lowest cost GDNs appear to be West Midlands and Northern for 2009-10, and WWU and West Midlands for 2008-09. Southern and London are the highest cost for 2009-10 and Southern and Scotland for 2008-09.

Figure 5.4: Repairs regression 2008-09 and 2009-10 (2009-10 prices)

	Panel Data Rankings	
GDN	2008-09	2009-10
EoE	4	3
Lon	6	7
NW	5	5
WM	2	1
No	3	2
Sc	7	6
So	8	8
WW	1	4



Maintenance

5.40. As stated in the December document we had concerns over this regression. There was inconsistency in reporting between routine and non-routine maintenance costs. Following the resubmission we are still not convinced that these are being reported consistently and there is a material difference in how the GDNs view the definition for non-routine maintenance. We have therefore decided that, for the historical costs, we will run the regression based on total maintenance costs.

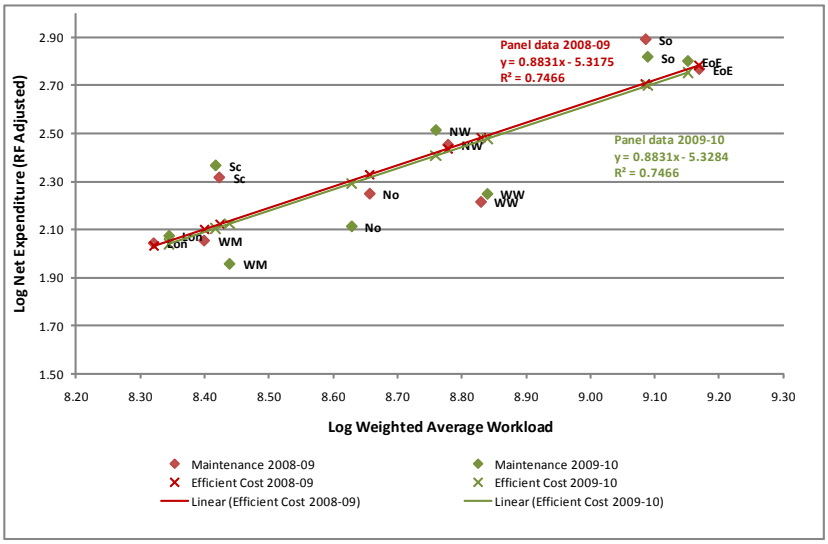
5.41. We were not satisfied with the original drivers and have decided to use an alternative driver of MEAV which represents the size and scale of the network that is being maintained. This has demonstrated a good fit for both years with significant R^2 values. We have taken account of the work done by NGG on the use of maintenance hours and will still consider using this as a driver if we can get a consistent set of information from the GDNs.

5.42. As part of the forecast we expect the GDNs to report total maintenance costs and highlight exceptional one-off maintenance costs. A clear definition of this will be given.

5.43. Total maintenance costs have increased for most GDNs except for Southern, Northern and West Midlands. Southern and Scotland appear the highest cost companies for both years based on panel data. WWU and Northern appear to be the lowest cost for both years.

Figure 5.5: Maintenance regression 2008-09 and 2009-10 (2009-10 prices)

	Rankings	
GDN	2008-09	2009-10
EoE	4	5
Lon	5	4
NW	6	6
WM	3	3
No	2	2
Sc	8	8
So	7	7
WW	1	1



Other direct activities

5.44. We will not be carrying out any regressions on other direct activities, but expect the GDNs to highlight and justify any material year-on-year movements in their business plans. We will look at trends and compare between GDNs any costs in this activity as a proportion of total direct opex.

Independent networks

5.45. We will carry out a separate assessment of the SIU.

6. Indirect Operating Expenditure/Business Support costs

Chapter Summary
This chapter sets out our latest thinking on the approach for assessing business support costs.

Summary of consultation proposals

6.1. In our December document, we set out our proposed approach for assessing indirect opex. This made the distinction between those costs that are required to support the overall business (business support) and those costs that support opex or capex activities (closely associated indirect costs). For gas distribution most of the closely associated indirect costs are within direct costs as part of work management. We outlined our intention to separate out business support costs and to assess closely associated indirect costs within direct opex.

6.2. Building on this separation, we proposed that the assessment of business support costs associated with transmission and gas distribution should be conducted in the same way to enable comparison across the group of transmission and gas distribution companies. In order to conduct the cost assessment, we proposed a combination of tools. These included the following tools.

- Historical trend analysis to look at performance against price control baselines and movements in costs over time. For example, it may be appropriate to compare the growth in such costs across sectors such as distribution and transmission.
- Regression analysis using a combination of historical and forecast data from the transmission and distribution businesses in relation to a selection of cost drivers (eg customer numbers, length of network, MEAV, total direct costs and total fixed and current assets from the regulated accounts, and employee numbers).
- The use of expert review from recognised specialists, particularly in relation to costs linked to IT and property.
- The use of standard metrics to benchmark against other external companies.

Consultation responses

6.3. We received a small number of comments in relation to our proposed approach for assessing business support expenditure. Respondents did not identify any additional categories of business support costs. They suggested that identifying appropriate cost drivers for business support costs within the transmission businesses was the key priority. They raised some concerns on the appropriateness of some of the cost drivers we had proposed (eg customer numbers, employee numbers) on the basis that they may not enable suitable comparisons between companies. In addition, one respondent expressed the view that there is no reason

why support costs per cost driver should be consistent across networks and highlighted that this could affect the ability to benchmark.

6.4. One respondent expressed concern regarding the consistency and normalisation of business support costs across networks, stating that robust processes are needed if meaningful comparisons are to be made between businesses. A number of respondents highlighted that differences in the definitions of business support activities in existing regulatory reporting structures would make cross-company comparison difficult.

6.5. There was general support for the proposal to engage specialist consultants to assist in the assessment of IT, telecommunications and property costs. The rationale for utilising specialist consultants to assess property costs was, however, questioned by one respondent. Also one GDN suggested that for property owned by the GDNs an assessment of the notional rental on those buildings should be included for benchmarking purposes.

Latest thinking

6.6. We have carried out further work to refine the business support activities set out in the December document. We consider the appropriate activities are:

- Information Systems and Telecommunications
- Property
- Human Resources and non operational training
- Finance and regulation
- Insurance
- Procurement (excluding stores and logistics)
- CEO and other corporate functions.

6.7. We will separately assess operational training, stores and logistics and ask the GDNs to identify these costs as we believe these follow more closely the direct costs of the network business. This is also consistent with the treatment of these costs within DPCR5.

6.8. In the business plan template guidelines, we have set out clear definitions for each activity. To ensure comparisons between network companies are valid we will collect all business support costs on a gross basis, ie before any capitalisation of costs and any other allocations. We have structured the business plan templates to collect business support costs in a required level of detail to perform the cost assessment. In order to have sufficient confidence in the numbers, we will be collecting the data on the basis of the new definitions for at least 2009-10 and 2010-11 through the 2010-11 RRP submissions.

6.9. We will adopt a similar approach for the assessment of business support costs for both transmission and gas distribution to enable comparison across the broader group of companies. We will use the same tools we set out in December. For

property costs we will consider the use of notional rent where the property is owned by the GDN for comparison purposes only.

6.10. With regard to cost drivers for business support activities we accept the comments made in relation to the use of customer and employee numbers. We will therefore focus more on the use of total direct cost, total assets and MEAV.

6.11. We will also use external benchmarking information for the various business support activities where the use of such data will enhance and improve our assessment.

6.12. In DPCR5 an in-sourcing/out-sourcing adjustment was made to account for the fact that companies may have differing business models. These differing models may mean that some business support costs or closely associated indirect costs that are directly incurred in one company may be incurred within a charge for contactors in another. We will determine a methodology for collecting information from transmission and gas distribution companies to make similar adjustments.

7. Capital expenditure

Chapter Summary
This chapter outlines our intended approach for capex activities and the approach for assessing the capex element of the companies' business plan submissions in line with the RIIO framework. The chapter also includes an assessment of GDNs' capex using panel data analysis and the revised regional factors detailed in Chapter 4.

Summary of consultation proposals

7.1. We outlined our proposed approach for assessing capex in the December 2010 document and outlined that this would be completed according to the four key cost categories: LTS and storage; mains reinforcement and governors; connections; and other capex.

LTS and Storage

7.2. We explained that at GDPCR1 we carried out a technical assessment of GDNs' business plan forecasts taking into account both the need for the investment to meet growing demand and the efficiency of the associated costs. We set out that we are looking to develop safety and reliability outputs and secondary deliverables linked to this area of expenditure, with the onus on the GDNs to provide appropriate output information in their business plans to justify their forecast costs. We explained that we would focus on the quality of evidence presented in the business plans, with consideration given to a more detailed review of a small number of specific projects.

Mains Reinforcement

7.3. We set out that at GDPCR1 we used regression analysis to develop baselines for reinforcement expenditure. We noted that mains reinforcement spend is sensitive to local network growth, and that GDNs have highlighted that this has triggered investment despite an overall downturn in annual demand growth. A relatively small reinforcement workload makes costs sensitive to individual projects and we set out options to improve our analysis.

Governors

7.4. We explained that at GDPCR1 we set baselines for governor expenditure through technical assessment. We noted that GDNs forecast continued spend in this sector, but expressed concern that there was little evidence to substantiate GDNs' early forecast expenditure given historical trends. We set out our expectation that GDNs should commit to delivery of outputs based on asset health indices, to justify forecast expenditure relating to asset integrity.

Connections

7.5. We explained the basis of how we set expenditure allowance at GDPCR1 and noted that GDNs' latest forecast figures were higher than we anticipated. As such, we set out we would be looking for GDNs to provide further evidence where they are forecasting increased capex and workload volumes for RIIO-GD1.

7.6. We proposed to assess companies' connection forecasts using regression analysis, comparing gross connections expenditure against a CSV taking into account the number of connections and mains length.

7.7. We noted GDNs' suggestions that individual higher value projects and fixed back office costs may distort regression analysis and suggested possible options to deal with this.

Other capex

7.8. We explained that in previous price control reviews we had used specialist consultants to assist us with the assessment of other capex, notably IT expenditure. We also set out that, where possible, we looked to identify opex savings which could be taken into account elsewhere in our analysis. We noted that output measures and asset health criteria are essential components of a well-justified business plan and that we would expect investments to be linked to the delivery of network outputs.

7.9. We proposed to carry out benchmarking using longer term historical levels of expenditure, especially where external drivers or legislation are cited as a reason for investment.

Consultation responses

7.10. There was broad support for our overall approach for assessing capex in the companies' business plans, using cost analysis and project specific review. However, there were some detailed comments and concerns with our general approach to cost assessment which are discussed in our overview chapter. Responses on this area were limited and most of the comments made were in support of the proposals in the December document.

7.11. Respondents commented on issues concerning the linkage of capex to output measures. One respondent expressed concern over the appropriateness of asset health indices in relation to IT projects, and set out that asset health indices may not be in place for the beginning of RIIO-GD1. They also pointed out that capex investment might not directly reduce opex but may prevent future opex increases.

7.12. One respondent acknowledged the appropriateness of linking LTS and storage capex with demand forecasts, but pointed out that the threshold of reinforcement will differ between networks.

7.13. Recognising the benefits of taking a holistic approach to investment in the pipeline networks, one respondent suggested that Ofgem should take in to account cost efficiencies gained by considering upsizing replacement mains as solutions to reinforcement.

7.14. In relation to connections activity, one respondent agreed that back office costs should be considered separately, with a volume driver in respect of the physical connections activity. Similarly, another respondent supported the removal of higher value projects (more than £50k) including medium pressure (MP) and intermediate pressure (IP) connections, from the regression analysis.

7.15. Two respondents expressed concern with linking capex to relevant outputs, citing examples such as vehicles, tools, plant and IT systems for which this would not be appropriate. One suggested that IT capex and IT opex should be assessed together to consider the capitalisation and organisational issues that distort the analysis.

Latest thinking

Key messages

7.16. Whilst the feedback on our December document was limited, there has been ongoing consultation with GDNs focussing on our cost assessment techniques, in particular with regards to regression analysis for the connections and reinforcement activities. We have tested ideas put forward to improve cost analysis and have decided to adopt methods which we believe bring benefit. These are explained in more detail in the development of cost drivers section below.

7.17. Having received broad support for our proposals to assess capex as set out in our December document, we will assess forecast business plans in line with those proposals.

Approach

7.18. We will assess GDNs' capex forecasts using a range of qualitative and quantitative methods as described in Chapter 1.

7.19. We have used regression analysis for assessing connections and reinforcement costs using two years' historical data for 2008-09 and 2009-10. We will extend this to include 2010-11 when we receive the July 2011 submissions. We will also run the

analysis on the companies' forecast submissions to compare forecast and historical costs.

7.20. For activities common across various cost areas, we will make comparisons between them, taking into account justifiable differences in unit costs. The construction of new services, eg, is carried out for new connections, for replacement in conjunction with mains replacement policies and to restore supplies following emergency repairs. We will follow a similar approach for mains laying and governor construction activities.

7.21. We expect forecast business plans to show how proposed capex links with primary outputs or secondary deliverables. We acknowledge that linking some areas of capex to outputs may be difficult. However, any proposed investment not linked to a commitment to deliver specific outputs will be subject to a high level of scrutiny and may compromise our decision to fast-track GDNs or support funding requests.

7.22. We will consider using technical assessment of individual projects by independent consultants to verify the robustness of evidence provided. Recognising that strategic investment provides benefits in other cost areas, we will look to identify benefits across other areas of the forecast plans.

7.23. We expect GDNs to provide evidence that they have appraised suitable alternatives, including national transmission system (NTS) investment where appropriate, to show that an optimum solution has been selected.

7.24. A key element of evidence for forecast levels of connections, reinforcement and LTS activity will be forecast demand growth, informed by realistic views of the new connections market and other technical and economic factors. We will pay particular attention to the robustness of this evidence and its general consistency between GDNs. We will consider referring to external information if GDN demand forecasts appear significantly inconsistent or we lack confidence with information submitted.

LTS and storage

7.25. We will examine GDNs' proposals against project justifications within the business plans, which should identify a link to measurable outputs. The evidence may include demand forecasts for load-related investment, which we would expect to be based on information sufficiently robust to justify the level of expenditure. Similarly, investment to improve asset integrity should be appropriately linked to asset health and reliability outputs, as well as asset criticality.

7.26. Business plans should also set out the overall diurnal storage strategy across all pressure tiers, demonstrating the need for investment and the cost efficiency of the proposed solution.

7.27. GDNs are expected to submit evidence that a proportionate level of appraisal of potentially suitable alternative solutions has been made; including any feasible NTS based capacity solutions, together with an explanation for selecting the preferred option.

7.28. We will require details of the GDN's approval documentation, together with any subsequent approvals for increased project spend, to support the proportionate assessment of high value projects from inception to completion. High level details of project costs will be incorporated into the forecast business plan template.

7.29. We will consider carrying out specific project reviews to assess high value projects (typically those in excess of £0.5m) to enable us to achieve a clear view on both the need for the investment and the efficiency of the proposed expenditure. We recognise that investment triggers will be specific to the unique requirements of individual networks.

Mains Reinforcement

7.30. Reinforcement investment is driven by the need to construct additional capacity to meet general demand growth or growth brought about as a direct result of the connection of specific new loads on the lower pressure tiers. We recognise that the need for investment depends on the growth of localised demands, which is not necessarily proportional to total network demand growth. We expect the level of forecast investment to be clearly justified by economic or other factors impacting on this activity.

7.31. Additional capacity can be delivered through the construction of new assets, upsizing or upgrading replacement assets, managing system pressures or a combination of these options. GDNs are expected to appraise, on a proportionate basis, all available alternatives to achieve additional network capacity.

7.32. As part of their appraisals, GDNs may take into account the adverse environmental effects of increased leakage resulting from elevating system pressures, and the efficiency advantages to be gained from developing a capacity strategy in conjunction with other capital projects and replacement programmes. We will assess reinforcement alongside mains replacement, pressure management and other investment areas.

7.33. Our quantitative cost assessment will be undertaken primarily using regression analysis, plotting cost against a weighted work volume driver.

Governors

7.34. We intend to continue to assess governor expenditure by technical review, to achieve a view of the need for the investment and the efficiency of spend. We would expect any repex to be linked to a commitment to deliver measurable reliability or

safety outputs or secondary deliverables. Compliance with internal policies will not automatically be accepted as the sole justification for expenditure.

7.35. New governor installations constructed to provide additional network capacity will, as with mains reinforcement, require evidence of the need for investment and associated cost efficiency.

Connections

7.36. Our cost assessment will be undertaken using regression analysis, plotting cost against a work volume driver taking in to account mains and services workload.

Other capex

7.37. IT, pressure profiling, leakage control equipment, gas conditioning, liquefied natural gas (LNG) facilities, tools, vehicles, plant, land and buildings represent areas of investment in this category. IT and vehicles represent the higher value elements.

7.38. We consider IT investment to be a key enabler for driving further efficiencies in other cost areas. IT related forecast capex and opex spend will be assessed together, taking into account the balance between capex and opex of IT systems.

7.39. IT expenditure may be linked to outputs in terms of legislative requirements, economically justified safety or environmental risk improvement, customer satisfaction, or a reduction in expenditure in other areas, for example business support costs.

7.40. We recognise the advantages achieved through economies of scale that may impact on IT expenditure, and are considering the extent to which this effect may be taken in to account in our assessment of forecast costs. We may achieve an understanding of the effect of economies of scale by identifying fixed and variable cost elements.

7.41. As proposed, we will call upon independent technical advisors to assess the need and efficiency of capex and associated opex in relation to IT.

7.42. For vehicle related capex, we will use trend analysis by comparing historical and forecast costs, and making inter-GDN comparisons.

Development of cost drivers

Connections

7.43. GDNs have suggested that the inclusion of fixed back office costs may distort regression analysis, and we have examined the effect of removing these costs from the analysis to isolate direct activity costs. We found that this did not improve the robustness of the regressions. Additionally, we are not confident that the reported back office costs and associated workloads are consistent and accurate having observed a wide range of values that have not been explained by the GDNs. We also note that back office costs as a proportion of the overall activity cost are relatively low, at an average of 5.2 per cent over the two years. We therefore see no merit in using this analysis.

7.44. GDNs have indicated that high value projects are atypical and can distort regression analysis, so we have examined the effect of removing reported projects over £50k from the analysis. Again this showed no improvement in the regression and we do not, therefore, intend to adopt this approach going forward. However, we do recognise the need to understand the detail of projects which GDNs consider atypical and request that they provide details in terms of pressure tier and project scope. We may still consider their impact on analysis and give consideration to the exclusion of specific projects from regression analysis to assess them separately. We have tested the removal of both back office costs and high value projects together in our analysis, but do not observe any benefits. We intend to use total activity costs, subject to adjustment for any atypical elements, in our assessments going forward.

7.45. We will consider the cost assessment of connections mains and services separately, to facilitate comparisons across different cost areas as described in paragraph 7.20.

7.46. Moving forwards we will review whether a driver comprising of mains laid, number of connections undertaken, and the synthetic cost values that support it, remain appropriate.

Reinforcement

7.47. GDNs have suggested that individual atypical mains reinforcement projects may distort regression analysis, and that work in progress (WIP) may affect the accuracy of individual years' assessments because of difficulties aligning annual cost with work volumes. We have observed a significant improvement in the analysis by removing the costs of one very high value atypical project which did not have any reported workload associated with it due to the timing of cost reporting and workload being misaligned. However, the removal of all projects based on a nominal value of £0.5m showed no benefit. We therefore intend to include all projects in the regression analysis apart from those we identify as being genuinely atypical based on the details collected in the business plan template or projects that are justified as

being truly atypical by the GDNs. Such projects will be subject to separate technical assessment.

Regional factors

7.48. For the purposes of cost analysis, we have adjusted regional factors for labour (direct and contract) as outlined in Chapter 4. This has been used in our revised analysis of GDN performance and the methodology will be used in the business plan analysis.

Other changes

7.49. Following concern regarding the more irregular spend and the adverse effects of WIP we are moving towards the use of panel data using 2008-09 and 2009-10 data. We will extend this to include 2010-11 when we receive the July submissions.

Revised analysis and views on costs

Reinforcement

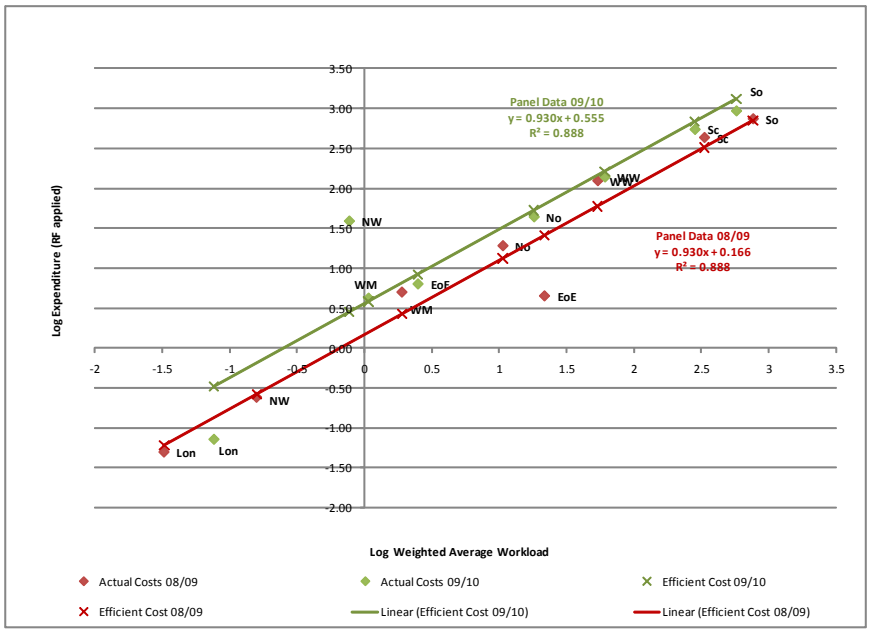
7.50. The regression graph below shows reinforcement mains costs against workload using panel data for the resubmitted 2008-09 and 2009-10 figures, using the revised regional factors detailed in Chapter 4.

7.51. The lowest cost GDNs are the East of England and London for 2008/9 and 2009/10 respectively, and the highest cost companies are WWU and North West for 2008-09 and 2009-10. This is consistent with the analysis reported in the December document which used GDPCR1 regional factors for direct and contract labour, and without using panel data.

7.52. A high value project in the North West, reported with no workload is included in this analysis, as discussed in paragraph 7.47. Removing the project costs for the regression changes GDN's ranking. Where required, we expect to remove projects which distort the regression, however in moving to panel data, we expect such anomalies to be minimal.

Figure 7.1: Total mains reinforcement gross capex against weighted workload (2009/10 prices)

	Panel Data Rankings	
GDN	2008-09	2009-10
EoE	1	3
Lon	2	1
NW	3	8
WM	7	7
No	6	5
Sc	5	4
So	4	2
WW	8	6



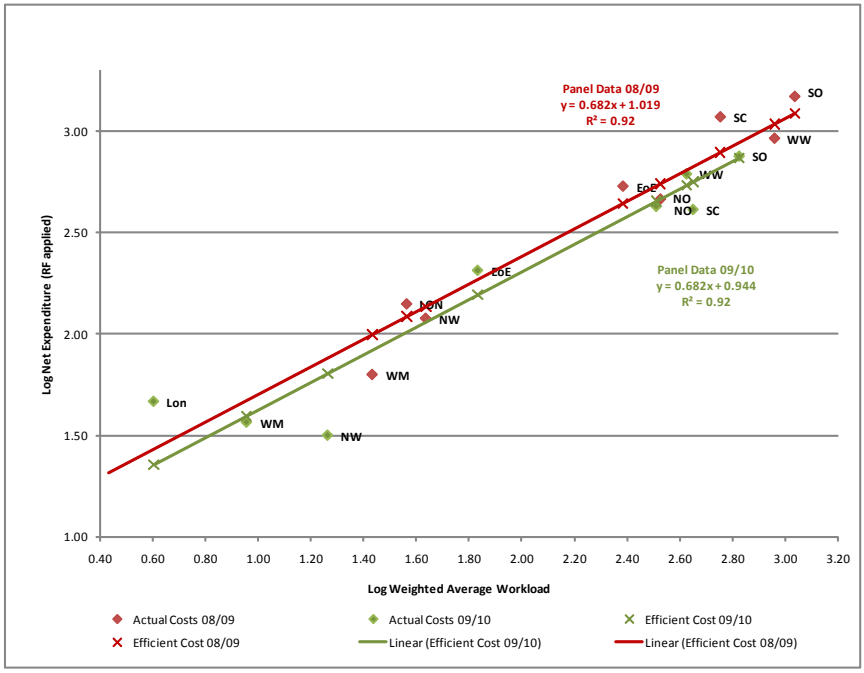
Connections

7.53. The regression graph below shows connections cost against workload using panel data for the resubmitted 2008-09 and 2009-10 figures with revised regional factors detailed in Chapter 4.

7.54. The lowest cost GDNs are West Midlands and North West for 2008-9 and 2009-10 respectively; previously this was WWU for 2008/09 in the regression presented in our December document which used GDPCR1 regional factors for direct and contract labour and without using panel data. The highest cost GDNs are Scotland and London for 2008-9 and 2009-10 respectively, consistent with our previous regression analysis.

Figure 7.2: Total connections gross capex against weighted workload (2009/10 prices)

	Panel Data Rankings	
GDN	2008-09	2009-10
EoE	7	7
Lon	5	8
NW	4	1
WM	1	3
No	2	4
Sc	8	2
So	6	5
WW	3	6



8. Replacement expenditure

Chapter Summary
This chapter outlines our intended approach for repex and our plans for assessing the repex element of the companies' business plan submissions in line with the RIIO framework. This chapter also includes an updated assessment of the GDNs repex, using panel data analysis and revised regional factors. Details of our proposed outputs and incentives for replacement expenditure are set out in Chapter 9 of our supplementary Annex - Outputs and incentives.

Summary of consultation proposals

8.1. In our December document we set out the overall trends in repex for each of the GDNs. This showed the latest industry historical performance against the baselines for the first two years of GDPCR1. It also showed the GDNs' initial forecast against the baselines for the remainder of price control and their high level forecast for the first five years of RIIO-GD1.

8.2. We highlighted that we would continue to benchmark mains and service repex using regression analysis comparing costs against a weighted workload driver for lengths of mains of different diameters that were abandoned and different types of service work.

8.3. We also set out proposals to move from a revenue driver for repex based on mains abandoned to a driver based on risk removed. Our latest thinking on this is set out in Chapter 9 of the supplementary Annex - Outputs and incentives.

8.4. We indicated that we are expecting the GDNs to provide further evidence on asset health in relation to multi-occupancy building (MOB) supply infrastructure replacement that would allow us to consider supporting forecast expenditure in this area.

8.5. Finally, we stated that we will not be providing further funding in RIIO-GD1 for LTS repex projects that formed part of our baseline allowances for GDPCR1, as the GDNs will have already received benefit from deferral. We explained that we will be looking for the GDNs to provide robust evidence for all LTS repex projects planned during RIIO-GD1 to support both the need for investment, the timing for completion and the efficiency of spend.

Consultation responses

Iron mains replacement programme

8.6. With regard to the HSE enforced iron mains replacement programme, there was general support for our proposals to set allowed revenues with respect to risk

removed. There were some detailed comments surrounding the mechanism by which this could be applied, with specific concerns over the effects of the dynamic nature of risk and the different positions between GDNs with regards to their risk profiles.

8.7. There was support from one respondent with respect to the proposal to adopt a risk removed approach across a wider scope of network assets including steel mains and for the incentive to take into account the potential future use of the network. However, some GDNs expressed concern associated with the difficulties that risk assessment of other assets would present.

8.8. One respondent believed that the current methodology already captures risk removed through the link between mains abandoned and risk removed. Their argument was based on the fact that any new techniques to reduce the cost and speed of installation is still some time away. The GDN also expressed concern surrounding difficulties in calculating risk on assets other than iron mains.

8.9. One respondent expressed concern that any changes to the approach taken as a result of the current HSE/Ofgem review of iron mains replacement may lead to difficulties in incorporating the change in time for their business plans in July 2011.

8.10. One respondent expressed concern that the repex cap over the whole control period could fail to recognise the higher costs associated with larger diameter mains, and dynamic variations in the diameter profile of the pipes to be replaced, which are driving a significant increase in the cost. The GDN also believed that the fixed cap constraint could have the effect of increasing the total costs across consecutive price controls because it would drive the development of less cost efficient mains replacement projects. One respondent questioned the move to a risk removed revenue driver, on the basis that the network is dynamic in nature and the risk changes during the price control period, there are different starting levels for each GDN, and there is a non-linear relationship between cost and risk.

8.11. One respondent emphasised that incentives should enable the GDNs to replace mains in the most efficient way over the long term, as opposed to the current year only. Another noted that benefits including safety, reliability and the environment should be reflected together in a revenue driver.

8.12. Two GDNs proposed that the incentive should be calibrated for drivers that feed into the mains risk prioritisation system (MRPS) but are outside of the GDNs' control, such as the weather impact on failures. One of these GDNs recommended the inclusion of non safety factors, such as reliability, as well as evidence of network deterioration.

Cost assessment

8.13. In terms of cost assessment, two respondents expressed their general agreement with the regression approach followed in GDPCR1 and the use of workload

volume as a driver to assess efficiency and set allowances. Both GDNs also suggested that low-volume, high-cost projects (eg LTS) should continue to be assessed on an individual basis.

8.14. These two GDNs also acknowledged the importance of normalising the expenditures for regional factors over those set out in the BCIS data which are focused on direct labour and contract labour rates. One noted that the additional costs incurred due to the impact of the TMA should be removed from the regression.

8.15. Another GDN, agreed with using workload volume as a driver but suggested that the separation of mains and services costs is difficult to achieve and could lead to inaccurate results. The GDN suggested combining allowances for mains and services.

Services

8.16. One GDN stated that the allowances provided for service relays following emergency and meterwork in GDPCR1 were both too low, and that this needed to be addressed in the next price control.

LTS

8.17. With regards to our approach for non-delivered LTS repex projects during GDPCR1, one of the GDNs stated that disallowing spend in the next control, that has been allowed in current control, is not the right approach. They stated that part of the outperformance results from exposure of alternative solutions, including work deferral where justified, and the resultant underspend can be used to offset overspends in other areas. However, if further expenditure is required in subsequent controls, then this should be allowed for as otherwise there is asymmetric treatment and this defeats the idea of the IQI.

Latest thinking

Key messages

8.18. We will adopt a set of various techniques in assessing the GDNs forecast expenditure in relation to repex. This will range from assessing the evidence in the companies business plans, unit cost and regression analysis, with consideration also given to other business areas, the performance of which is directly linked to the mains replacement programme. A time series approach will be used to compare each GDN's future performance to its known historical performance, whereas a panel data approach will be used to compare GDNs' performance.

Revised analysis and cost assessment

8.19. Similarly to GDPCR1, we will be reviewing the GDNs proposed length of mains to be abandoned, and the proposed lengths of mains to be laid during the RIIO-GD1 period which will allow us to estimate and compare the GDNs abandonment ratio. We will estimate the unit costs of mains laid by diameter band using the GDNs' forecast expenditure and compare this to historical information and across GDNs.

8.20. We will continue carrying out regression analysis to assess the performance of the GDNs based on a weighted average workload driver that combines volume laid and number of services, similarly to GDPCR1. Other options that we are currently considering include running the regression excluding the costs and associated workload of larger diameter mains (greater than 355mm), due to the volatility of the unit costs among the GDNs above this band level and the relatively low volume of mains laid associated with them. We are also reviewing the option of benchmarking the performance of the GDNs on mains and services replacement independently.

8.21. Given our latest approach of setting a primary output and associated expenditure based on the cost of removing risk from the network, we will be looking for the GDNs to demonstrate that consideration has been given to the least cost way of doing so. In other words, the GDNs may need to consider alternative ways of removing risk that will be more cost effective compared to abandoning a main. We are considering comparing the forecast unit cost per risk removed of each GDN. We acknowledge that potential limitations might exist in using such analysis as the GDNs are on different points of their risk profile curves. To overcome this limitation we will explore the possibility of normalising the risks before carrying out the assessment.

8.22. We expect the GDNs to highlight in their well-justified business plans any associated benefits in other business areas that arise as a result of carrying out the mains and service replacement programme. As an example, we would expect to see reduced level of costs in delivering the maintenance and emergency services activities under opex. We would also expect reduced levels of shrinkage, as a result of the safety and environmental benefits of the programme. This may be evident through reduced number of PREs, fractures, gas in buildings (GIBs), or incidents.

8.23. We will continue to assess LTS repex projects on a project specific basis We will be looking for the GDNs to provide robust evidence for all LTS repex projects planned during RIIO-GD1 with additional evidence to support both the timing and need for the project. Where there is significant uncertainty associated with large LTS projects it may be appropriate to set a fixed ex ante baseline together with a trigger that allows the company to access funding if the work goes ahead.

8.24. In relation to our approach for the non-delivered LTS repex projects during GDPCR1, we have considered the GDN’s response, but we do not intend to provide further funding in RIIO-GD1 for LTS repex projects that formed part of our baseline allowances for GDPCR1. The only exception will be where the GDNs can appropriately demonstrate that they have offset this deferral by delivering additional

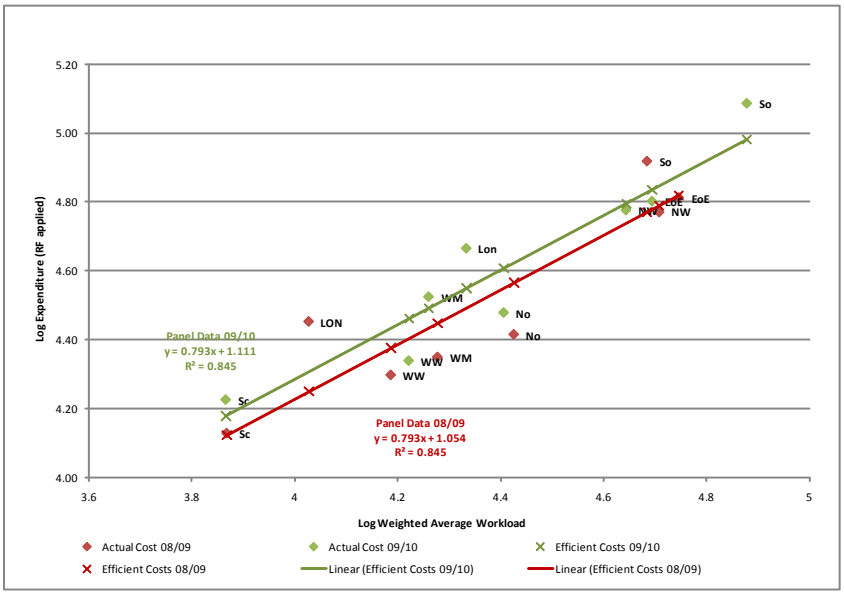
outputs in other areas that have an equivalent benefit to this work. For RIIO-GD1 we expect to put in place specific outputs relating to large LTS repex projects that are included in the baseline. If the companies do not deliver the work, they will be expected to deliver it in the following period without any additional funding.

8.25. Figure 8.1 presents the revised regression results for 2008-09 and 2009-10. Compared to our December document, the regression has been updated using panel data analysis, with the updated labour (direct and contract) regional factors as outlined in Chapter 4, as well as a revised cost and workload allocation for the Service Relay Domestic Meterwork activity. This analysis therefore resolves a previously reported inconsistency.

8.26. We have not made any adjustment for non-labour regional factors provided to London and Southern as part of GDPCR1 or additional TMA costs incurred. The onus is on the companies to provide appropriate evidence and quantification of company specific factors that are relevant for their areas. As can be seen, the impact of the updates in terms of the GDNs rankings has been minimal, with Northern and WWU continuing to show the lowest costs of delivery relative to workload. Southern and the London GDN show the highest costs.

Figure 8.1: Replacement expenditure regression 2008-09 and 2009-10 (2009-10 prices)

	Rankings	
GDN	2008-09	2009-10
EoE	5	3
Lon	8	8
NW	4	4
WM	2	5
No	1	1
Sc	6	6
So	7	7
WW	3	2



Appendices

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Appendix 1 - Total expenditure analysis

Calculation of direct labour and contract labour regional factor indices8

1.1. As part of the analysis of historical data we have calculated direct and contract labour indices for both London and Southern GDNs based on a methodology used in GDPCR1. However, unlike the GDPCR1 approach which used only London as a high cost region, we have identified and used two high cost regions, London and the South East. We have applied a single weighted average, based on population numbers, to all other regions excluding London and the South-East, so that the national average is equal to one. This group of regions (ie all regions of England, Scotland and Wales excluding London and South East) is referred to as Elsewhere in this section.

1.2. We estimated work that should be done by London and Southern GDNs:

- within the London region area
- within the South East region area
- elsewhere.

1.3. Our view is that only work needing to be done locally should be done within the relatively high cost region. We estimated a GDN's percentage share of work:

- done in a specific region, and
- needing to be done locally.

1.4. We used population estimates published by the Office of National Statistics (ONS) to proxy work done. We assumed that a region's population share of the GDN's total population is proportionate to the work done by the GDN in that region as illustrated in Appendix Table 1.1.

Appendix Table 1.1: Estimation of work done in a specific region

Example of computation of a GDN's work done in a region							
GDN	Total Population '000	Population in London Re	Populatio in SE Region	Population elsewhere '0	% population in london r	% population in SE regio	% population elsewhere
London	5,000	3,500	1,000	500	70%	20%	10%
Southern	10,000	3,000	6,000	1,000	30%	60%	10%

8 The data used in the illustrations of this appendix are hypothetical.

1.5. We estimated work needing to be done locally by assuming that 40 per cent of work management needs to be done locally, while 100 per cent of each of the remaining direct opex cost activities needs to be done locally as illustrated in Appendix Table 1.2.

Appendix Table 1.2: Estimation of a GDN's work needing to be done locally

Cost activity	GDN's normalised direct opex (£)	% of work needing to be done locally	Costs needing to be incurred locally (£)
Work Management	20.0	40%	8
Emergency	10.0	100%	10
Repairs	20.0	100%	20
Maintenance	10.0	100%	10
Other Direct Activities	2.0	100%	2
Total	62.0	81%	50
*Other Direct Activities less Xoserve and Opex TMA			
London example			
Work needing to be done in London region	0.70 x 0.81	0.56	
Work needing to be done in SE region	0.20 x 0.81	0.16	
Work to be done Elsewhere	1 - 0.56 - 0.16	0.27	
Regional Factors			
London Region Index	1.25	1.25 x 0.56	0.71
South East Region Index	1.08	1.08 x 0.16	0.17
Elsewhere Weighted Average Index	0.96	0.96 x 0.27	0.26
London GDN Index			1.14

1.6. We calculated the London (1.25) and South East (1.08) regions' indices for contract labour as an average of building construction, road construction, Social housing construction, and public sector indices based on data from:

- the Quarterly Review of Building Prices published by the Building Construction Information Service (BCIS),
- Building Information Service (BIS) Tender Price Index of Road Construction,
- BIS Tender price Index of Social Housing, and
- BIS Tender Price Index for Public Sector.

1.7. We calculated the weighted average contract labour index for Elsewhere as illustrated in Appendix Table 1.3.

Appendix Table 1.3: Calculation of contract labour index for elsewhere.

Region	Population (millions) (a)	Weight (b) = (a)/total (a)	Average BCIS & BIS indices (c)	Elsewhere index (d) = Average(c) x (b)
North East	2.5	0.06	0.95	0.05
North West	6.9	0.16	0.99	0.16
Yorkshire & Humber	5.5	0.13	0.97	0.12
East Midlands	4.5	0.10	0.94	0.10
West Midlands	5.4	0.12	0.95	0.12
East	5.8	0.13	0.96	0.13
Wales	3.0	0.07	0.96	0.07
Scotland	5.2	0.12	0.95	0.11
Southwest	5.2	0.12	0.95	0.11
Total	44.0	1.00		0.96
Average			0.96	

1.8. We calculated the London (1.25) and South East (1.08) regions' indices for direct labour using the mean wages data published by the Office of National Statistics (ONS) in the Annual Survey of Hourly Earnings (ASHE). The GDNs provided us with a list of work professions/skills categories that are relevant to the gas distribution industry. We then calculated London and the South East regions' indices as illustrated in Appendix Table 1.4. We gave an equal weighting to each occupational category used in the analysis.

Appendix Table 1.4: Calculation of direct labour regional factors for London and Southern GDNs

Occupational category	UK Mean Wage (a)	London Region Mean Wage (b)	South East Region Mean Wage (c)	London region indices (d) = (b)/(a)	South East Region Indices (e) = (c)/(a)	London region factor (f) = (d) x 0.56	South East Region factor (g) = (e) x 0.16	(h) = Elsewhere factor 0.96*x 0.27	Absolute index (i) = (f)+(g)+(h)	Occupational weights (j)	Weigthed index (k) = (i) x (j)
A	34,462	51,414	41,969	1.49	1.22	0.84	0.19	0.26	1.29	0.20	0.26
B	38,753	52,787	43,790	1.36	1.13	0.76	0.18	0.26	1.20	0.20	0.24
C	34,490	37,217	34,677	1.08	1.01	0.60	0.16	0.26	1.03	0.20	0.21
D	33,535	37,041	34,567	1.10	1.03	0.62	0.16	0.26	1.04	0.20	0.21
E	23,097	32,000	28,000	1.39	1.21	0.78	0.19	0.26	1.23	0.20	0.25
Total										100%	1.16
* 0.96 is the weighted average index for Elsewhere											GDN Index

1.9. We calculated the direct labour indices for each Elsewhere's region as illustrated in Appendix Table 1.5, and then computed a weighted average index for Elsewhere as illustrated in Appendix Table 1.3.

Appendix Table 1.5: Calculation of direct labour regional factors for an elsewhere region

Occupational category	UK Mean Wage (a)	Elsewhere Region's Mean Wage (b)	Elsewhere Region's indices (c) = (b)/(a)	Occupational weights (d)	Elsewhere Region's Weigthed index (e) = (c) x (d)
A	34,462	33,414	0.97	0.20	0.19
B	38,753	36,787	0.95	0.20	0.19
C	34,490	27,217	0.79	0.20	0.16
D	33,535	31,041	0.93	0.20	0.19
E	23,097	22,000	0.95	0.20	0.19
Total				100%	0.92

1.10. We used the indices for London and Southern GDNs, and set the other GDNs to the Elsewhere weighted average. We then standardised the GDN's indices by dividing them with the industry average as illustrated in Appendix Table 1.6.

Appendix Table 1.6: Standardisation of GDNs' indices

GDN	Regional factor index	Standardised regional factor index
East of England	0.96	0.93
London	1.16	1.13
North West	0.96	0.93
West Midlands	0.96	0.93
Northern	0.96	0.93
Scotland	0.96	0.93
Southern	1.10	1.07
Wales & West	0.96	0.93
Industry average	1.03	1.00

Criteria for selecting our regression models

1.11. We intend to use the following criteria to evaluate the regression models:

- The goodness of fit of the models (see below).
- Qualitative information on the quality of data we have for cost drivers and other explanatory variables that fed into the models. For example, if the data for an explanatory variable is known to be of poor quality (eg a rough estimate made by the companies) then we may prefer an alternative model which does not suffer from this deficiency.
- The functional form of the model must make intuitive sense – ie the form of the relationship between the costs and the drivers must be plausible.
- The magnitude and sign of the estimated coefficients must make sense – the interpretation of these coefficients must be consistent with our knowledge of the sector.
- The estimated relative efficiencies must be plausible – based on the activity there is a reasonable range within which costs can be expected to vary for efficiency reasons.
- The statistical test results (see below).

Measures of goodness of fit

1.12. Measures of fit tell how well an estimated model fits the actual data. Any measure of goodness of fit will only tell us how well the model fits the data – it does

not indicate whether a model should be used or not. Our ultimate aim is to estimate relative efficiency – the more inefficiency present, the less well our models will fit the data – there is no target level for the goodness of fit. While it is desirable to explain the differences between companies that are not as a result of differences in efficiency, the model selection process should not rely on only maximising the goodness of fit. The other model selection criteria listed above are just as important and should not be overridden.

1.13. The most common used measure is R-squared. It measures the proportion of the variance of the dependent variable that is explained by the explanatory variables in the model.

1.14. The value of R-squared ranges from 0 to 1. It is 0 if the only explanatory variable is a constant term and 1 when all variations in the dependent variables are accounted for by variations in the explanatory variables making the regression residuals all equal to zero. R-squared can thus be thought of as a measure of how well the model performs compared to a simple model with just a constant term.

1.15. R-squared however has some limitations that must be noted. A comparison of R-squared is only meaningful when the dependent variables are the same. To compare models with different dependent variables (eg costs and log of costs) it is necessary to put them on like terms and compare how well they both predict costs.

Statistical tests

1.16. Ofgem developed a number of statistical tests in co-operation with its academic advisor for the panel data models that we estimated by Ordinary Least Squares for DPCR5. These tests provide an indication of the robustness of the modelling results and also indicate where some of the outputs from the regressions might be biased and require an adjustment to avoid misleading results. We shall investigate the outcome of the statistical tests and make appropriate adjustments. We shall also use the results from these tests to feed into our judgement in identifying the best models. The tests are:

- White test for heteroscedasticity, to ensure robust inference,
- F-test for a constant cost driver coefficient over time,
- Ramsey RESET test for model misspecification,
- Jarque-Bera test for normality, and the
- Standardised residuals test for outliers.

1.17. These tests including the respective hypotheses tested are briefly discussed below.

White test

1.18. When an OLS regression is run it produces estimates of the standard errors for each of the coefficients in the model. These standard errors are a measure of the

uncertainty surrounding the estimates produced. These estimated standard errors can be used to perform hypothesis tests on the coefficients from the model. However, these standard errors will be biased and the results of any hypothesis tests will be misleading if there is:

- Serial correlation: this occurs when the residuals from the regression are not random over time. For example, a positive residual in one period might typically be followed by another positive residual in the next period.
- Heteroscedasticity: this typically occurs when the variation in the residuals is very different over time. For example, if the residuals were very large in magnitude in some periods compared to others then we might think that the spread of residuals was not constant which would be an indication of heteroscedasticity. We have used the White test to check whether the variation in residuals is constant.

1.19. We test for heteroscedasticity because any violation of this might be an indicator of a more general model misspecification. The White test examines whether the residual variance of the variable in the regression model is constant (homoscedasticity). If there is evidence of variation in the residual variance (heteroscedasticity) it implies that the standard errors of the coefficients (and therefore any hypothesis testing) are biased.

F-test for a constant cost driver coefficient (slope)

1.20. The F-test examines whether the slope coefficients for the different years are statistically similar or different. If they are similar, then the data can be pooled over the given years because it has similar characteristics. If they are statistically different then there is no justification for pooling the data.

Ramsey RESET test

1.21. The Ramsey Regression Equation Specification Error Test (RESET) is a general test for model misspecification. For example, the test might identify:

- Incorrect functional form - some or all of the variables (ie the costs and the driver) should be transformed to logs, powers, reciprocals, or in some other way.
- Correlation between the driver and the residuals, which may be caused, among other things, by measurement error in the driver.

Jarque-Bera test

1.22. The Jarque-Bera test is used to test whether the residuals are consistent with a normal distribution. Normality of residuals is not a necessity, but it is an indication of a well behaved model.

Standardised residuals test

1.23. The standardised residuals test is used to test for outliers. An outlier is an observation that is different to the others in a dataset and has influence over the entire dataset's characteristics. In terms of regression analysis, variation in the data is necessary to carry out estimation. However, outliers can have a disproportionate impact (influence or leverage) on the sign, size and statistical significance of estimated coefficients. Therefore, outliers can make models perform worse in terms of overall fit and standard errors. In efficiency analysis, outliers may skew the efficiency score in such a way that leads to a wrong and potentially unachievable industry frontier.

1.24. Nevertheless, it is important not to exclude an outlier unless its values can be attributed to measurement error instead of a chance of occurrence that reflects the underlying model. Effectively, the detection of an outlier provides a basis for investigating the data further, instead of excluding that observation.

1.25. Ofgem is concerned about data being misreported or being derived from different allocation methods, which make costs/drivers non-comparable. In addition, because Ofgem's comparative analysis is undertaken in order to set an efficient level of expenditure, an extreme observation is bound to significantly influence the outcome of the price level set when it skews the efficiency scores on which the analysis is based. Therefore, there is justification on these grounds to identify outliers and devise means of handling them.