Commerce Commission

Information Disclosure:
Approaches for Understanding EDB and GPB Cost Efficiency

Technical Paper for Consultation

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CONTENTS

GLOSSARY OF TERMS, ABBREVIATIONS AND DEFINITIONS

Abbreviation	Definition
AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
AMP	Asset Management Plan
Capex	Capital Expenditure
COLS	Corrected Ordinary Least Squares
DEA	Data Envelopment Analysis
EDBs	Electricity Distribution Businesses
FERC	Federal Energy Regulatory Commission
GDBs	Gas Distribution Businesses
GPBs	Gas Pipeline Businesses
GTBs	Gas Transmission Businesses
ID	Information Disclosure
MED	Ministry of Economic Development
NZ	New Zealand
OLS	Ordinary Least Squares
Opex	Operating Expenditure
Part 4 Purpose	Purpose of Part 4, as set out in s 52A of the Act
SFA	Stochastic Frontier Analysis
TFP	Total Factor Productivity

EXECUTIVE SUMMARY

X.1 This paper sets out our thinking to date on approaches for assessing EDB and GPB cost efficiency for the purpose of undertaking summary and analysis of information disclosed under Part 4 of the Commerce Act. We invite interested parties to comment on these approaches and the associated issues as well as the information required to assess cost efficiency. These submissions will inform our setting of draft information disclosure requirements.

X.2 Direct comparisons between suppliers have been used widely in a regulatory context to assess operating expenditure (opex) efficiency. At this stage, we consider that comparisons with other EDBs or GPBs are the most appropriate approach to assessing relative opex efficiency. Based on our preliminary assessment summarised in this report, we consider that:

- there are enough EDBs to enable comparisons of EDB opex between NZ suppliers; and
- international or sub-company data is likely to be required to assess GPB expenditure.

X.3 To help ensure comparisons are on a like-for-like basis, the analysis needs to take into account the drivers of opex across the industry, as well as any supplier-specific factors which affect costs and are outside management control in the short to medium term. This will help ensure that a supplier is not identified as inefficient when in fact the higher costs observed are due to environmental factors outside management control.

X.4 Based on our preliminary assessment we consider that in contrast to opex, comparisons of historic capital expenditure (capex) across suppliers are likely to play a more limited role in our summary and analysis. We consider that the preferred means to assess both EDB and GPB capex is to use a combination of unit capex comparisons and engineering-based assessments of the quantity of activity proposed.

X.5 Experience from other regulators shows that the development of robust models for assessing cost efficiency takes time and requires repeated iterations involving extensive industry input. The views presented in this paper are preliminary and do not provide a definitive view of our approach to examining expenditure. Instead, this paper merely represents a first step in developing approaches to assessing EDB and GPB costs, and identifying the drivers of expenditure and thus the information required to enable a useful comparison of costs.

SECTION 1 INTRODUCTION

Purpose of this Paper

1.1 The purpose of this paper is to:

- set out our thinking to date on approaches for assessing EDB and GPB efficiency, for the purpose of undertaking summary and analysis of information disclosed under Part 4 of the Commerce Act; and
- invite interested parties to provide comment on the appropriate approach to assessing cost efficiency, and the information needed to enable such assessments.

1.2 Approaches for assessing Transpower's cost efficiency are not specifically covered in this paper. However, many of the approaches discussed may be applicable when examining Transpower's expenditure.

1.3 Responses to this paper will inform our draft decisions on the data to be collected through information disclosure. We are currently developing draft information disclosure requirements for EDBs and GPBs, and expect to release draft determinations in December 2011.

1.4 The purpose of information disclosure regulation is to ensure that sufficient information is readily available to interested persons to assess whether the purpose of Part 4 is being met.[1] The Commission is required to summarise and analyse the information disclosed 'for the purpose of promoting greater understanding of individual regulated suppliers, their relative performance, and the changes in performance over time'.[2] A comparison of expenditure across operators and an examination of cost trends will address part of this requirement.

1.5 Through analysing performance and publishing the results, we aim to increase the information available to interested persons, including regulated suppliers, on sector performance. Among other things, disclosing information about the relative performance of regulated suppliers should:

- assist regulated suppliers in identifying good practice in different areas of their business;
- facilitate and reveal improvements in sector performance over time;
- provide valuable insight into the efficiency of suppliers, and thus the impact of Part 4 regulation.

1.6 In addition to assessing cost efficiency, we are also considering our approach to assessing other areas of supplier performance, to enable interested persons to assess whether the Part 4 purpose is being met. We will seek feedback from interested parties on our approach in relation to other areas of performance (such as profitability, pricing and revenues, quality, and investment and innovation) in due course.

Structure of this Paper

1.7 The remainder of this paper is structured as follows:

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[1] For example, interested persons need information to assess whether a supplier is managing its assets for the long term, achieving efficiencies in their business, and sharing these efficiencies with consumers.

[2] Commerce Act 1986, s 53B.

- Section 2 outlines a proposed process for reviewing supplier costs;
- Section 3 discusses potential approaches to assessing operating expenditure (opex) efficiency and data requirements;
- Section 4 outlines an approach to reviewing capital expenditure (capex) efficiency and data requirements;
- Section 5 discusses potential opex-capex trade-offs and outlines possible approaches for taking these into account;
- Section 6 discusses next steps, including the process for submissions on this paper;
- Appendix A provides an overview of precedent in the use of relative efficiency analysis in regulated electricity and gas sectors;
- Appendix B summarises cost drivers identified in previous reviews of EDB and GPB cost efficiency.

Next Steps

1.8 We invite submissions from all interested parties on the views contained in this paper. Submitters should focus on the questions set out in shaded boxes throughout the paper. Section 6 of this paper sets out the timing and process for submissions, and provides a full list of the questions we ask submitters to focus on.

1.9 In parallel with the submissions process, we plan to establish a small, focussed reference group(s) to provide technical assistance to the Commission as we develop specific information requirements that will enhance understanding of supplier performance, including in the area of cost efficiency.

SECTION 2 PROCESS FOR ASSESSING EXPENDITURE

What is Cost Efficiency?

2.1 An assessment of cost efficiency assists in identifying the scope for a firm to reduce its expenditure while maintaining the same outputs (e.g. GWh of electricity supplied or GJ of gas conveyed) and quality. In regulated sectors, assessments of expenditure often use other suppliers in the sector as a benchmark (comparative efficiency assessments).

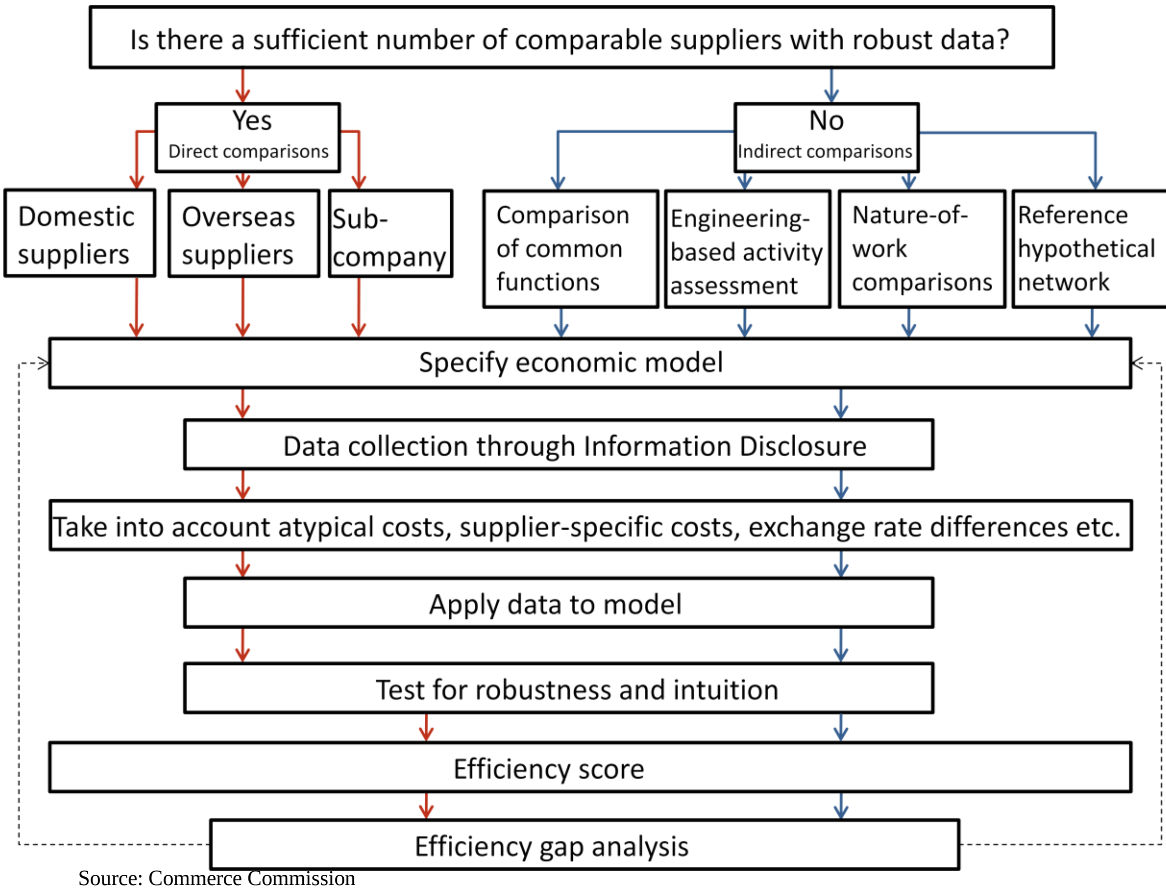
2.2 However, expenditure may vary across EDBs and GPBs for a number of reasons, including the size of their network, customer composition and geography, as well as differences in efficiency.

2.3 When assessing the comparative efficiency of suppliers, it is important to account for these factors so as not confuse inefficiency with differences in operating circumstances that are outside management control in the short to medium term.

Process for Assessing Cost Efficiency

2.4 Figure 1 outlines a process for assessing cost efficiency, including potential approaches and techniques based on direct and indirect comparisons. We discuss the steps in this process below.

Figure 1 Process for assessing cost efficiency



Source: Commerce Commission

2.5 Where there is a sufficient number of EDBs or GPBs (direct comparators) and where the data for these suppliers is considered to be robust, direct comparators may be used to provide an assessment of comparative cost efficiency. Direct comparators may include domestic and/or overseas suppliers, as well as sub-company comparisons (e.g.

regions or pipelines within the same supplier). A supplier may also be compared against itself over time when assessing cost trends.

2.6 Indirect comparisons may be appropriate if direct comparators cannot be identified or if suitable data is not available. Such comparisons may also provide useful cross-checks for the results from direct comparisons.

2.7 Potential indirect approaches include comparisons of common functions (e.g. human resources) with benchmarks from other industries, and engineering-based assessments of the level of activity proposed. These are discussed in more detail in sections 3 and 4.

2.8 An assessment of cost efficiency requires the specification of the economic model. This is a theoretical model of the costs subject to an efficiency assessment and the different drivers of these costs. The model specification is based on economic and engineering theory and network insight. This is translated into simplified quantitative models which can be estimated using the available information on direct or indirect comparators. One of the key requirements is that the model must be able to explain the variation in costs across EDBs and GPBs, and over time (if considering several years' of data).

2.9 As illustrated in Figure 1, once the approach and economic model have been determined, the next step of the cost efficiency process is to collect the necessary cost and network data. In the context of the New Zealand regulatory regime and the energy sector, the vehicle for collecting this data is information disclosure. Adjustments to costs may be required to account for atypical costs (e.g. storm damage), differences in purchasing power for a dollar spent (if using international data), and for supplier-specific costs that cannot be captured in the model.

2.10 The specified model and approach is then applied to the data. If adopting a direct comparisons approach, there are a number of techniques that may be used to compare suppliers based on the economic model specified. These are briefly discussed in section 3.

2.11 It is important that the models are thoroughly tested prior to making any conclusions about the efficiency of a supplier. This may include statistical testing and economic and engineering intuition checks. The efficiency scores produced by the model then need to be reviewed and any identified efficiency gaps interpreted.

2.12 This review should also assess the sensitivity of the results to the assumptions in the model (e.g. using alternative cost drivers) to help identify whether the gap is attributable to inefficiency, or whether there may be unexplained factors, outside a supplier's control, which may account for differences in costs. If such a factor is identified, the modelling and benchmarking process would then be repeated taking this factor into account. This may include re-specifying the economic model, using additional information or re-specifying information disclosure requirements. The process for assessing efficiency is therefore iterative and can be expected to be refined over time (as indicated by the two dotted arrows in Figure 1)

SECTION 3 ASSESSMENT OF OPERATING EXPENDITURE

3.1 Based on our preliminary assessment we propose, where possible, to undertake assessments of EDB and GPB opex relative to other EDBs and GPBs respectively. The use of direct comparators will help to make comparisons on a like-for-like basis. The choice of comparator will be largely determined by data availability and quality, and whether suppliers operate under similar circumstances (e.g. similar market conditions). The assessment would use current year and potentially previous years' data, where available.

NZ Suppliers

3.2 There are currently 29 EDBs in the New Zealand electricity distribution sector. This is likely to provide a sufficient number of direct comparators to allow comparative efficiency techniques to be applied to EDBs in a given year and over time (see paragraph 3.22 for a brief discussion of these techniques).

3.3 There are only three regulated GDBs and two regulated GTBs. Multiple years' of data would be required to allow an assessment based on the quantitative techniques described below to be applied robustly to NZ data.

Q.1 How much insight would an assessment of operating expenditure based on NZ comparators alone provide, for EDBs and for GPBs?

Overseas Suppliers

3.4 The limited number of domestic GDBs and GTBs may mean that assessments of relative performance using statistical techniques may not be valid and insights from comparing suppliers may be limited. Comparisons with international gas pipeline services may expand the number of comparators and insights gained. International comparisons may also provide additional insight for EDBs.

3.5 Previous studies of GPB cost efficiency and productivity, including those commissioned by the Commerce Commission, have included international comparators from the Australian and North American energy sectors (see Appendix A for a summary of these studies).

3.6 Cost and network characteristics data for United States gas and electricity utilities is available in Federal Energy Regulatory Commission (FERC) datasets and has been used in a number of international benchmarking studies.[3] This dataset includes financial information and a number of gas and electricity network statistics such as plant capacity, number of customers and length of pipes. Although this data has been widely used in comparative efficiency assessments, the quality of this data is unclear.[4]

[3] See FERC *Form No. 1* filings for data on major electricity utilities and *Form No. 2* for major natural gas pipeline utilities information.

[4] See Jamasb, T., Newberry, D., Pollitt, M. and Triebs, T., *International benchmarking and regulation of European gas transmission utilities,* 2006.

3.7 Comparisons of Australian and New Zealand supplier costs have previously used a variety of Australian data sources, including Access Arrangement Investigation filings.[5] However, the author of these studies has noted that the data suffers from a number of issues, including inconsistency in reporting definitions across operators, a focus on forecast rather than historical data, and a lack of annually reported data.

3.8 The Australian Energy Market Commission (AEMC) has recently recommended that the Australian Energy Regulator (AER) facilitate regulatory data collection to enable benchmarking of Australian EDBs and GPBs.[6] This may provide a robust dataset against which to benchmark the New Zealand suppliers in future.

3.9 We anticipate that the proposed AER benchmarking dataset would provide valuable insight into the relative performance of GDBs and GTBs. This dataset may also be used for benchmarking EDBs. However, it is not yet known when this dataset will become available or what information will be collected. Until this information becomes available, comparisons with United States GPBs using FERC data may be appropriate. We could also consider any ad-hoc Australian GPB data that becomes available in the future, outside of the proposed AER dataset, as well as any other international data. For reasons discussed in paragraph 3.7 above, we do not propose to use historical Australian data.

Q.2 How insightful could international comparators be in assessing EDB and GPB expenditure?

Q.3 What companies, countries or datasets should be included in the analysis?

Sub-company Comparisons

3.10 Another option is to benchmark costs at the sub-company level (e.g. by region or pipeline/circuit). This would increase the number of comparators available and allow costs to be benchmarked both within and across companies. Sub-company comparisons would require a supplier to have discrete pipelines or regions managed separately within its business, and costs to be allocated consistently across different areas or pipelines, as well as network characteristic data by area/pipeline.

3.11 Examples of sub-company level analysis include:

- Royal Mail (UK) which does not have domestic comparators of similar scope. An assessment of the overall efficiency of Royal Mail was formed by benchmarking the approximately 1300 delivery offices and 70 mail centres against each other.[7]

[5] See for example Economic Insights, *Assessment of data currently available to support TFP-based network regulation*, 9 June 2009; and Meyrick and Associates, *Comparative benchmarking of gas networks in Australia and New Zealand*, 14 May 2004.

[6] Australian Energy Market Commission, *Review into the use of total factor productivity for the determination of prices and revenues*, June 2011.

[7] LECG, *Future efficient costs of Royal Mail's regulated mail services: Internal benchmarking final conclusions*, January 2006.

- Benchmarking of individual routes has been considered in the United Kingdom for assessing the efficiency of the national rail infrastructure operator Network Rail.[8]

3.12 We are interested in exploring the potential to undertake sub-company comparisons, particularly for GPBs where there are only a limited number of direct NZ comparators. The practicality of using sub-company comparisons will depend, in part, on the cost effectiveness of collecting this data.

Q.4 How appropriate are sub-company comparisons of costs?

Q.5 How feasible and costly would it be to collect sub-company cost and characteristic data to enable sub-company comparisons?

Specification of an Economic Model

3.13 The use of direct comparators requires the specification of an economic model of costs and cost drivers. This should specify those costs to be benchmarked, and those that should be excluded, for example because they are deemed to be outside the supplier's control (e.g. local body rates). The model should also include industry-wide factors which affect costs but are outside management control. This may include factors which are constant or relatively stable over time (e.g. topography), and cost drivers which vary year to year (e.g. electricity distributed or gas conveyed). The model may also include measures of quality to account, in part, for any cost-quality trade-offs.

3.14 It is important that the cost drivers included in the model are, to the extent possible, outside management control (in the short term) so as not to provide incentives for suppliers to distort the results of the benchmarking exercise.

3.15 Cost adjustments may also be required to account for supplier-specific costs that cannot be captured in the model.

3.16 The specification of the economic model requires careful consideration. Unless correctly specified, there is a risk that the model may identify a firm as inefficient when in fact the higher costs observed are due to environmental factors or company characteristics outside the supplier's control (e.g. climate or geography).

3.17 The current EDB information disclosures contain disaggregated cost data and data on a number of potential cost drivers, many of which have been used in previous benchmarking studies. Based on preliminary comparisons of EDB costs, it is likely that additional cost driver information is required to understand the observed variation in EDB opex.

3.18 The New Zealand gas sector is subject to information disclosure, but to date the Commerce Commission has not released detailed requirements. Instead, GDBs and GTBs provide limited financial and network statistics data based on the Ministry of Economic Development's (MED) requirements. This includes information on system length, number of customers, total amount of gas conveyed, pipe size, interruptions, and maximum monthly flow.

[8] Office of Rail Regulation, *Periodic review 2013: Establishing Network Rail's efficient expenditure*, July 2011.

3.19 Appendix B lists the EDB and GPB outputs and network characteristics identified as cost drivers in previous studies, and the equivalent data (where available) from the current information disclosures.

Q.6 What factors (outside management control) drive industry wide opex?

Q.7 To what extent does the current information disclosure data capture these factors?

Q.8 What cost drivers, if any, (outside management control) are unique to your EDB or GPB?

Q.9 To what extent does the current information disclosure data capture these factors?

Q.10 What factors (other than changes in input prices) influence opex over time?

Q.11 To what extent should quality be taken into account when assessing cost efficiency?

Comparative Efficiency Techniques

3.20 There are a number of possible techniques for assessing opex relative to other suppliers. These are generally relatively simple and well understood techniques that can take into account supplier characteristics such as scale, population density and topology, which impact on costs and which tend to be largely outside management control.

3.21 These techniques depend on a good understanding of the economic and engineering characteristics of suppliers and the correct translation of these into a quantitative model, as well as the quality of data used in the modelling. Inconsistent and incorrect data may undermine the value of this type of analysis.

3.22 Potential comparative efficiency techniques for assessing different aspects of performance include unit cost ratios, index numbers, regression analysis, comparisons of actual and forecast costs, and techniques such as Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). These techniques have been used by a number of regulators throughout the world to assess the expenditure of regulated suppliers. There is therefore a substantial amount of research available, and a number of models have been successfully developed to explain the variation in costs across suppliers (see Appendix A for examples of these models and their application in the energy sector).

3.23 Our aim at this stage is to work with the industry to obtain a better understanding of the key cost drivers and reasons for cost differences between suppliers (i.e. the economic model) rather than to explore the alternative benchmarking techniques. The choice of technique will depend on the amount and quality of data available, and the cost effectiveness of the technique.

3.24 Under Part 4, total factor productivity (TFP) analysis is used to determine the long-run average productivity improvement rate when setting the DPP (the ‘X-factor’). It also could be examined as part of summary and analysis. However TFP is based on longer-term trends and assessments of year-on-year movements are unlikely to be very insightful. We intend to use the information disclosures to collect the necessary annual data to enable a periodic calculation of TFP.

Level of Aggregation of Assessed Opex

3.25 Different components of opex have different drivers. While an analysis of total opex may provide an overall assessment of suppliers' relative cost efficiency, this high level aggregation could make it difficult to identify the drivers of expenditure. This may limit the potential to explain the differences in expenditure across suppliers and over time. A more disaggregated analysis of specific opex categories would enable drivers of individual costs to be identified, and thus better explain differences in cost across suppliers.

3.26 The current EDB information disclosures include the following categories for operating expenditure:[9]

- general management, administration and overheads;
- system management and operations;
- routine and preventative maintenance;
- refurbishment and renewal maintenance;
- fault and emergency maintenance;
- pass-through costs;
- other.

3.27 The GPB information disclosures do not provide this break-down.[10]

Q.12 What level of opex should be assessed? Should the current sub-categories of EDB and GPB opex (e.g. general management, administration and overheads) be separately assessed, should further disaggregated cost data beyond these categories be collected and assessed, or should the analysis focus on total opex only?

Q.13 What components of opex should be separately benchmarked?

3.28 As shown in Figure 1, there are a number of indirect comparisons that may be used to assess cost efficiency, either as an alternative or a complement to direct comparisons. Here we discuss two approaches which may be appropriate for assessing opex efficiency.

External Comparisons of Common Functions

3.29 Costs of individual business functions may be compared with regulated utilities and operators in other industries who share a set of common functions.[11] This may include sectors not subject to regulation.

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[9] Commerce Commission, *Electricity Distribution (Information Disclosure) Requirements 2008*, 31 October 2008.

[10] Gas (Information Disclosure) Regulations 1997.

[11] See for example LECG, *Update assessment of GDN indirect opex based upon 2006/07 actual performance*, 24 September 2007.

3.30 External comparisons are usually limited to unit cost comparisons of overhead and indirect opex only (e.g. human resources, accounting, finance, legal, and corporate management) as this type of activity is not industry-specific.

3.31 In 2010, general management, administration and overhead costs accounted for between 13 percent and 61 percent of total controllable EDB opex (i.e. opex less pass-through costs), with an industry average of 36 percent.[12] Therefore it is likely that a considerable proportion of expenditure may be benchmarked using this approach. The equivalent figures for GPBs are not known. However, it is unlikely that this approach could be used to benchmark all costs, as some activities are unique to GPBs and EDBs and incomparable with other industries (e.g. line fault repairs).

3.32 This approach would require cost data by function (e.g. human resources, accounting, finance, legal, and corporate management) and data on the drivers of these costs (e.g. number of full time equivalents).

Q.14 How much insight would external comparisons of common functions provide?

Q.15 What functions should be benchmarked and how easily available is cost data at a function-level?

Q.16 What industries and operators should be included when benchmarking these functions?

Nature-of-work Comparisons

3.33 Nature-of-work comparisons use TFP estimates for those sectors in the economy which represent activities undertaken by the regulated entity (e.g. construction). A 'virtual' benchmark is then constructed by weighting the sector-specific TFP estimates by the contribution of the activity to total expenditure of the operator. For example, if construction-related activities accounted for 30 percent of a supplier's opex, then the TFP estimate for the construction industry would receive a weight of 30 percent.

3.34 This approach may provide insight into the cost efficiency of a supplier if there is a lack of direct comparators, or if the data provided is not of sufficient quality to enable direct comparisons. Nature-of-work comparisons may also be used as an indicator of the future productivity of the industry as a whole. Examples of the application of this approach include:

- Office of Rail Regulation in the United Kingdom for assessing the cost efficiency of Network Rail as part of its price control review[13]; and

3.35 Ofgem in assessing future productivity improvements in the gas sector.[14] TFP data quality might be an issue. NZ Statistics has started publishing sector-specific TFP

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[12] Based on Commerce Commission calculations using 2010 EDB information disclosure data and DPP compliance statements.

[13] Oxera, *Network Rail's scope for efficiency gains in CP4*, April 2008.

[14] Reckon, *Gas distribution price control review: update of analysis of productivity improvement trends*, September 2007.

estimates only recently.[15] It is unclear at this stage whether the data is sufficiently robust to be used in nature-of-work comparisons. Contentions surrounding sectoral productivity estimates in Australia render that information unsuitable for use in a regulatory context.[16]

3.36 Furthermore, as discussed in paragraph 3.24 above, TFP is based on long-term trends. Year-on-year comparisons of TFP growth would provide limited insight into cost efficiency. However, periodic nature-of-work comparisons may provide some additional insights in assessing the performance of EDBs and GPBs.

Q.17 Should nature-of-work comparisons be further considered in assessing EDB and GPB opex efficiency? If so, what sectors should be included in the analysis?

Conclusions on Assessment of Operating Expenditure

3.37 We propose where possible to assess EDB and GPB opex relative to other EDBs and GPBs using comparative efficiency techniques. We think there are sufficient NZ suppliers to assess EDB opex relative to domestic comparators. However, a lack of NZ GPBs means that overseas suppliers or sub-supplier comparisons are likely to be required to assess GPB opex.

3.38 To help ensure comparisons are on a like-for-like basis, we aim to work with EDBs and GPBs to understand the industry drivers of opex (including potentially the drivers of individual components of opex), and any supplier-specific factors outside management control.

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[15] Economic Insights, *Regulation of suppliers of gas pipeline services – gas sector productivity*, 10 February 2011, p. 39.

[16] Economic Insights, *Regulation of suppliers of gas pipeline services – gas sector productivity*, 10 February 2011, p. 39.

SECTION 4 ASSESSMENT OF CAPITAL EXPENDITURE

4.1 We consider that direct comparisons between suppliers are only of limited usefulness in assessing capex. Capex is driven by the needs of the network, which is itself a function of asset condition, network configuration and loading and other legacy issues. As such, the level of network need is likely to be specific to each supplier and not comparable across the industry. Direct comparisons of capex would not be able to sufficiently account for these supplier-specific circumstances.

4.2 Furthermore, the techniques discussed for opex typically rely on the use of historic data.[17] Where possible, we are keen to avoid an assessment of capex based on historic expenditure for a number of reasons:

- Current and future capex is driven by the needs of the network at the time. An assessment based on one or even several years' of historic data may not be representative and, for example, may not be able to distinguish between whether a supplier's relatively high capex is driven by inefficiency or by the relatively high needs of the supplier's network at that time.
- An assessment of cost efficiency based on the historic capex provided in the disclosures may bear little relation to future efficient capital expenditure. Historic underinvestment in assets may mean future capex is significantly higher than previous expenditure.
- It may not be appropriate to revisit sunk costs in assessing cost efficiency under Part 4, irrespective of their efficiency and effectiveness. An investment may have been the optimal decision at the time given the information available then, but in hindsight may have been an inefficient choice (e.g. due to an unforeseen decrease in demand). Revisiting past expenditure with the benefit of hindsight may discourage future investment.

4.3 We propose to assess capex largely based on forecast expenditure. However comparisons of actual and forecast expenditure at the level of an individual operator may provide additional insight into a supplier's cost efficiency. Furthermore, we think that the use of engineering-based assessments of the level of activity proposed, making use of intercompany comparisons where possible, will better take into account any supplier specific factors than the direct benchmarking approach we propose to use for opex. The proposed approach for assessing capex is discussed in more detail below.

Q.18 To what extent should assessments of historical capex based on direct comparisons be considered as part of summary and analysis?

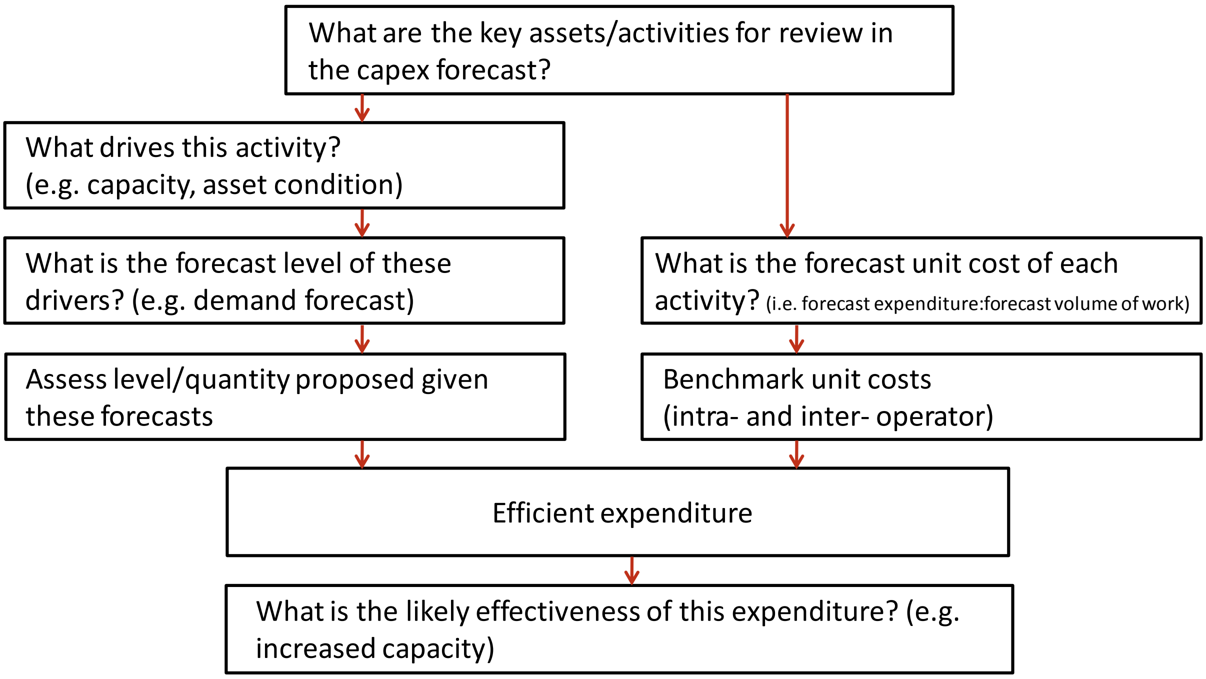
Engineering-based Approaches with Supplier-specific Drivers

4.4 Figure 2 illustrates an engineering-based approach which uses supplier-specific drivers and forecast data to assess separately the level of activity proposed and the cost of undertaking this activity. We discuss each element of this approach below. A similar approach was used by Ofgem during the most recent electricity distribution price

[17] Forecast expenditure may also be benchmarked, although there is likely to be more 'noise' in this data which could make identifying a robust model difficult.

control review (DPCR5) to assess network investment.[18] This approach differs from the comparative approach discussed for opex, which jointly assesses both the level of an activity and the cost of this activity.

Figure 2 Engineering-based approach with supplier-specific drivers



Source: Commerce Commission

4.5 To ensure this analysis is cost-effective, we propose to examine only information on material activities in the capex forecast. The approach then considers both the level of activity forecast and the cost of this activity.

4.6 To assess the quantity of activity proposed by each supplier, the drivers of different activities on the assets are identified.

4.7 Supplier and external forecasts for these drivers are then reviewed to assess the level of activity proposed by a supplier compared with the forecasts of the activity drivers.

4.8 To assess the cost of the proposed activity, unit cost forecasts for these activities are benchmarked across and within operators where relevant. Combining the cost benchmarking and volume assessment provides a view on efficient capex for each operator.

4.9 The final stage of the analysis identifies measures of effectiveness or the benefit delivered by investment (e.g. increased capacity), and assesses this against the proposed levels of expenditure

[18] Ofgem, *Electricity Distribution Price Control Review: Final proposals – allowed revenue cost assessment*, 7 December 2009.

Q.19 What are the material assets and activities that should be included in a capex assessment?

Q.20 What are the drivers of activity on these assets?

Q.21 How can capex effectiveness be measured?

4.10 This approach is envisaged to require the disclosure of activity-level (by project and/or major asset) cost and cost driver data. This is likely to include:

- identification of the drivers of each type of activity (e.g. asset replacement) on each major asset group;
- quantification of current and forecast levels for these drivers;
- quantity of activity proposed, by project and/or major asset group;
- forecast capital expenditure, for each type of activity by project and/or major asset group; and
- unit cost data for standard activities by project and/or major asset group.

4.11 Much of this information is already available in the EDB Asset Management Plans (AMPs). However the data is not currently standardised or collected in a user-friendly format.[19] We expect that GPBs will also be required to provide this information in their future AMPs. The use of standardised templates in the disclosures in which suppliers provide this information would assist in assessments of capex efficiency.

Q.22 How suitable is the proposed approach for assessing capex?

4.12 It is unlikely that comparable disaggregated data is available from overseas and unit costs could be limited to the New Zealand suppliers (although sub-company level comparisons may also be possible).

Conclusions on Assessment of Capital Expenditure

4.13 We consider that direct comparisons and reviews of historic expenditure are of limited usefulness when assessing the efficiency of forecast capex. We consider that a more appropriate approach is to separately assess the future level of capex activity proposed based on an engineering-based review of the drivers of activities, and the unit cost of undertaking these activities. This approach will require the asset information currently provided in the AMP to be refined and standardised.

[19] In many cases, the data is provided within the qualitative text.

SECTION 5 ASSESSMENT OF TOTAL EXPENDITURE

Opex-capex Trade-off

5.1 Up to this point, the discussion has focused on assessing opex and capex separately using different approaches. However, this separate assessment may not provide an accurate assessment of supplier efficiency.

5.2 For example, a supplier that incurs higher opex in maintaining assets at a reasonable level may appear less efficient in an opex assessment relative to another supplier that follows a strategy of minimising maintenance spend and then replacing assets (i.e. incurring relatively more capex but less opex). Conversely, this latter supplier may then appear to be less efficient on capex relative to the other EDB or GPB, even if total expenditure were to be the same.

5.3 Possible approaches to dealing with this trade-off are discussed below.

Q.23 To what extent do suppliers consider the opex-capex trade-off could distort an assessment of expenditure that is based on separate reviews of opex and capex?

Q.24 Which components of expenditure have significant opex-capex trade-offs?

Direct Comparators

5.4 This approach has already been discussed in relation to an assessment of opex. It could also be applied to total expenditure (i.e. opex plus capex), or to combined components of opex and capex which perform similar activities or deliver the same benefit (e.g. opex maintenance and capex asset replacement and renewal). However, as discussed in paragraphs 4.1 and 4.2, we have concerns about the comparability of capex across suppliers and the relevance of historic capex to future expenditure.

Nature-of-work Comparisons

5.5 This approach is discussed in section 3 in relation to an indirect assessment of opex. Total expenditure, or combined components of opex and capex, could also be reviewed based on sector-specific TFP estimates. However, as discussed above, there may be data quality issues with TFP data available in NZ and we have concerns that annual assessments of TFP provide limited insights into the cost efficiency of suppliers.

Engineering-based Approach

5.6 Another option is to review combined components of opex and capex (reflecting all spend on an activity or asset) using an engineering-based approach and unit cost comparisons of expenditure (i.e. a similar approach to that discussed for capex in section 4). In addition to the standardised asset and capex data discussed, this would require suppliers to provide information on the drivers of non-maintenance opex and capex on non-system fixed assets if there is considered to be opex-capex trade-offs in these areas too.

Reference Model

5.7 The reference model approach involves constructing a hypothetical network to provide an individual comparator for each supplier based on engineering knowledge and supplier-specific characteristics (e.g. population density).This approach is widely used in telecoms regulation and has also been used by the regulator to assess electricity distribution network costs in Sweden, Spain and Chile.[20]

5.8 The reference model approach may provide valuable insight into cost efficiency where there is a lack of reliable comparator data. However, we have a number of concerns with this approach, including that it likely to be resource-intensive and that by not using real examples of good performance, the model may potentially produce unrealistic results. Adjustments to the model may be required to reflect legacy issues that mean the network has not been designed optimally. At this stage, we do not consider the use of a reference model to be a viable or cost-effective.

Q.25 How should the cost analysis take into account any opex-capex trade-offs?

Conclusions on Assessment of Total Expenditure

5.9 The discussion until now has focussed on assessing opex and capex separately. However, this could distort the assessment of supplier efficiency if there are significant opex-capex trade-offs. There are a number of potential approaches that may help address this issue including the use of direct comparisons and engineering-based approaches for assessing total expenditure or combined components of opex and capex.

[20] See Jamasb, T., and Pollitt, M., *Reference models and incentive regulation of electricity distribution networks: An evaluation of Sweden's Network Performance Assessment Model (NPAM),* September 2007 for a discussion.

SECTION 6 NEXT STEPS

6.1 This section sets out the process and questions for submissions on the matters covered in this paper. Our recent Process Update Paper sets out in more detail our timeframes for issuing the draft and final Information Disclosure requirements for EDBs, GPBs, and Transpower.[21]

Process and Questions for Submitters

6.2 We invite submissions on the views discussed in this paper. Submitters should focus on responding to the questions set out in shaded boxes throughout the paper. We should receive submissions no later than **5pm on Friday 4 November 2011**.

6.3 We also invite cross-submissions on matters raised in submissions to this discussion paper. The purpose of cross-submissions is to ensure that we are aware of points of agreement or disagreement on matters raised by other submitters. We therefore request that parties providing cross-submissions focus these in that way. We should receive cross-submissions no later than **5pm on Friday 18 November 2011**.

6.4 All submissions and cross-submissions should be supported by documentation and evidence, where appropriate.

6.5 Submissions and cross-submissions should be sent to:

regulation.branch@comcom.govt.nz;

or

Anna McKinlay
Chief Advisor
Regulation Branch
Commerce Commission
P.O. Box 2351
Wellington

Form of submissions

6.6 To foster an informed and transparent process, we intend to publish all submissions and cross-submissions on our website. Accordingly, we request an electronic copy of each submission and request that hard copies of submissions not be provided (unless an electronic copy is not available). We also require that these electronic copies be provided in an accessible form (i.e. they are 'unlocked' and text can be easily transferred).

6.7 If the submission contains confidential information or if the submitter wishes that the published version be 'locked', an additional document labelled "public version" should be provided.

Confidentiality of submissions

6.8 We discourage requests for non-disclosure of submissions, in whole or in part, as it is desirable to test all information in a fully public way. We are unlikely to agree to any requests that submissions in their entirety remain confidential. However, we recognise

[21] Commerce Commission, Information Disclosure Regulation— Electricity Lines Services and Gas Pipeline Services: Update on Process, 12 September 2011.

that there will be cases where interested parties making submissions may wish to provide confidential information to us.

6.9 If it is necessary to include such material in a submission the information should be clearly marked and preferably included in an appendix to the submission. Interested parties should provide us with both confidential and public versions of their submissions. The responsibility for ensuring that confidential information is not included in a public version of a submission rests entirely with the party making the submission.

6.10 Parties can request that we make orders under s 100 of the Act in respect of information that should not be made public. Any request for a s 100 order must be made when the relevant information is supplied to us and must identify the reasons why the relevant information should not be made public. We will provide further information on s 100 orders if requested by parties, including the principles that are applied when considering requests for such orders. A key benefit of such orders is to enable confidential information to be shared with specified parties on a restricted basis for the purpose of making submissions. Any s 100 order will apply for a limited time only as specified in the order. Once an order expires, we will follow our usual process in response to any request for information under the Official Information Act 1982.

Questions for submitters

6.11 We ask submitters to focus their submissions on the questions listed in shaded boxes throughout this paper. For convenience, the box below provides a full list of these questions.

Questions for submitters

Q.1 How much insight would an assessment of operating expenditure based on NZ comparators alone provide, for EDBs and for GPBs?

Q.2 How insightful could international comparators be in assessing EDB and GPB expenditure?

Q.3 What companies, countries or datasets should be included in the analysis?

Q.4 How appropriate are sub-company comparisons of costs?

Q.5 How feasible and costly would it be to collect sub-company cost and characteristic data to enable sub-company comparisons?

Q.6 What factors (outside management control) drive industry wide opex?

Q.7 To what extent does the current information disclosure data capture these factors?

Q.8 What cost drivers, if any, (outside management control) are unique to your EDB or GPB?

Q.9 To what extent does the current information disclosure data capture these factors?

Q.10 What factors (other than changes in input prices) influence opex over time?

Q.11 To what extent should quality be taken into account when assessing cost efficiency?

Q.12 What level of opex should be assessed? Should the current sub-categories of EDB and GPB opex (e.g. general management, administration and overheads) be separately assessed, should further disaggregated cost data beyond these categories be collected and assessed, or should the analysis focus on total opex only?

Q.13 What components of opex should be separately benchmarked?

Q.14 How much insight would external comparisons of common functions provide?

Q.15 What functions should be benchmarked and how easily available is cost data at a function-level?

Q.16 What industries and operators should be included when benchmarking these functions?

Q.17 Should nature-of-work comparisons be further considered in assessing EDB and GPB opex efficiency? If so, what sectors should be included in the analysis?

Q.18 To what extent should assessments of historical capex based on direct comparisons be considered as part of summary and analysis?

Q.19 What are the material assets and activities that should be included in a capex assessment?

Q.20 What are the drivers of activity on these assets?

Q.21 How can capex effectiveness be measured?

Q.22 How suitable is the proposed approach for assessing capex?

Q.23 To what extent do suppliers consider the opex-capex trade-off could distort an assessment of expenditure that is based on separate reviews of opex and capex?

Q.24 Which components of expenditure have significant opex-capex trade-offs?

Q.25 How should the cost analysis take into account any opex-capex trade-offs?

APPENDIX A: COST ASSESSMENTS OF REGULATED SUPPLIERS – INTERNATIONAL PRECEDENT

A1 There is a significant amount of precedent on the use of comparative efficiency approaches to assess the relative cost efficiency of regulated electricity and gas suppliers. This appendix summaries the approaches adopted and the cost drivers used in a sample of New Zealand and international studies.

Electricity

New Zealand

A2 Recent estimates of New Zealand electricity distribution sector productivity have used total factor productivity (TFP) techniques to assess performance. For example, a 2009 study by Economic Insights for the Commerce Commission estimates the productivity growth differential for New Zealand EDBs using 13 years of information disclosure data.[22] An index number technique is used to calculate TFP based on the following supplier outputs:

- KWh of electricity supplied
- Total MVA kilometres (based on length of line for each voltage capacity and a conversion factor based on the voltage of the line)
- Capacity (installed distribution transformer capacity kVA x kilometres of mains length)

A3 In order to calculate the index, outputs were weighted using an econometric model for EDB operating costs. [23] This model uses similar cost drivers to those listed above, but also includes number of connections/customers and System Average Interruptions Duration Index (SAIDI).

A4 In 2003 Covec were appointed by the Commerce Commission to develop econometric models for assessing the performance of the electricity distribution industry in New Zealand.[24] The study used information disclosed by the companies for the period 1999-2002. Separate models for opex, capex and total cost were estimated using the following cost drivers:

- ODV asset value
- Number of customers (opex and total cost models only)
- Kilometres (opex and capex only)
- Transformer capacity (opex and capex only)
- SAIDI (opex and total cost models only)

[22] Economic Insights , *Electricity distribution industry productivity analysis: 1996-2008,* 1 September 2009

[23] See Meyrick and Associates, *Regulation of electricity lines business: Resetting the price path threshold – comparative option*, 3 September 2003

[24] Covec Limited, *Regulation of the New Zealand electricity distribution sector: An empirical analysis*, 2003

A5 The models estimated by Covec explain a high proportion of the variation in costs across companies and were subsequently used to estimate cost efficiency catch-up targets for EDBs using Stochastic Frontier Analysis (SFA).

A6 In 1999, NZIER were commissioned by the Ministry of Commerce to estimate a performance frontier for the electricity distribution industry in New Zealand. [25] Historic total cost per customer and operating costs per customer were modelled using the following cost drivers:

- Customer density
- Proportion of overhead lines
- Capital goods price index for the electricity distribution sector
- Number of customers
- Delivered electricity per customer
- Maximum demand per customer

A7 Company-specific inefficiency was then estimated using SFA. However, the analysis was not able to produce robust efficiency scores due to inconsistencies in the allocation of costs between the retail, generation and distribution components of the business, mis-measurement in the customer density measures, and the omission of explanatory factors such as climate, maximum demand and company specific costs.

Australia

A8 Australian analysis of electricity distribution efficiency has been largely limited to comparisons of TFP. For example, a 2006 study for the Essential Services Commission (ESC) has calculated TFP for the five Victorian electricity distribution operators using data for the period 1995-2003.[26] TFP was calculated based on number of customers, on and off peak electricity volumes and non-coincident peak demand.

UK

A9 At the 2009 electricity distribution price control review (DPCR5), Ofgem developed models for assessing the efficiency of individual cost categories (e.g. tree cutting), more aggregated cost groupings (e.g. indirect costs) as well as total operating expenditure.[27]

A10 A number of costs were excluded from the analysis or adjusted to take into account atypical costs and supplier-specific factors (e.g. regional wage differences) which would otherwise limit the ability of the analysis to make comparisons on a like-for-like basis.

A11 A corrected OLS (COLS) model was used to assess the relative efficiency of each supplier in each cost area using an upper quartile or upper third benchmark (an upper third benchmark was used where there was more uncertainty in the quality of the data). The following cost drivers were included in Ofgem's models:

- Modern Equivalent Asset Value (MEAV)

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[25] NZIER., *Electricity lines business performance indicators*, March 1999

[26] Essential Services Commission and Pacific Economics Group, *Total factor productivity and the Australian electricity distribution industry: estimating a national trend*, December 2006

[27] Ofgem, *Electricity Distribution Price Control Review: Final proposals – allowed revenue cost assessment*, 7 December 2009

- Direct costs (as a driver of indirect costs)
- Overhead faults
- Underground faults
- Lines replaced
- Asset manhours
- Tree spans cut

A12 At the previous price control review in 2004, Ofgem assessed total operating expenditure using a composite variable consisting of number of customers (weighted by 25percent), length of network (weighted by 50percent) and units of energy distributed (weighted by 25percent). This composite variable approach was adopted as the relatively small number of electricity distribution network operators in the industry limited the number of variables that could be included in the model.

Germany

A13 Sumicsid were commissioned by the German regulator Bundesnetzagentur to develop benchmarking models for electricity and gas distribution.[28] The resulting electricity distribution model examines total direct cost (i.e. opex plus capex less taxes) and includes the following outputs to capture both service and capacity provision:

- Number of metres of high, medium and low voltage respectively
- Total service area for high, medium and low voltage respectively
- Coincidental load high, medium and low voltage respectively
- Coincidental load transformer
- Feed-in power of decentral generation

A14 The amount of energy distributed was not included as a cost driver as this was not considered to be relevant once a measure of capacity provision was included in the model. Company-specific efficiency was then estimated using COLS, Data Envelopment Analysis (DEA) and SFA.

Finland

A15 In a study commissioned by the Finnish energy regulator in 2010, Professor Timo Kuosmanen of Helsinki School of Economics explores the use of a DEA-based approach called StoNED to assess the relative efficiency of electricity distribution companies.[29] The model is based on the regulators current model and examines total cost (capex, opex and the cost of interruptions) with the following drivers:

- Amount of energy transmitted on the network (weighted by voltage to reflect the cost of transmission)
- Total length of network

[28] Sumicsid, *Development of benchmarking models for German electricity and gas distribution*, 2007

[29] Kuosmanen, T. , *Cost efficiency analysis of electricity distribution networks: Application of the StoNED method in the Finnish regulatory model*, 2010 Similar to SFA, StoNED takes into account the extent of noise in the model when assessing the efficiency of operators.

- Total number of customers connected to the network
- Proportion of underground cables

A16 Peak load is not included in the model as it is highly correlated with the amount of energy transmitted on the network.

A17 The Finnish regulator currently assesses efficiency using both DEA and SFA.

US

A18 In 2005, Pacific Economics Group (PEG) undertook an econometric assessment of plant ownership, operations and maintenance costs incurred by 66 US electricity distribution companies.[30] The following cost drivers were included in the model:

- Number of customers served
- Percentage of line miles overhead
- Average precipitation (as a proxy for degree of forestation)
- System age
- Value of the transmission and generation plant (to capture whether the utility undertakes both generation and transmission and the impact of this on costs)
- Percentage of deliveries made to residential and commercial customers
- Average temperature
- Price of labour, material and capital

A19 Companies were then benchmarked using SFA.

Canada

A20 PEG has also undertaken a study of Ontario power distributors for the Ontario Energy Board using data for the period 2002-2005.[31] Econometric models of operating, maintenance and administration expenses (excluding street lighting, bad debts, pensions and energy conservation costs) were estimated using the following outputs/cost drivers:

- Price of labour
- Retail delivery volume
- Number of retail customers served
- Length of distribution lines
- Percentage forestation or rural service territory
- Percentage of distribution plant underground Indicator of whether territory lies on the Canadian shield (shallow, rocky soils and numerous lakes)
- Whether the operator is in a non-contiguous service territory
- Price of materials and services

[30] PEG. (2005), *Econometric benchmarking of cost performance: The case of U.S. power distributors*, The Energy Journal, Vol. 26, No. 3, 2005

[31] PEG, *Benchmarking the costs of Ontario power distributors*, 25 April 2007

- Percentage of distribution revenue from residential and commercial customers
- Ratio of plant value to construction cost index
- Number of transformers owned by the company

A21 Predicted costs from the model are compared to actual costs to obtain an assessment of the cost efficiency of each operator.

A22 The econometric model is also used to calculate weights for the outputs in calculating a productivity index.

A23 PEG highlights a lack of data on customer mix, capital usage, system age and deliveries to other distributors as limiting factors in the analysis.

Gas

New Zealand

A24 A 2011 report by Economic Insights for the Commerce Commission examines the productivity of New Zealand GPBs relative to the productivity of the economy as a whole.[32] This exploratory analysis uses an index number technique to estimate TFP. TFP estimates for Australian, US, Canadian and European gas operators are also reviewed as part of the study.

A25 The following variables are used to estimate potential gas distribution TFP:

- Throughput
- Customer numbers
- Pipeline length
- Labour good price index

A26 The gas transmission model uses the same variables as above but excludes customer numbers and includes asset value instead. A lack of data means that the analysis undertaken is not considered definitive.

A27 A comparative benchmarking study by Meyrick and Associates for the Commerce Commission in 2004 uses data from gas transmission and distribution operators in New Zealand and Australia to estimate multilateral TFP.[33] Four New Zealand and ten Australian operators are included in the study.

A28 The study estimates a operating and maintenance expenditure model for gas distribution using information on throughput and total customer numbers. A transmission cost model is also estimated using throughout and system capacity (captured by asset value, maximum feasible capacity and observed peak demand). A lack of consistent measures of capacity and the use of forecast rather than historical data for some GPBs are cited as limiting factors in the study.

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[32] Economic Insights, *Regulation of suppliers of gas pipeline services – gas sector productivity*, February 2011

[33] Meyrick and Associates, *Comparative benchmarking of gas networks in Australia and New Zealand*, May 2004

A29 In response to the Meyrick study, Pacific Economics Group (PEG) developed an econometric model to assess New Zealand and US gas distribution companies. The model uses the following drivers of gas distribution and meter ownership costs:

- Customers numbers
- Throughput
- Miles of distribution mains
- Percentage of mains which is not cast iron
- Capital and labour price indices

Australia

A30 A study undertaken as part of the 2007 review of the gas access arrangement for Multinet compares Multinet's total expenditure and operating and maintenance expenditure against US GDBs.[34] Relative cost efficiency is assessed using an econometric model and US Federal Energy Regulatory Commission (FERC) data. The model includes the following cost drivers:

- Total number of customers
- Proportion of throughout that is not industrial
- Energy density (total residential consumption: residential customers)
- Capital price index
- Opex input price index

A31 In 2001, Pacific Economics Group (PEG) benchmarked three GDBs in Victoria against 43 US distribution companies using an econometric model and the following cost drivers:[35]

- Labour costs
- Plant value
- Number of gas delivery customers
- Total gas throughput
- Percentage of total distribution and transmission miles which are distribution
- Percentage of distribution main that are cast iron
- Percentage of sales volume to non-industrial uses
- Percentage of electricity capital in the gross value of distribution plant

UK

A32 As part of the current gas distribution price review (RIIO-GD1), Ofgem has developed a number of models for assessing components of operating expenditure (e.g. emergency,

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[34] Meyrick and Associates, *Cost comparisons of Multinet and United States gas distribution businesses allowing for operating environment differences*, March 2007

[35] Pacific Economic Group, *Envestra gas distribution operations and maintenance cost performance: Results from international benchmarking*, 2001

repairs), as well as a total expenditure model and separate models for total opex, repair expenditure (repex) and capex.[36] Cost drivers included in their regression analysis to date include:

- MEAV
- Maintenance hours of work
- Emergency hours of work
- Repair hours of work
- External condition reports
- Number of publically reported escapes (PREs)
- Metallic pipe length

A33 Ofgem has proposed using a variety of quantitative and qualitative approaches to assess capex, including regression analysis of historical connections and reinforcement costs, comparisons of forecast and historical costs, unit cost comparisons, and technical reviews.

Germany

A34 In 2007, Sumicsid developed a gas distribution benchmarking model for the German regulator Bundesnetzagentur.[37] The model uses data on total service area, total number of connections, total distributed energy and synchronised load output to compare direct costs across around 500 firms. Other cost drivers considered include:

- Soil type
- Number of buildings in area served
- Whether the firm is a multi-utility operator
- Quality
- Height and tilt
- Degree of sealed ground in area where the firm is operating; and
- Number of connection points

A35 The relative efficiency of gas distribution companies is assessed using OLS, DEA and SFA.

Europe-wide

A36 A study for the Council of European Energy Regulators in 2006 uses a sample of US and European data to identify gas transmission cost drivers, and to assess the relative efficiency of individual suppliers.[38] The study uses data on 40 US operators from the FERC database, as well as data on four European operators. Models are estimated for

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[36] Ofgem, *Decision on strategy for next gas distribution price control review – RIIO-GD1 Tools for cost assessment*, 31 March 2011

[37] Sumicsid, *Development of benchmarking models for German electricity and gas distribution*, 2007

[38] Jamasb, T., Newberry, D., Pollitt, M. and Triebs, T., *International benchmarking and regulation of European gas transmission utilities*, 2006

operating and maintenance expenditure, revenue, and total expenditure using the following cost drivers:

- Throughout
- Length of pipelines
- Compressor horsepower
- Number of compressor stations
- Number of compressor units
- Capacity (maximum daily peak delivery x number of days per year)
- Load factor (delivery: capacity)

A37 Efficiency scores are estimated using DEA, COLS and SFA. The study was limited by the small number of comparable European operators that could be included in the study.

APPENDIX B: SUMMARY OF COST DRIVERS FROM ELECTRICITY DISTRIBUTION, GAS DISTRIBUTION AND GAS TRANSMISSION COST ASSESSMENTS

A38 The following tables list the cost drivers used in previous electricity distribution, gas distribution and gas transmission cost efficiency studies. Where equivalent data is currently provided in the information disclosures, this has been highlighted. This information is intended to aid discussions with suppliers in identifying the appropriate cost drivers for inclusion in an assessment of EDB or GPB expenditure.

A39 Table A1 lists cost drivers from previous assessments of electricity distribution cost efficiency and the equivalent data from information disclosure (where available).

Table A1: Summary of cost drivers from previous electricity distribution cost efficiency studies

Output/network characteristic	**Equivalent data from information disclosure**
Number of customers	*Number of ICP*
Length of network	*Total length of circuit*
Length of network weighted by voltage of line	
Electricity distributed	*Electricity supplied to customers' connection points*
Proportion of overhead lines	*Total length of circuit overhead/Total length of circuit*
Proportion of underground cables	*Total length of circuit underground/Total length of circuit*
Length of high, medium and low voltage network respectively	*Length of circuit for various voltages*
Delivered electricity per customer	*Electricity supplied to customers' connection points/Number of ICP*
Customer density	*Number ICP/Total length of circuit*
Maximum demand per customer	*GXP maximum coincident system demand or maximum system demand/Number of ICP*
% deliveries made to residential/commercial customers	
% distribution revenue from residential/commercial customers	
Transformer capacity	*Total distribution transformer capacity*
Number of transformers owned by the company	
Coincidental load transformer HS/MS and MS/NS	

Coincidental load high/medium/ low voltage	*GXP Maximum coincident system demand*
Overhead faults/underground faults	*Total number of faults or interruptions*
System age	*Average age of system fixed assets*
Modern Equivalent Asset Value	
Lines replaced	
Tree spans cut/affected	
Total service area for high/ medium/low voltage	
Feed-in power of de-central generation	*Embedded generation output at HV and above*
Average temperature	
Degree of forestation	
Average precipitation	
Whether the operator is in a non-contiguous service territory	
System Average Interruptions Duration	*SAIDI or CAIDI or SAIFI*
Labour goods price index	
Material goods price index	
Capital goods price index	

A40 Table A2 lists cost drivers from previous assessments of gas distribution and transmission cost efficiency and the equivalent data from information disclosure (where available).

Table A2: Summary of cost drivers from previous gas distribution and transmission cost efficiency studies

Output/network characteristic	**Equivalent data from information disclosure**
Throughput (TJ)	*Total amount of gas conveyed*
Total customer numbers	*Total customers*
Number of connection points	
Number of buildings in area served	
Number of residential customers	
Total residential consumption	
Percentage of sales volume to non-industrial	

users	
Miles of distribution mains	*System length*
Proportion of mains which are not cast iron	
Proportion of high pressure pipe	*Pipe size*
Number of compressor stations	
Compressor horsepower	
Maximum daily peak delivery	*Maximum monthly flow*
ODV	
Plant value	
MEAV	
Quality	*Unplanned outages*
Multi-utility operator	
Height and tilt	
Degree of sealed ground	
Soil type	
Maintenance, emergency and repair hours of work	
External condition reports	
Labour goods price index	
Capital goods price index	