NERA
ECONOMIC CONSULTING

Holistic Economic Benchmarking

A report prepared for Grid Australia

20 September 2013

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1. Introduction and scope of this report

This report has been prepared at the request of Grid Australia, a body representing the five electricity transmission owners in the National Electricity Market (NEM).

Grid Australia has asked me to provide independent advice addressing:

- the suitability or unsuitability of applying the Australian Energy Regulator's (AER's) proposed economic benchmarking techniques to Transmission Network Service Providers (TNSPs);
- the alignment or misalignment of the AER's proposed use of economic benchmarking techniques with other parts of the regulatory framework applying to network businesses, as set out in the National Electricity Law (NEL) and National Electricity Rules (NER);
- the process that should be adopted in relation to the development of the AER's proposed Economic Benchmarking Model, from the perspective of what may be considered 'good benchmarking practice', including the approach to substantiating the robustness of the model(s) and their degree of 'accuracy'; and
- the adequacy or inadequacy of the input, output and environmental factors defined by the AER.

In considering these questions, I have had regard to:

- the AER Draft Expenditure Forecast Assessment Guideline for Electricity Transmission (the 'Draft Expenditure Guidelines'), and the accompanying Explanatory Statement and Factsheet, published 9 August 2013;
- the AER Briefing Paper – Economic benchmarking workshop 7 — Application of economic benchmarking techniques, June 2013 (the 'Briefing Paper');
- the Regulatory Development Branch (RDB) of the Australian Competition and Consumer Commission (ACCC) Technical Report – Economic Benchmarking Model: Technical Report, June 2013 (the 'Technical Report');
- the benchmarking model developed by the RDB, which accompanies the Technical Report (the Economic Benchmarking Model);
- the relevant provisions of the NEL;
- the relevant provisions of the NER and particularly Chapter 6A, which covers the economic regulation of TNSPs;
- the history of the development of Chapter 6A of the NER, including:
  - the 2006 report of the Expert Panel on Energy Access Pricing;
  - the Australian Energy Market Commission's (AEMC) 2006 rule determination in relation to the economic regulation of transmission services; and
  - the AEMC's 2012 Economic Regulation of Network Service Providers Rule Change, in response to proposals by the Australian Energy Regulator (AER) and the Energy Users Rule Change Committee;
- other reviews of the application of benchmarking in the NEM, namely:

  - the AEMC's 2011 Review Into the Use of Total Factor Productivity for the Determination of Prices and Revenues; and
  - the Productivity Commission's 2013 Review of Electricity Network Regulation; and
- the approach and relevant precedent from the development and use of benchmarking techniques for regulatory purposes in other jurisdictions.

1.1. Background

In November 2012 the AEMC completed the Economic Regulation of Network Service Providers Rule Change, which was first proposed by the AER and the Energy Users Rule Change Committee.[1] These rule changes were precipitated by rises in electricity and gas retail prices, a significant proportion of which has been due to increases in network charges.

The rule changes clarify the AER's powers to perform benchmarking analysis in its evaluation of TNSP's proposed operating and capital expenditure allowances. They also include new requirements for the AER to publish annual benchmarking reports that describe the relative efficiency of each TNSP in providing prescribed transmission services over a 12 month period.[2]

In order to implement these changes, the AER is required to prepare and consult on an Expenditure Forecast Assessment Guideline. The AER released its Draft Guideline in August 2013, in which it proposes to use a range of economic benchmarking techniques to inform its determinations – in particular, multilateral total factor productivity (MTFP), Data Envelope Analysis (DEA), and regression analysis ('econometric methods').[3] The AER proposes to use these techniques:

1. to provide information on the relative economic efficiency of NSPs and changes in the efficiency of NSPs over time, to determine whether an NSP is responding to incentives, ie, to undertake both *comparative* and *time-series* analysis;
2. as a first pass assessment to determine a 'reference cost forecast' against which an NSP's proposal would be compared in order to identify areas of focus for more detailed review techniques. This reference forecast would be across an NSP's *total costs*, ie, both opex and capital costs[4]; and

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1 AEMC, *Economic Regulation of Network Service Providers and Revenue Regulation of Gas Services, Final Rule Determination,* November 29, 2012.

2 NER Chapter 6A Part L 6A.3.1.

3 AER, *Explanatory Statement, Draft Expenditure Forecast Assessment Guidelines for electricity transmission and distribution*, August 2013, p. 44. See also AER Economic benchmarking workshop 7 — Application of economic benchmarking techniques, June 2013.

4 Capital costs comprise a return on and depreciation of the Regulatory Asset Base (RAB). I note that in its Explanatory Statement the AER variously refers to 'total costs', 'total expenditure', 'a total cost forecast of total expenditure'. However the accompanying explanation, and the example in the illustrative Economic Benchmarking Model make clear that the 'reference cost forecast' is intended to reflect total costs, rather than total expenditures.

3. to provide a top down view of opex, and so to inform the AER of the appropriate opex rate of change.

During the early stages of consultation on the Guideline, the AER released a Technical Report prepared by the RDB of the ACCC, which discusses how MTFP, DEA, and regression analysis ('econometric methods') models may be developed, and illustrates the potential application of these techniques in regulatory determinations. The RDB also developed an indicative Economic Benchmarking Model in an Excel spreadsheet that includes MTFP, DEA, opex efficiency and opex productivity calculations.

The AER's Explanatory Statement confirms that it expects to apply economic benchmarking as outlined in this illustrative spreadsheet, whilst noting that ultimately the decision on how to apply economic benchmarking in an individual determination will be taken by the AER based on the availability and quality of data.[5]

1.2. Relevant experience

I am a Director of the global firm of expert economists, NERA Economic Consulting (NERA) and head of its Australian operations, based in Sydney. I have more than twenty five years' experience in the economic analysis of markets and the provision of expert advice and testimony in litigation, business strategy and policy contexts. I hold a post-graduate, BSc (Hons)[6] in economics from the University of Canterbury, which was awarded with first class honours in 1983.

Since joining NERA in 1989 I have directed a wide range of regulatory economics, financial and competition assignments. I have advised on countless matters at the forefront of the design and implementation of the arrangements for energy network regulation in Australia, as well as in New Zealand and elsewhere.

A significant part of my early career at NERA was spent working on the development and evaluation of econometric, DEA and Stochastic Frontier Analysis (SFA) benchmarking techniques for application in the economic regulation of water and sewerage service providers in England and Wales. I twice provided expert evidence before the then Monopolies and Mergers Commission in the United Kingdom on the role and application of economic benchmarking techniques in the water sector regulatory regime.

More recently, in 2010 I provided expert evidence before the New Zealand Commerce Commission on the application of MTFP analysis to determine efficiency factors for New Zealand electricity lines companies.

In addition, I have extensive experience of the broader regulatory frameworks that apply to electricity network businesses in the NEM, having advised on the initial development of those frameworks. In particular, in 2005 I was appointed by Hon Ian Macfarlane, Minister for Industry, Tourism and Resources, to an Expert Panel to advise the then Ministerial Council

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5 AER Explanatory Statement, p. 83.

6 See: http://www.canterbury.ac.nz/courses/grad_postgrad/science/bschons.shtml

on Energy (MCE) on achieving harmonisation of the approach to regulation of electricity and gas transmission and distribution infrastructure. I subsequently advised the AEMC on its review of Chapter 6A of the NER, and most recently I advised the Energy Networks Association on all aspects of the 2012 Economic Regulation of Network Service Providers Rule Change.

A copy of my curriculum vitae in included as Appendix A.

1.3. Preparation of this report

In preparing this report, I have made all the inquiries that I believe are desirable and appropriate and no matters of significance that I regard as relevant have, to my knowledge, been withheld from this report. I have been provided with a copy of the Federal Court Guidelines on Expert Witnesses in Proceedings in the Federal Court of Australia, dated 4 June 2013. I have reviewed those guidelines and this report has been prepared consistently with the form of expert evidence required by those guidelines.

I have been assisted in the preparation of this report by my colleagues Ann Whitfield, Tom Graham and Julian Secomb, each of whom works with me in Sydney. Notwithstanding this assistance, the opinions in this report are my own and I take full responsibility for them. I have reviewed all work completed by my colleagues and all materials considered by them where necessary to form the opinions I express in this report.

1.4. Structure of this report

The remainder of this report is structured as follows:

- section 2 considers the AER's proposed use of economic benchmarking from the perspective of good regulatory practice, and addresses the questions put to me regarding:
  - the suitability or unsuitability of applying the AER's proposed economic benchmarking techniques to TNSPs;
  - the alignment or misalignment of the AER's proposed use of economic benchmarking techniques with other parts of the regulatory framework applying to network businesses, as set out in the NEL and the NER; and
- section 3 considers the development of the AER's proposed Economic Benchmarking Model, from the perspective of good benchmarking practice, and addresses the questions put to me in relation to:
  - the process that should be adopted to the development of the model(s), including the approach to substantiating the robustness and suitability of the models used; and
  - the adequacy or inadequacy of the input, output and environmental factors being considered by the AER.

2. Good regulatory practice

The AER Draft Expenditure Guidelines, the Explanatory Statement, the Technical Report, and the Economic Benchmarking Model illustrate the manner in which the AER is contemplating using the output of its benchmarking analysis as part of its regulatory determination process.

In this section I assess the AER's proposed approaches from the perspective of good regulatory practice, and consistency with the economic framework reflected in the NEL and Chapter 6A of the NER. In particular, I consider:

- the nature of the expenditure-related decisions that the AER is required to make at the time of a regulatory determination, and the role of benchmarking as a tool in relation to those decisions;
- the different concepts that can potentially be measured by economic benchmarking techniques;
- the applicability of the AER's proposed economic benchmarking techniques to TNSPs; and
- the alignment or misalignment of the AER's proposed use of economic benchmarking techniques with other parts of the regulatory framework.

2.1. The AER's expenditure-related decisions

In assessing the applicability of the AER's proposed use of economic benchmarking techniques as part of the regulatory determination process, it is helpful first to be clear on the particular expenditure-related decisions that the AER is required to make as part of a regulatory determination.

As part of its regulatory determination for each NSP, the AER is required to make decisions in relation to:

- the level of operating expenditure required for each year of the next regulatory period;
- the level of new capital expenditure required for each year of the next regulatory period; and
- in circumstances where the NSP has spent more on capex in the previous regulatory period than allowed for at the time of the previous determination, the amount of expenditure that should be rolled in to the NSP's Regulatory Asset Base (RAB).

The AER's regulatory determination does not extend to decisions as to the level of each NSP's existing RAB, nor to decisions on either *total expenditure*[7] or *total costs*[8] for that

[7] Being the sum of opex and capex. In the UK, for example, the water regulator (OFWAT) does make a decision in relation to total expenditure (totex).

[8] I use the term 'total costs' here and elsewhere in this report to refer to opex plus the return on and depreciation of the regulatory asset base.

regulatory period (as opposed to separate decisions for opex and capex, which themselves determine the total expenditure and total cost amounts).

A fundamental underpinning of the regulatory regime applying to TNSPs is that they be provided with a 'reasonable opportunity' to recover their efficient costs and with incentives to promote economic efficiency in the provision of services. These requirements are reflected in section 35 of the NEL, which forms the foundation of the regulatory regime.[9] The fundamental nature of these requirements was confirmed by the Expert Panel on Energy Access Pricing (the Expert Panel) established by the MCE in December 2005, of which I was a member.

In making its decisions in relation to the required level of opex and capex for the next regulatory period, the NER requires the AER to be satisfied that the level of expenditure in each case reflects the efficient costs of achieving the relevant expenditure objectives, and the costs that would be required by a prudent operator.[10] In deciding whether or not it is satisfied, the AER is required to have regard to specified 'expenditure factors',[11] which include the benchmark expenditure that would be incurred by an efficient TNSP over the relevant regulatory control period, as well as the most recent Annual Benchmarking Report published by the AER.[12]

The NER requirements reflect that benchmarking is recognised as an important tool available to the AER for assessing an NSP's expenditure proposals. However, the conduct of benchmarking analysis and its role in the regulatory determination process need to be consistent with the objectives and criteria set out in the NER in relation to the determination of opex and capex forecasts, as well as the principles in the NEL.

The AEMC's 2006 determination relating to the Economic Regulation of Transmission Services, confirmed the building block approach to the determination of transmission revenues. The AEMC concluded that, for transmission businesses, the building block approach is preferable to industry-wide benchmark regulation, because of the general lumpiness of transmission investments and the uniqueness of individual TNSPs' costs.[13] The AEMC also specified the evidentiary matters to which the AER should have regard in making regulatory decisions (ie, the 'expenditure factors'), which included benchmark data and the actual and expected expenditure of the TNSP during any preceding periods.[14]

In November 2012 the AEMC made amendments to the NER to clarify and remove ambiguities regarding the powers of the AER to interrogate, review and amend capital

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9 *National Electricity (South Australia) Act 1996*, Section 35 (3)(a) & (b).

10 NER 6A.6.6(c) and 6A.6.7(c).

11 NER 6A.6.6(e) and 6A.6.7(e).

12 NER 6A.6.6(e)(4) and 6A.6.7(e)(4).

13 AEMC, National Electricity Amendment (Economic Regulation of Transmission Services) Rule 2006 No. 18, Rule Determination, 16 November 2006, p. 40.

14 AEMC, National Electricity Amendment (Economic Regulation of Transmission Services) Rule 2006 No. 18, Rule Determination, 16 November 2006, p. 51

expenditure and operating expenditure proposals submitted by NSPs.[15] The AEMC stated in its final determination that it considered benchmarking a critical exercise in assessing the efficiency of an NSP and approving its capital expenditure and operating expenditure allowances.[16] It also noted that there appears to be little doubt about how the AER should undertake a benchmarking exercise, including that it should take into account differences in the environments of the different NSPs, ie, factors that are outside the control of the NSP.[17]

2.2. The different concepts addressed by benchmarking

In assessing the AER's proposed use of economic benchmarking techniques, it is also helpful to be clear on the different concepts to which such techniques are variously directed.

In particular, economic benchmarking techniques can be used to assess:

- the absolute level of productivity (ie, the ratio of outputs to inputs) achieved by an NSP, and how this absolute level compares with other NSPs;
- the change in productivity (ie, productivity growth rate) for a particular NSP over time; and
- the change in productivity of a particular NSP over time, compared with that of other NSPs.

In addition, benchmarking measures can potentially be derived in relation to operating expenditure, capital expenditure, total expenditure (ie, opex and capex) and total costs.

The above measures of either the absolute level of productivity or the change in productivity over time are often equated with the absolute level of or changes in efficiency, achieved by an NSP. However, it is important to distinguish between these two concepts.

In particular, the 'efficient' level at which inputs are transformed into outputs is determined by the production frontier, which itself depends on the available technology. An NSP's actual performance, even for the best-performing NSP, need not reflect the production frontier. In other words, an NSP may not be achieving the level of productivity that would be associated with performance at the theoretically most efficient level.

However, because the most efficient level is not directly observable, observations relating to the actual productivity achieved by the best-performing firms are often taken as a proxy for the measurement of efficient outcomes. I note that the AER's Explanatory Statement contains a discussion of the use of revealed efficiency rather than the actual (unobservable) efficiency

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[15] AEMC, National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 and National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012, 29 November 2012, p. vii.

[16] AEMC, National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 and National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012, 29 November 2012,p. 25.

[17] AEMC, National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 and National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012, 29 November 2012,p. 113.

frontier, and the judgement that this requires in interpreting the results of the benchmarking analysis.[18]

The three measurement concepts above relate to the absolute level of productivity, as well as the productivity growth rate, both in relation to the NSP's own performance over time and its performance compared to others. Some economic benchmarking techniques are only suitable for measuring changes in productivity, whilst others also allow comparisons between firms' absolute levels of productivity to be drawn.

In particular, MTFP analysis can be used to capture all three of the above measures. MTFP analysis involves forming an index by defining an arbitrarily selected NSP as the 'reference' firm and setting its value to one for a particular year (typically the first year in the sample). The productivity level of any NSP is then measured relative to this reference firm in that selected year. The particular form adopted in constructing the MTFP indices satisfies the property of transitivity, meaning that any two observations can be compared indirectly relative to the productivity of the reference firm in one year. Importantly, such a comparison of productivity levels does not depend on which firm is selected as the reference firm. This allows qualitative assessments of productivity levels (ie, rankings) and quantitative assessments of productivity levels (relative to the productivity of the reference firm in one year) to be undertaken, as well as comparisons of productivity growth rates (both of the same NSP over time, and across NSPs).

2.3. Applicability of economic benchmarking to TNSPs

A threshold question in any assessment of the AER's proposed use of economic benchmarking is the appropriateness of applying such benchmarking techniques to TNSPs in the NEM.

Two particular issues in this context, ie:

- first, the small number of TNSPs in the NEM, and the consequent small sample size available for benchmarking applications; and
- second, the 'lumpy' nature of the capital expenditure undertaken by TNSPs.

2.3.1. Small sample size

The AER proposes to undertake benchmarking analysis separately for TNSPs and DNSPs,[19] since the different characteristics and drivers of expenditure between transmission and distribution activities preclude a combined analysis.

The sample size for economic benchmarking will depend upon both the number of businesses for which the analysis is conducted, and the number of years for which data for each business are available.

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[18] AER Explanatory Statement, p. 86.

[19] AER Explanatory Statement, p. 87.

There are currently fifteen distribution businesses and five transmission businesses operating in the NEM.[20] This limits the sample size available for the benchmarking of NSPs, and for TNSPs in particular.

In addition, there is substantial variation between the five TNSPs in terms of both the size of their operations, and the operating environment they face. As a consequence, the factors that can be expected to affect expenditure are likely to vary for each TNSP. However, as the number of variables incorporated into the analysis increases, so does the necessary sample size in order to ensure that the results from the analysis are reliable.

In my opinion, a sample size of just five, compounded by the heterogeneity between TNSPs, presents a serious limitation on the ability of benchmarking techniques to offer any meaningful conclusion as to the relative efficiency *across* TNSPs.

If explanatory variables which drive differences between TNSPs are omitted from the analysis due to the small sample size, then differences in results between TNSPs are likely to reflect omitted variables, rather than being able to be interpreted as 'inefficiency'.[21] In contrast, if all explanatory variables are included, then the small sample size means that the reliability of the results will be insufficient to enable conclusions as to the efficiency of one TNSP relative to another to be drawn.

The insufficiency of sample size affects all three of the benchmarking techniques that the AER is proposing to use, ie, regression analysis, MTFP and DEA:

- In the case of the proposed regression analysis, the small sample size raises concerns in relation to the statistical reliability of the analysis. The greater the number of explanatory variables included in the analysis, the larger is the sample size required in order to find a significant relationship. In general, the larger the sample size, the more reliable is the regression analysis.
- In relation to MTFP analysis, the AER intends to combine its MTFP approach with regression analysis, in order to take account of the different environmental factors affecting NSPs.[22] The reliability of such regression results would again be adversely affected by the small sample size. This difficulty is recognised in the report by Economic Insights accompanying the AER Draft Expenditure Forecast Assessment Guidelines. In particular, Economic Insights states that the ability to adjust benchmarking results for multiple operating environment factors will be constrained by the number of observations available, and that several years of data may be required to support any regression based environmental adjustments, particularly for TNSPs.[23]

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[20] I have excluded the Murraylink and Basslink interconnectors from this count, since these are specific assets, rather than networks.

[21] The Productivity Commission has noted that the small available data set "reduces the feasibility for more elaborate models that take into account the multiple environmental factors affecting inter-firm performance".: Productivity Commission, *Electricity Network Regulatory Frameworks*, 9 April 2013, p. 166.

[22] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 5.

[23] Economic Insights, *Economic Benchmarking of Electricity Network Service Providers*, 25 June 2013, p. 96.

- Finally, DEA is also likely to be less appropriate for small samples. DEA effectively gives companies 'the benefit of the doubt' in that it assigns an efficiency score of 1.0 (perfectly efficient) to a firm unless there exists a linear combination of other firms that are found to be more efficient. Where there are few observations compared to the number of outputs and environmental variables, and there is significant variation in those variables between companies, DEA may erroneously find many inefficient companies to be efficient. DEA is more likely to give accurate efficiency scores when the sample size is larger. This point has been previously noted by the ACCC, leading it to conclude that DEA methods are more effective the larger the number of observations in the sample.[24]

One potential solution to the problems posed by a small number of TNSPs is to expand the number of observations by including international data on TNSPs. This possibility has been discussed by the ACCC and is practiced by regulators in Europe and the United Kingdom.[25] However, the use of international data brings with it its own set of problems. There are underlying differences in the way that electricity network activities are structured internationally, and in the way that data is collected across countries as well as across businesses.[26] Additional variables must often be introduced in order to account for data heterogeneity, negating the potentially improved explanatory power expected from the addition of international data.

This point is made by Graham Shuttleworth (2005) in a review of benchmarking practices applied to electricity networks in the United Kingdom:[27]

> *"Unfortunately, cross-border comparisons often require the inclusion of so many more variables (to allow for cross-border differences) that the extra observations have no additional value as new information."*

In conclusion, the available sample size for the benchmarking of TNSPs within the NEM will severely limit the explanatory power of any benchmarking model in relation to the relative efficiency performance *across* TNSPs. Expanding the dataset to include international observations poses additional problems and is unlikely to resolve the issue.

I note that the difficulty of making cross-sectional comparisons of economic benchmarking results across TNSPs is acknowledged by the AER in its Explanatory Statement.[28]

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[24] ACCC, *Benchmarking Opex and Capex in Energy Networks*, May 2012, p. 10-11.

[25] The ACCC's discussion of international benchmarking can be found in: ACCC, *Benchmarking Opex and Capex in Energy Networks*, May 2012, p. 150. A description of international benchmarking undertaken in the United Kingdom and Europe can be found in: Jamasb, T. and M. Pollitt, *International Benchmarking and Regulation: An Application to European Electricity Distribution Utilities*, Energy Policy, 31, 2003, pp. 1609-1622.

[26] The ACCC has previously noted the difficulties associated with the use of international data in the benchmarking of opex and capex in energy networks. See: ACCC, *Benchmarking Opex and Capex in Energy Networks*, May 2012, p. 34 and p. 150.

[27] Shuttleworth, *Benchmarking of electricity networks: practical problems with its use for regulation*, January 2005, p. 313.

[28] AER, *Explanatory Statement, Draft Expenditure Forecast Assessment Guidelines for electricity transmission and distribution*, August 2013, p. 92.

2.3.2. 'Lumpiness' of TNSP capital expenditure

A second challenge often raised in relation to the application of economic benchmarking techniques to TNSPs is the 'lumpiness' of capital expenditure for transmission.

TNSPs typically undertake capex projects that involve large, relatively infrequent augmentation or replacement of particular assets or groups of assets, rather than a steady stream of smaller projects.[29] A consequence of this lumpy profile of capital expenditure is that there is significant variability in a TNSP's incremental capex over time. In other words, it is very difficult to define a 'steady-state' level of new capex associated with transmission activities. The amount of new capex needing to be undertaken by a TNSP often therefore depends on whether or not it has recently undertaken a major capital investment.

The extent to which this lumpiness of capital expenditure poses a difficulty for benchmarking analysis depends on exactly what is being benchmarked.

Where benchmarking is proposed in relation to capex only, or in relation to total expenditure (capex plus opex), then the lumpiness of capex does pose a difficulty. In these cases, an NSP's relative efficiency assessed using benchmarking techniques will depend on where it is in the investment cycle, rather than being a true reflection of efficiency.

However, the AER is not proposing to benchmark capex. Indeed, the AER's Technical Report notes that the role of economic benchmarking in assessing capital expenditure may be limited.[30] Rather, the AER is proposing to apply economic benchmarking techniques to opex, and to total costs.[31] In the case of total costs, the issue of the lumpy investment profile for transmission assets is reduced, since the assessment of capital costs takes into account both new capex and the existing asset base.

The lumpy nature of transmission investment is therefore less of a difficulty in relation to the benchmarking applications being proposed by the AER.

2.3.3. Summary

In summary, the small sample size available for the benchmarking of TNSPs within the NEM will severely limit the explanatory power and significance of any benchmarking model applied for comparative analysis across TNSPs. This in turn raises the question of the value of applying comparative economic benchmarking models to TNSPs. At a minimum, extreme care will be required in interpreting the results of any such analysis, while differences between the benchmark analysis and observed outcomes will not be able to be presumed to

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[29] This point is also made by the Productivity Commission, see: Productivity Commission, *Electricity Network Regulatory Frameworks*, 9 April 2013, p. 164.

[30] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, June 2013, p. 19.

[31] I note that in its Explanatory Statement (p. 66) the AER does refer to assessing NSP's capex performance against other NSPs, and that economic benchmarking may be relevant in this regard. However the more detailed discussion in Appendix A does not propose to apply benchmarking to capex alone.

reflect 'inefficiency'. I discuss this point further in relation to the AER's proposed use of its Economic Benchmarking Model in the regulatory determination process (see section 2.4)

The small sample size for TNSPs raises fewer concerns in relation to the application of benchmarking techniques to measure changes in the same TNSP's performance over time (ie, a time-series analysis), provided that the costs being benchmarked are total costs (and so reflect the capital stock), rather than only new capex expenditure. However, in this case it will be necessary for the AER to ensure that it has sufficient data from past years for a particular TNSP in order to be able to draw robust conclusions. This is recognised at a number of points in the AER's Explanatory Statements and the accompanying consultant report.[32]

2.4. AER's proposed application of benchmarking

The AER proposes to use benchmarking techniques as part of a suite of tools to assess NSPs' expenditure. Specifically, it proposes to use MTFP, DEA and regression analysis ('econometric methods') as part of regulatory determinations.

The AER proposes to use the results of the DEA, MTFP and regression analysis:[33]

1. To provide information on the 'relative economic efficiency' of NSPs and 'changes in the efficiency' of NSPs over time, so as to determine whether an NSP is responding to incentives. The AER considers that this analysis will inform its assessment of whether the revealed cost approach to determining expenditure forecasts remains appropriate;
2. To determine a 'reference cost forecast' or 'total cost counterfactual' against which the total costs implied by the NSP's proposed expenditure would be compared in a 'first pass' in order to identify whether the NSP's proposal requires more detailed assessment, and, if so, the areas of focus for more detailed review techniques. This reference forecast would be across the NSP's *total costs* (ie, opex plus capital costs – being return on capital and depreciation); and
3. To provide a top down 'reference forecast' for opex.

MTFP and/or DEA are proposed to be used for the first two applications (together with regression analysis in order to take account of different environmental factors), whilst regression analysis is proposed for the third application.

I note at the outset that the ultimate application of the AER's economic benchmarking models as part of the regulatory determination process should be informed by the assessment of how the models perform in practice. Benchmarking models that exhibit a high degree of robustness and therefore have credibility will be suited to being used in the determination process in ways in which less robust models will not be. At this stage, the AER would wise

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[32] See for example Economic Insights, *Economic Benchmarking of Electricity Network Service Providers*, 25 June 2013, p. 96.

[33] AER, *Explanatory Statement, Draft Expenditure Forecast Assessment Guidelines for electricity transmission and distribution*, August 2013, p. 44. See also AER, *Economic benchmarking workshop 7 — Application of economic benchmarking techniques*, June 2013.

not to 'lock-in' either the particular benchmarking techniques it will adopt or how the results of its analysis will be used in the regulatory determination process, ahead of undertaking a transparent and robust development process of actual models, based on real NSP data.

This view is also expressed by the AER in its recent Explanatory Statement, where it discusses the principles it considers should apply in considering alternative assessment techniques.[34] In relation to its proposed principle of 'validity' the AER states that it will not be in a position to satisfy itself as to whether a technique is appropriate until after it has received data or information to test the technique.[35] I strongly support this position. However I also note that much of the AER's discussion of how it intends to apply economic benchmarking techniques, both in the Explanatory Statement and in the earlier documentation, appears to take a more settled view on how the results of the economic benchmarking models will be applied.

In the remainder of this section I first consider the interaction between the three applications of economic benchmarking proposed by the AER (section 2.4.1). I then discuss each of the AER's proposed applications of economic benchmarking in more detail (sections 2.4.2 to 2.4.4). In particular, I set out my understanding of each of the three proposed uses of benchmarking, and provide a commentary on each proposed approach from the perspective of how it fits with the wider regulatory framework under the NER. My assessment in this section is largely independent of the question of whether the AER's benchmarking techniques are themselves found to be robust and to provide 'sensible' outputs (which I consider separately in the section 3 of this report).

2.4.1. Interaction between the AER's proposed applications

The interaction between the AER's three proposed applications of benchmarking and the decisions the AER is required to make as part of a regulatory determination is not completely clear from the documentation provided by the AER.

Figure 2.1 below illustrates how the three applications may fit together. The key uncertainty is whether, in the event a TNSP satisfies the 'first pass' assessment of total costs, it would not be subject to the later benchmarking of opex. The AER notes in its Explanatory Statement that it will 'use benchmarking techniques beyond the first pass assessment'.[36] However it is not clear whether this includes the proposed regression analysis of opex (rather than the AER's proposed category level benchmarking).

In my view, it is important that the AER provides clearer guidance on the intended interaction between the three proposed applications of benchmarking techniques. In particular, comprehensive end-to-end numeric examples across all of the proposed applications should

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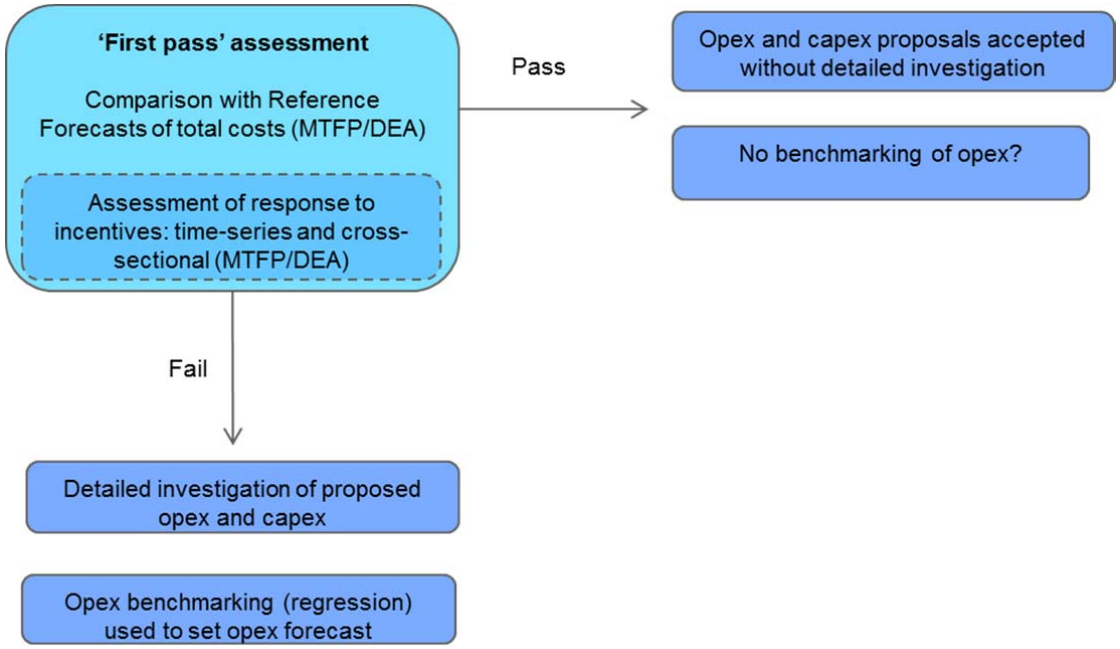
[34] AER, *Explanatory Statement, Draft Expenditure Forecast Assessment Guidelines for electricity transmission and distribution*, August 2013, p. 55-56.

[35] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 56.

[36] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 43.

be provided, in order for stakeholders to understand fully the AER's proposed approach. Such clarity is important, since the AER's use of benchmarking will affect the incentives faced by NSPs under the regulatory regime. It also reduces the perception of potential 'regulatory opportunism', where economic benchmarks are used wherever they would result in a lower expenditure forecast.

Figure 2.1
Interaction between the AER's Proposed Applications of Benchmark Techniques



First pass assessment

The AER refers to a 'first pass' assessment, which uses economic benchmarking techniques amongst other analyses, to identify areas of an NSP's expenditure proposal that warrant further investigation.

The AER's suggested use of benchmarking analysis to derive a reference forecast of 'total costs' and its proposed use of MTFP to assess whether an NSP is responding to incentives both appear to form part of this 'first pass' assessment.

The intended first pass assessment is expressed most clearly in the Technical Report, which suggests that there are two criteria that a NSP needs to meet in order to have its regulatory proposal fast-tracked, ie:[37]

1. An NSP must be deemed to be 'relatively efficient' in relation to 'historical expenditure'; and

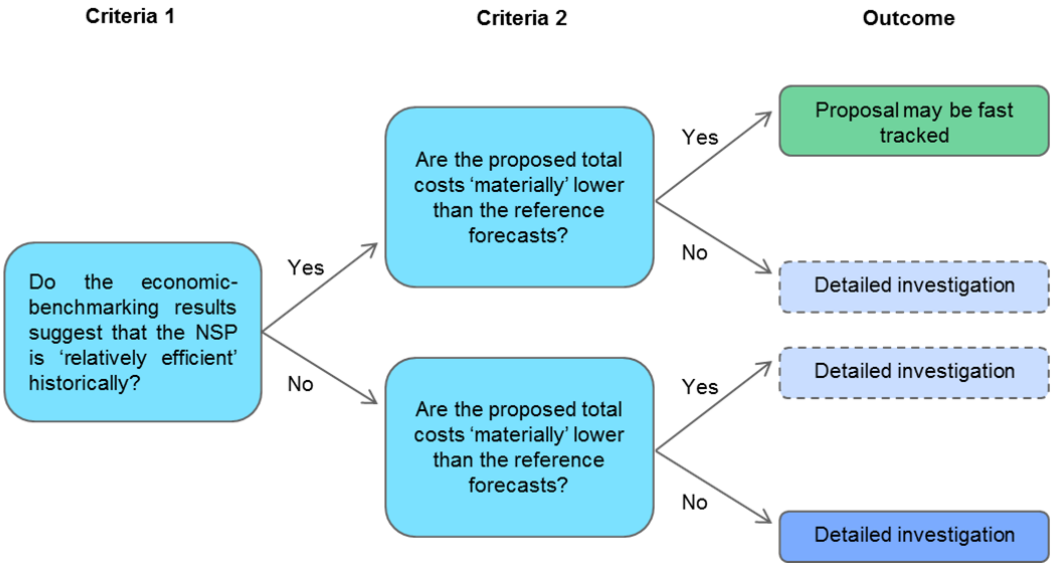
[37] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, June 2013, p. 12

2. The NSP's proposed total costs must be 'materially' lower than the 'reference' total costs derived from the benchmarking analysis.

The AER does not clearly specify what is required for the assessment under the first criterion.[38] However it appears to refer to the assessment of the NSP's response to incentives, to which the AER refers several times, including in the Explanatory Statement, where it states that 'the efficiency of historical costs is relevant to considering whether an NSP is responding to incentives'.[39]

Figure 2.2 summarises my understanding of the AER's proposed use of economic benchmarking in its 'first pass' assessment. The AER does not provide explicit guidance on what would happen if a NSP were to meet one of the criterion above and not the other, ie, if a NSP is deemed to be 'relatively efficient' in relation to its historical costs but its proposed total cost is not judged to be 'materially' lower than the 'reference' total cost forecast, or vice versa. I have assumed that these two outcomes would also result in a detailed investigation of the NSP's proposed expenditure for the forthcoming regulatory period (however this is depicted using dashed boxes in Figure 2.2 given the lack of definitive guidance).

Figure 2.2
The AER's Proposed Use of Benchmarking as Part of a 'First Pass' Assessment



[38] Some parts of the Technical Report appear to imply that the 'regulatory implications' of the assessment of NSP relative efficiency (and response to incentives) are taken into account via the development of the reference cost forecast used for the 'first pass' assessment, rather than being a separate exercise. Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, June 2013, p. 6.

[39] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 83.

Economic benchmarking of opex

The AER has also not been definitive on when the econometric benchmarking of opex would be undertaken. It would appear contradictory for an NSP to satisfy a 'first pass' assessment of its total costs, but still be subject to the top down modelling of opex. Moreover, the AER's rationale for assessing the responsiveness of an NSP to the incentives in the regulatory regime (via its assessment of historic costs) is to inform its view as to the appropriateness of taking revealed costs as the starting point for expenditure forecasts. Again, it would appear not to be consistent to determine that a firm was responding to incentives but to then substitute benchmark operating costs for outturn costs.

However the AER Explanatory Statement notes that the AER will 'use benchmarking techniques beyond the first pass assessment',[40] which does not rule out the possibility that the AER would adopt benchmarking analysis to assess opex, even where the TNSP's total costs satisfy the first pass assessment.

2.4.2. TNSP's responsiveness to incentives

Proposed approach

The AER states in its Explanatory Statement that one proposed application of benchmarking techniques is to assess whether NSPs have been responding to incentives. Where NSPs are not responding to incentives (or are not responding quickly enough) the AER expresses the view that it may not be appropriate to base an NSP's forecasts purely on its historical expenditure.[41]

None of the AER's documents to date provide a comprehensive example as to how the AER intends to undertake this assessment.

The Technical Report provides a discussion of how the AER might use MTFP analysis to compare firms over time (against themselves) and against other NSPs (both via a 'frontier' firm and the 'sample average'), in relation to both their absolute performance and also the change in their efficiency.[42] However it does not clarify which of these of these evaluations the AER intends to focus on, or whether it intends to focus on them all.

The Explanatory Statement suggests that assessments regarding the 'efficiency of historical costs', the 'relative inefficiency' and whether an NSP is showing 'improving efficiency' will all be considered.[43] This appears to suggest the use of both *comparative* and *time-series* analysis of both absolute efficiency and changes in efficiency. However, the AER also notes

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[40] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 43.

[41] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 83.

[42] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, pp. 5- 6.

[43] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, pp. 83-84.

that, in the case of TNSPs, difficulties with comparative assessments may make measurements of the TNSPs' own productivity over time the most relevant metric. [44]

Commentary on approach

The AER proposes to use the rankings derived from its MTFP analysis in order to form a view as to whether an NSP is responding to incentives within the regulatory framework. This in turn is intended to provide an insight into whether historical 'revealed' expenditures are an appropriate starting point for forecasts.

Several points arise in relation to the AER's proposed approach. The first is that a firm's response to the incentives in the regulatory framework is not a binary question. Rather, the extent to which a firm is responding to incentives will inevitably be one of degree. Some firms may respond more than others, but this difference may be due to constraints faced by the firm (such as the age of its existing capital stock), rather than a lack of power in the incentive framework.

By framing the issue in terms of whether or not a firm is responding to incentives, the inevitable subjectivity that enters into this assessment is masked. The AER does refer to an assessment of whether an NSP is responding 'quickly enough' to incentives. However, again, an assessment of what is 'quickly enough' is inherently subjective.[45]

The AER appears effectively to be proposing three separate measures that would enter into the assessment of whether an NSP is responding to incentives. These include comparisons of absolute efficiency levels between NSPs, as well as assessments of the change in efficiency (ie, productivity growth) over time. However the AER has not provided any definitive guidance as to how the results over these three separate measures would be interpreted in order to draw an overall conclusion that an NSP has (or has not) been sufficiently responding to incentives.

In an earlier Briefing Paper the AER expresses the view that an NSP may not be responding to incentives where:[46]

- 'The NSP's productivity performance compares poorly to its peers (ie, it is a long way from the efficiency frontier) and it fails to catch up over time;
- The NSP's productivity performance remained constant or declined over time whilst that of other NSP's continued to grow.'

It is not clear from the AER's commentary whether both of these criteria need to be met for the NSP to be judged an overall poor performer, or only one. The example given in the Technical Report suggests that poor performance against just one measure would be

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[44] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 92.

[45] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 83.

[46] AER Economic benchmarking workshop 7 — Application of economic benchmarking techniques, June 2013, p. 3.

sufficient for the NSP to be judged as performing poorly overall. Specifically, in the example provided, NSP 8 is improving its efficiency over time and at a rate similar to the 'frontier' NSP, but has a productivity growth rate less than the average growth rate across the group.[47] The AER characterises NSP 8 as having 'poor efficiency performance'.[48]

In the Explanatory Statement, the AER appears to suggest that in the case of TNSPs it will focus on the performance of a business' own productivity over time. Specifically, the AER states that:[49]

> *"[D]espite the difficulties of cross sectional comparisons of economic benchmarking results for TNSPs, the measurement of their productivity over time will be relevant."*

However, the discussion elsewhere in the Explanatory Statement does not make it clear that cross-sectional comparisons will not be adopted in assessing TNSP's responsiveness to incentives.

In the event that the AER did undertake a comparative assessment against a 'frontier' firm, the selection of the 'frontier' firm is also a key issue for consideration. For example:

- there may be no single NSP that remains the most efficient in absolute terms over time. The example in the Technical Report has been constructed such that there is a single 'frontier' firm, which is the best performing over time. In reality, however, there may not be one single firm that is the best performing over time. The AER has not provided an example of how it would adapt its assessment in this circumstance.
- further, although one firm may be judged as the best performing, it does not necessarily mean that it represents an efficient firm. In other words, the 'frontier' firm may not itself be efficient, as discussed in section 2.2. This problem is exacerbated in the application of the proposed benchmarking techniques to small samples;[50] and
- it is not obvious how the performance of the 'frontier' firm itself would be assessed.

If instead a comparison is made in relation to the change in efficiency over time, and the average change in NSP efficiency performance is used to assess each NSP's response to incentives, I note that, by construction, not every NSP can be expected to out-perform the average. Indeed, the AER also notes the problems of using averages in its Briefing Paper, ie:[51]

> *"[I]t may not be appropriate to base the productivity growth the NSP is expected to achieve on the average For NSPs that are close to the efficient frontier, it may be difficult for them to match industry average productivity growth rates as it will not be possible for them to continue*

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47 Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, pp. 5- 6.

48 Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 6.

49 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 92.

50 See the discussion in section 2.3.1 in relation to DEA analysis.

51 AER *Economic benchmarking workshop 7 — Application of economic benchmarking techniques*, June 2013, p. 4.

> *to produce efficiency gains relative to inefficient NSPs that have more scope to make catch-up gains by adopting efficient practices already implemented by frontier NSPs."*

The AER notes that the current Economic Benchmarking Model does not specifically consider the appropriate benchmarks to use to compare efficiency, and uses either the frontier firm, or industry-average businesses, without testing for alternative benchmarks that could be used.[52] It also discusses this issue in its more recent Explanatory Statement, and concludes that, given that different techniques may estimate the frontier in different ways, the selection of the appropriate frontier is a matter that it will consider in the light of the results of its benchmarking analysis. It also notes that:[53]

> *"The appropriate benchmark may also differ depending on the sensitivity of benchmarking results to technique and model specification. When there is uncertainty about the appropriate model specification and different specifications provide different results, it may be necessary to use the results cautiously."*

I note elsewhere in this report that it will be important for the AER to interpret the results of its benchmarking results carefully, given the reliability of the modelling results, and the ability of the model specification to incorporate all relevant environmental factors. The identification of a frontier firm for TNSPs is likely to be particularly difficult, given the difficulties with undertaking comparative analysis across the small number of TNSPs in the NEM.

Consistency with existing regulatory framework

The AER's assessment of whether or not an NSP is responding to incentives is intended to provide an insight into whether historical expenditures are an appropriate starting point for forecasts, and in particular whether the revealed cost approach remains appropriate.[54]

'Revealed costs', or actual historic expenditure, are currently taken into account in the regulatory determination process in two key ways:

1. In developing **opex** forecast for the following regulatory period, actual opex in the base year is assumed to represent an efficient revealed cost, from which forecasts of the opex required for the forthcoming regulatory period are developed by adding step changes and applying a growth rate; and
2. Actual **capex** costs by the NSP during the regulatory period are rolled into the RAB. An *ex post* review of actual capex costs prior to their inclusion in the RAB can only be undertaken under the NER if the total capex incurred by a TNSP for the regulatory period is above the total capex allowance for the regulatory period.[55]

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[52] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 3.

[53] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 87.

[54] AER *Economic benchmarking workshop 7 — Application of economic benchmarking techniques*, June 2013, p. 1.

[55] *National Electricity Rules*, Version 56, Clause S6A.2.2.

Where the AER concludes that an NSP is not responding to incentives, it may consider whether replacing actual ('revealed') base year opex with an estimate based on benchmark opex is appropriate. I discuss the use of benchmark opex estimates and consistency with the regulatory framework further in section 2.4.4.

In its Explanatory Statement, the AER also states that it may apply the results of economic benchmarking as part of the *ex post* review of capex, noting also that it may only account for information and analysis that the NSP could reasonably be expected to have considered or undertaken when it spent the relevant capex.[56]

In the case of capex, the AER is limited by the NER to making an ex-post adjustment to capex before rolling it into the RAB in circumstances where the TNSP has spent more on total capex than its capital expenditure allowance.[57] The AER would not therefore be able to make a different decision in relation to the roll-in of capex into the RAB as a consequence of its benchmarking assessment, unless this 'overspend' condition had been met. Outside of this circumstance, the role of the benchmark assessment appears limited to informing the AER's statement on the extent to which the roll forward of the RAB from the previous regulatory control period contributes to the achievement of the capital expenditure incentive objective,[58] rather than affecting the actual amount of the roll-forward.

For recurrent capital expenditure, where the AER concludes that the NSP is responding to incentives, then it may place greater weight on the role of historic expenditure in developing future capital expenditure requirements. However I note that recurrent expenditure only forms a small part of TNSP capex, and so in practice the AER would still need to assess the remainder of the NSP's capex proposal.

2.4.3. Reference forecast for total costs

Approach

The AER is proposing to derive a 'reference forecast' for each NSP's total costs (ie, opex plus capital costs (return on and depreciation of the RAB)) for the regulatory period, against which the total costs resulting from the NSP's expenditure proposal can be assessed.[59] This is intended to form part of a 'first pass' assessment, to determine which areas of the NSP's expenditure proposal may warrant more detailed investigation.[60]

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[56] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, pp. 57, 60 & 66.

[57] *National Electricity Rules*, Version 56, Clause S6A.2.2.

[58] As required under NER 6A.14.2(b).

[59] As noted earlier, the AER Explanatory Statement es contain inconsistencies in the description of this use of economic benchmarking. The draft guidelines state that economic benchmarking can be used to both 'develop a top down **total cost forecast** of total expenditure'[59] [emphasis added] and to 'develop a top down forecast of total expenditure'[59]. I note that the former is what the proposed Economic Benchmarking Model does and the latter refers to what the AER needs to make a decision on as part of the regulatory determination.

[60] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p.3, p. 83. More clearly stated in Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, pp. 9-12.

The Technical Report and the Economic Benchmarking Model present a comparison of the forecast annual total costs for each NSP under the following two approaches:

1. The building block model (BBM), based on the NSP's expenditure proposal and assumptions regarding the appropriate WACC and remaining asset lives; and
2. The 'reference total cost forecast', based on the benchmark MTFP results.

In order to derive the reference forecast for total costs, the NSP's outturn total costs in the base year[61] are adjusted annually by a single growth rate, reflecting:

- overall output growth rate (based on average historic growth in output); plus
- overall input price changes (weighted average of opex price change and capital input price change); minus
- potential productivity and efficiency changes.

The model estimates the annual rate of productivity and efficiency growth over the forecast regulatory period as the sum of two components, ie:

- an *efficiency improvement factor* – Each NSP's MTFP index result in the base year is divided by the MTFP index result in the base year estimated for the most efficient NSP (ie, NSP 1 in the Economic Benchmarking Model). The NSP-specific cost 'inefficiency' is then calculated to be one minus this value, and is assumed to be gradually removed over the next 20 years (ie, the annual efficiency improvement factor is one twentieth of the estimated inefficiency); plus
- a *productivity growth factor* – reflecting the expected annual industry-average productivity improvement. In the AER's example this is based on the observed industry-average productivity change over the sample period.

For each NSP, a comparison is then made between the total cost estimated for the regulatory period using the MTFP benchmarking results and the total BBM cost, as reflected in the NSP's regulatory proposal, both in present value terms. For each NSP, the difference between these two estimates is divided by the present value of the business' proposed total costs to arrive at what the AER terms a 'potential cost reduction'.[62]

Where the total costs resulting from the NSP's proposal are 'materially' below the benchmark reference total costs, the assessment of the NSP's proposal could be 'fast-tracked'. Where the total costs resulting from the NSP's proposal are materially above the benchmark reference total costs the NSP's proposed expenditure would be subject to further detailed investigation. The AER provides no further guidance on what would constitute a 'material' difference between the different cost projections. The example in the Technical Report

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[61] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 10. In the Economic Benchmarking Model, the 'base year' is year 4 of the current regulatory period. From the Economic Benchmarking Model it also appears that the 'actual costs' in this base year would reflect the WACC adopted for the current regulatory period, rather than the WACC proposed for the new regulatory period.

[62] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 11.

classifies NSPs where the ratio of the difference between benchmarked total cost and total cost proposed by the NSP to the total cost proposed by the NSP (referred to as a measure of an NSP's 'inefficiency') is in the range of 0.66 to 1.85 as being 'material', while an NSP with a ratio of 0.18 is not material.

Commentary on approach

The implication of the AER's first pass assessment is that the NSP's expenditure proposals will be subject to detailed analysis in all cases *unless* total costs associated with proposed expenditure are materially below the reference total cost benchmark. Where proposed total costs are either above the reference forecast, or are not materially below it, then the NSP's proposals would not be 'fast-tracked'.

On face value, it appears likely that the 'fast tracking of NSP proposals will only occur in a minority of circumstances, since if the reference forecasts represented true benchmark efficient costs then it would appear unlikely that they could be 'materially' outperformed.

The AER proposes to use MTFP benchmarking analysis to develop a reference forecast of *total costs*. As part of this approach it propose to form a judgement on the relative efficiency, in absolute terms, of the NSP's total costs, relative to the most efficient NSP. This judgement is to be made for a particular year, being year 4 of the existing regulatory period (the base year). It is also to be made in relation to the NSP's total costs, which include the costs associated with its existing RAB.

A conclusion by the AER that inefficiency exists, even if correct, fundamentally relates to the level of total costs in the base year. It will also be heavily dependent on the TNSP's capital stock (ie, the RAB for that year), which is in turn dependent on previous decisions made by the TNSP, including those made decades previously.

In contrast, decisions that the AER is required to make as part of its regulatory determination relate to the efficient level of opex and additional capex required by the NSP, looking forward over the next regulatory period. Given these fundamental differences, it is difficult to identify any insights that the AER's proposed benchmarking analysis of total costs is capable of providing to assist the decisions it is required to make.

The AER has highlighted the identification of differences in trends between the proposed growth in capex and opex inputs, and overall output growth, as one of the factors that the first pass assessment may uncover as worthy of further investigation.[63] The Explanatory Statement provides an example of how the AER may use the results of its MTFP total cost benchmarking to identify areas of an NSP's expenditure forecasts that warrant further investigation.

Specifically, Figure A.1 in the Explanatory Statement provides a breakdown of a TFP index of the change in total costs across three inputs (opex, lines and transformers) as well as

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[63] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 84. And also AER, *Economic benchmarking workshop 7 — Application of economic benchmarking techniques*, June 2013. p 3.

aggregate output. The AER classifies the inputs found to have the two highest growth rates (in the example, transformers and opex) as being the main sources of the change in TFP and therefore those that may warrant detailed review.[64]

However it would appear that such differences would also be able to be identified from trend analysis, without the need to employ more sophisticated benchmarking techniques.

I note also that the AER is also proposing to undertake 'category analysis' of key capital and operating cost expenditure, as part of its 'first pass' assessment.[65] Such analysis is itself based on benchmark cost estimates, and is used to highlight potential discrepancies between an NSP's expenditure forecasts for each of these categories, and the level of expenditure that may be expected as 'typical'. Category analysis would appear to be a more useful tool for identifying potential discrepancies, and key areas for the AER to focus on investigating in more detail. Given that the AER is also planning on undertaking category analysis for all NSP proposals as part of its 'first pass' assessment, it also raises the question as to whether the comparison with the total cost benchmark has a substantive role to play in the AER's assessment.

Further, in its illustrative Economic Benchmarking Model the AER has developed the reference total cost forecast on the basis of an assumed twenty year period in which efficiencies would be achieved. In contrast, in its Explanatory Statement the AER has expressed the view that no 'transition period' should be applied in developing expenditure forecasts that reflect efficient levels of expenditure.[66] The AER has not commented on the discrepancy between its assumptions in this area.

The development of a total cost benchmark requires an assumption on the return on capital, and the AER Explanatory Statement suggests that adopting a common cost of capital across NSPs would be appropriate.[67] In arriving at this conclusion, the AER has had regard to the report prepared by Economic Insights, which states the following:[68]

> *"While this [NSPs having different WACCs] may reflect reality, it has the downside of making it more difficult to compare like–with–like when making efficiency comparisons because capital is receiving different weights."*

In my opinion, the AER should not be guided by what it perceives to be a least 'difficult' approach but instead by what is considered good regulatory practice. The Explanatory Statement notes that the AER intends to conduct sensitivity analysis of the appropriate WACC for economic benchmarking given that the 'choice of WACC could potentially affect

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64 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 84.

65 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 45.

66 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 23.

67 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 93.

68 Economic Insights, *Economic Benchmarking of Electricity Network Service Providers*, 25 June 2013, p.66.

the outcomes of economic benchmarking analysis'.[69] I support this approach, particularly if the AER adopts a common cost of capital across NSPs.

Finally, the Technical Report suggests that the results of its 'first pass' assessment are 'invariant' to the observation that is selected as the reference firm.[70] I note that this is inconsistent with the theory of MTFP analysis. I noted in section 2.2 above that MTFP analysis allows qualitative assessments of productivity levels (ie, rankings) and quantitative assessments of productivity levels (relative to the productivity of the reference firm in one year) that are invariant to the selection of this 'reference' firm. However, the AER's quantitative application of the MTFP index (ie, to develop reference forecasts of total costs) does depend on the selection of the reference observation. This is demonstrated in Box 2.1 below.

[69] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 93.

[70] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 5.

Box 2.1
'First pass' assessment under two different MTFP 'reference' firm selections

In the Economic Benchmarking Model the MTFP of each business is presented relative to the MTFP of NSP 1 in 2011, which yields a set of 'overall cost efficiency' and 'potential cost reductions' in the model for each NSP. However, if the MTFP of each business is presented relative to the MTFP of another NSP (say NSP 2 in 2011), a different set of 'overall cost efficiency' and 'potential cost reductions' in the model would result for each NSP. This is illustrated in the table below.

	Reference firm: NSP 1		Reference firm: NSP 2	
NSP	Overall cost efficiency	Potential cost reduction	Overall cost efficiency	Potential cost reduction
1	1.00	$ 4,502	1.02	$ 7,784
2	0.98	$ (8,115)	1.00	$ (4,798)
3	0.97	$ (5,255)	0.99	$ (2,051)
4	1.00	$ 3,748	1.02	$ 7,041
5	0.97	$ 2,843	0.99	$ 6,145
6	0.98	$ (1,381)	1.00	$ 1,842
7	0.98	$ (14,949)	1.00	$ (11,656)
8	0.95	$ (14,485)	0.97	$ (11,371)
9	0.97	$ 4,176	1.00	$ 7,405
10	0.97	$ (7,203)	0.99	$ (4,006)
11	0.97	$ (13,740)	0.99	$ (10,624)
12	0.96	$ (14,486)	0.99	$ (11,341)
13	0.97	$ (6,057)	0.99	$ (2,882)

The results of the AER's 'first pass' assessment are therefore not 'invariant' to the observation that is selected as the reference firm.

Further, I note that the application of MTFP in the regulatory determination process for electricity distributors in New Zealand did not apply the results in the manner proposed by the AER. Specifically, a series of studies led by Denis Lawrence utilised MTFP to examine comparative productivity performance for electricity distributors in New Zealand.[71] The results of the MTFP analyses in these studies are used purely to rank and classify distributors. Different X-factors were then applied to different groups based on these rankings, but these

[71] See: Meyrick and Associates, *Regulation of Electricity Lines Businesses, Analysis of Lines Business Performance – 1996–2003*, Report prepared for the New Zealand Commerce Commission, 19 December 2003, Canberra; Meyrick and Associates, *Electricity Distribution Business Productivity and Profitability Update*, Report prepared for the New Zealand Commerce Commission, 7 December 2007, Canberra; and Lawrence, D and E Diewert (2006), *'Regulating Electricity Networks: The ABC of Setting X in New Zealand'*, in Coelli, T and D Lawrence (eds.*), Performance Measurement and Regulation of Network Utilities*, Edward Elgar Publishing, Cheltenham, pp. 207-237.

factors were not determined on the basis of the MTFP results and did not infer the removal of inefficiencies or potential cost reductions.[72]

Consistency with existing regulatory framework

The AER notes that the results from the total cost benchmarking "would not be used in an entirely mechanical way".[73] Where a TNSP's proposed expenditure fails the first pass assessment, the AER states that it 'may opt to undertake a more intensive review using detailed engineering and other assessments.'[74] The AER also refers to the potential for the benchmark reference total costs to 'provide useful information regarding the likely productivity and efficiency improvements that the NSP may achieve in the longer term'.[75]

The AER has made earlier statements that the first pass assessment would be used to develop 'preliminary expenditure allowances'.[76] This appears to imply a more mechanistic application of the benchmarking results to derive an expenditure forecast, at least at the early stage of the review process. However, the AER did not make clear how the development of a reference forecast of total costs would then subsequently be used to derive preliminary allowances for opex and new capex expenditure.

The latest Draft Guidelines do not refer to the development of 'preliminary expenditure allowances' as part of the first pass assessment. However the AER does make comments relating to the use of economic benchmarks to determine expenditure allowances, which are not explicitly limited to determining opex allowances. For example:[77]

> *"If, on the balance of evidence (accounting for submissions), we consider economic benchmarking provides the most appropriate forecast, then we will use it to set expenditure allowances."*

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[72] I note that a 1991 study by Denis Lawrence, Peter Swan and John Zeitsch used the MTFP index to compare the productivity levels and growth rates of the five major Australian state electricity systems and states that 'substantial cost savings' are possible if the Australian States were to achieve the productivity level of Queensland in 1988-89. They quantify these cost savings as being equal to the difference in the 1988-89 MTFP index for each Australian State compared to the 1988-89 Queensland MTFP index multiplied by the 'total costs' for each State system, noting that all inputs would need to be 'reduced in equal proportions'. See: Lawrence, D., P. Swan and J. Zeitsch, 1991, *The Comparative Efficiency of State Electricity Authorities*, in P. Kriesler, A. Owen and M.R. Johnson (eds.), Contemporary Issues in Australian Economics, MacMillan p. 198.

Similarly, a 1996 paper by Denis Lawrence and John Zeitsch uses MTFP to compare the efficiency of coal–fired electricity generation plants in the United States, Canada and Australia. Although the principal objective of the paper is stated to be a comparison of how the MTFP and DEA techniques rank the cost efficiency of firms through time, it defines the Keephills plant in 1985-1986 as being the most cost efficient plant and estimates 'productivity gaps' for each plant as the difference between its 1991-1992 MTFP estimate and the Keephills plant in 1985-1986. See: Zeitsch, J. and D. Lawrence, 1996, *Decomposing Economic Inefficiency in Base Load Power Plants*, Journal of Productivity Analysis 7(4), pp. 359–378.

[73] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 13.

[74] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 10.

[75] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 22. See also p. 13.

[76] AER, *Expenditure Forecast Assessment Guidelines, Issues Paper*, 2012, p. 33.

[77] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 82.

The 'Better Regulation Factsheet' accompanying the Draft Guidelines contains a statement that 'benchmarking lets us compare electricity network businesses against each other and determine how efficient they are by comparison. Inefficient networks will face cuts to their proposed expenditure'.[78]

The language used by the AER in both the Explanatory Statement and the Technical Report also raises potential concerns, since it appears to indicate a predisposition to interpret differences between actual and benchmarked costs as 'inefficient', and to adjust forecast expenditures solely on the basis of these differences. For example, the Technical Report uses terms such as 'potential cost reduction' and 'observed inefficiency' in describing the differences between an NSP's proposed costs and the benchmarking results.[79] The AER's Explanatory Statement continues with this use of language.

It is important to recognise that costs which are not explained by a benchmarking model are simply costs that cannot be attributed to the explanatory variables included in the model. Unexplained costs are likely to constitute shortcomings in the model (ie, omitted explanatory and environmental variables), especially where the model has been developed over a small sample. It is very unlikely that unexplained costs are wholly attributable to the inefficient expenditure of an NSP. It is therefore simply not correct to equate differences between benchmark and actual costs as 'observed inefficiency'. This point is also made by Shuttleworth (2005):[80]

> *"[T]he analysis may identify factors with a significant impact on costs, but claims that any unexplained costs are due to inefficiency, as opposed to any other factor, would be no more than unsubstantiated assertions."*

Indeed, comments made by the AER in relation to the judgement required in interpreting benchmarking results, particularly where the small sample size limits the operating expenditure factors that are included in the analysis, support the need for further investigation of differences between actual and benchmark results.[81]

It is important that the AER acts in a manner consistent with its statements that it will not adopt a mechanistic approach in interpreting differences between benchmarks and the TNSP's actual or projected costs. A determination made on the basis that all unexplained differences represent inefficient costs is likely to result in an inappropriate revenue allowance, which does not provide a TNSP with the opportunity to recover its efficient costs (as required by the section 35 of the NEL). Such an approach would be of even greater concern, where the robustness and applicability of the AER's economic benchmarking models have not been adequately demonstrated.

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78 AER, *Better Regulation: Draft Expenditure Forecast Assessment Guideline*, Factsheet, 9 August 2013, p. 2.

79 Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, pp. 2, 11, 13 & 17.

80 Shuttleworth, *Benchmarking of electricity networks: Practical problems with its use for regulation*, 30 January 2005, p. 313.

81 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, AER Economic benchmarking workshop 7 — Application of economic benchmarking techniques, June 2013.

Rather, where the AER's benchmarking model identifies differences between an TNSP's proposal and the reference forecast implied by its benchmarking analysis, the AER should then undertake the more detailed and TNSP-specific analysis required in order to understand the source of these differences, and the efficiency of the TNSP's proposal. This approach would be consistent with the view of the Productivity Commission that in the immediate future benchmarking models should be used primarily as a diagnostic tool to help assess the reasonableness of bottom-up proposals.[82]

2.4.4. Application of economic benchmarking to opex

Approach

The Technical Report and the Economic Benchmarking Model present an approach that uses econometric regression to estimate a 'reference forecast' for opex for the forthcoming regulatory period, against which the NSP's proposed opex can be compared. In particular, the Economic Benchmarking Model uses regression analysis to estimate base year opex, and then applies a rate of change to this base year amount to derive benchmark opex for the remainder of the regulatory period.

The **benchmark base year opex** is calculated by comparing actual opex in the base year with that predicted by the AER's regression equation. The opex 'efficiency score' in each year for each NSP is estimated by comparing the results of a regression analysis with the NSP's actual opex, as follows:

$$Opex\ '\ efficiency\ score'\ = \frac{Opex_{predicted}}{Opex_{actual}}$$

Where an NSP's actual expenditure is greater than that estimated using the regression analysis, the opex efficiency score will be less than one. The AER comments that one minus the opex efficiency score shows the proportion of actual opex that could be reduced by an inefficient NSP to operate as efficiently as the sample average.[83]

For the base year, the AER removes what it terms 'observed inefficiency' by, in effect, multiplying base year opex by the opex efficiency score calculated for that year.[84] Where the NSP's actual base year opex is less than benchmark opex (ie, the opex efficiency score is greater than one) no adjustment to actual base year opex is made.

An **annual rate of change** is then applied to the adjusted base year opex figure, equal to:

- the sum of the output growth rate and input price growth rate; *minus*

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[82] Productivity Commission, *Electricity Network Regulatory Frameworks*, 9 April 2013, p. 295.

[83] Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 14.

[84] In practice, the calculation in the Economic Benchmarking Model encompasses two steps, in order to accommodate outcomes where the NSP's actual opex is less than benchmark opex: (i) the opex 'inefficiency' for each NSP in each year is calculated as the maximum of zero and one minus the estimated opex efficiency for that year; (ii) multiplying the NSP's actual base year opex by '1 minus the estimated opex inefficiency'.

- the annual opex partial productivity gain, estimated using the coefficients from the econometric regression results.

The outcome of the AER's calculations is a 'reference opex forecast' for the forthcoming regulatory period.

The example presented in the Technical Report and the Economic Benchmarking Model compares the present value of reference opex forecast (over the whole regulatory period) with the forecast opex in the NSP's proposal. For each NSP, the difference between these two estimates is divided by the present value of the business' proposed opex for the period. The AER notes that the results of this analysis could be interpreted as follows:[85]

- where the NSP's proposed opex is lower than 'reference opex', this would tend to support the NSP's proposal as representing efficient costs; and
- where the NSP's proposed opex exceeds the 'reference opex' forecast, the difference *may be* explained by inefficiencies or failure to pursue further productivity growth.

The AER also proposes that the results of its benchmarking of opex may be used to set opex allowances for the next regulatory period, including making adjustments to the base year.[86]

Commentary on approach

A fundamental shortcoming of the AER's proposed approach outlined in the Technical Report is that it assumes that the NSP's capital stock is fixed for the period in which it is forecasting opex.[87]

In reality, NSPs capital expenditure decisions will affect their future opex, although the nature of this relationship is complex (some capital expenditure projects may increase future opex, while others may reduce it). However, the econometric opex benchmarking approach in the Technical Report does not take into account this potential interaction, and focuses only on benchmarking opex on the assumption that capital inputs are fixed in each period.

In practice, the AER is required to make a decision in relation to both the efficient level of opex for the forthcoming regulatory period, and also the incremental increase in capital stock (ie, capex) for the period. Determining the level of opex on the basis of benchmark analysis that assumes no change in capex is inconsistent with the circumstances in which the AER will actually be making its determination.

The AER's Draft Statement notes that capital inputs will be treated as a 'control variable' in the opex benchmarking regressions.[88] However this relates to the explanatory variables that are included in developing the regression equation, rather than the assumption that is made in

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85 Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 18.

86 Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 13

87 Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 18.

88 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, pp. 90-91.

relation to the NSP's future capex, which will in turn affect the forecasts of opex derived using the regression equation.

The AER's proposed approach also assumes that all differences between actual base year opex and the results of the regression analysis is due to inefficiency, rather than reflecting explanatory factors that are absent from the regression model. Indeed the AER uses the term 'observed inefficiency', which is incorrect. All that is 'observed' from the regression analysis is differences between actual and predicted or modelled opex, which are not explained by the benchmark model.

The example included in the Economic Benchmarking Model shows the removal of the estimated 'inefficiency' in opex in one year. In its earlier Technical Report, the AER commented that some form of glide-path assumption applied to the removal of inefficiency may be more appropriate, since the ability of an NSP to achieve cost savings will in practice be limited by a number of factors. The factors referenced by the AER are:[89]

- the magnitude of the cost 'inefficiency', where larger 'inefficiencies' will take longer to address;
- the business practices of the NSP; and
- the challenges of renegotiating workplace arrangements.

However, in contrast to this earlier statement, in its Explanatory Statement the AER disagrees with the view that it would be necessary to transition to the lower level of 'efficient' expenditure.[90] Rather, the AER argues that, reflecting what would be expected under competitive market conditions, it is expected NSPs should wear the cost of any inefficiency rather than passing this onto consumers through inefficient or inflated prices. In other words, it is up to the NSP in question to determine how best to manage its costs within the efficient revenue allowances set.

Consistency with existing regulatory framework

Neither the Explanatory Statement nor the earlier Technical Report provide direct guidance on when the econometric benchmarking of opex would be used as the basis for determining the NSP's opex allowance for the forthcoming regulatory period.

The Technical Report makes references to the NSP's base year opex needing to be 'found to be inefficient by a sufficiently wide margin', and that the finding of inefficiency needs to be supported by other assessment tools, such as category analysis.[91] The Explanatory Statement also refers to taking into account other assessment tools. I discussed in section 2.4 that it is not clear whether an NSP may be subject to econometric benchmarking of its opex, in circumstances where its total proposed costs were found to be less than the reference total

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89 Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 19.

90 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 23.

91 Regulatory Development Branch, *Economic Benchmarking Model: Technical Report*, p. 15, and footnote 8, p. 17.

cost forecast conducted as part of the 'first pass', and its productivity was found to be improving under the MTFP analysis.

The AER's Issues Paper in relation to its Expenditure Incentives Guidelines states that 'exogenous approaches' may be used to forecast opex when it is not considered that actual opex incurred by the NSP to be the best indicator of what an efficient level of opex should be.[92] Again, the AER is not clear on the factors that it will consider in making this assessment.

The small sample size used for the opex regression analysis means that the results need to be interpreted with care. In particular, it is not the case that differences between observed costs and modelled costs are necessarily due to 'inefficiency'.

If the AER were mechanistically to use the results of benchmarking as a reason to disallow a proportion of operating costs, there is a significant risk that it would be acting on an arbitrary basis without proper evidence. Such approaches run counter to best practice economic regulation since they reduce the process of setting revenues to a series of subjective judgements, undermine the assurance of cost recovery, and thereby weaken any incentives for efficient behaviour. Such an outcome would not be consistent with the existing framework where TNSPs are to be provided with a reasonable opportunity to recover their efficient costs.

I also note that where the revealed cost approach is not used to set operating cost forecasts for the upcoming regulatory period, this has implications for the strength and continuity of the incentives under the Efficiency Benefit Sharing Scheme (EBSS) applied to opex, under clause 6A.6.5 of the NER. The AER has previously raised the question of whether different EBSS schemes may be required, if 'exogenous forecasting approaches' (ie, regression analysis) is used to set opex forecasts.[93] The modification (or abandonment) of the EBSS on the basis of whether or not the TNSP is deemed to be 'efficient' in relation to economic benchmarking analysis could give rise to significant discontinuities in incentives between regulatory periods. It is important that this potential interaction is considered carefully by the AER in developing its approach to both incentive mechanisms and the application of economic benchmarking.

In addition, the pre-emptive productivity gain inherent in the AER's application of economic benchmarking to opex may compromise the intentions of the EBSS by removing the prospect for TNSPs to be rewarded for management induced gains. For example, it could result in a TNSP being rewarded for only some of its efficiency gains (if its actual opex is less than the allowance), or a TNSP being penalised while still making efficiency gains (if its actual opex is above the allowance but below where the allowance would be had pre-emptive productivity gain not been imposed). It is therefore important that the AER clarifies how management induced efficiency gains will be retained under the EBSS, by outlining its approach to developing its productivity factor and ensuring its application is limited to efficiency improvements that are exogenous to TNSPs.

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92 AER, *Expenditure incentives guidelines for electricity network service providers*, Issues Paper, March 2013, p. 26.

93 AER, *Expenditure incentives guidelines for electricity network service providers*, Issues Paper, March 2013, p. 26.

3. Good benchmarking practice

In this section I assess the AER's proposed Economic Benchmarking Model from the perspective of 'good benchmarking practice'. In particular, I address:

- the process that should be adopted in relation to the development of the AER's proposed Economic Benchmarking Model, including the approach to substantiating the robustness of the model(s) and their degree of 'accuracy'; and
- the adequacy or inadequacy of the input, output and environmental factors defined by the AER.

3.1. 'Benchmarking model 'illustrative' only

My review of the Economic Benchmarking Model and accompanying Technical Report indicates that it is very much an 'illustrative' model. In particular the model illustrates how the results of the proposed benchmarking techniques (DEA and MTFP, as well as regression analysis for opex) could be applied by the AER as part of the regulatory determination process. However it is a long way short of an actual application of those benchmarking techniques that in turn can be subject to an assessment of how well it performs.

In particular:

- the dataset used in the model reflects 'synthetic observations' constructed from a small number of NSPs operating in similar operating environments, rather than from actual NSP data from NSPs operating in different environments;
- the dataset appears to relate to DNSPs, rather than TNSPs, although the Technical Report is not clear on this point;
- the Technical Report notes that the spreadsheet model does not test for, nor identify, a preferred model specification, and no sensitivity analysis has been undertaken with respect to alternative input-output specifications;[94]
- the model includes two 'illustrative' output variables and four 'illustrative' input variables for the MTFP and DEA models, which the accompanying Technical Report notes 'could be' customers and peak demand (for outputs), and opex, overhead line length, underground cable length and transformer capacity (for inputs).[95] However, at this stage the spreadsheet does not contain a comprehensive set of input and output variables;
- the Technical Report notes that the MTFP results in the Economic Benchmarking Model have not been adjusted for environmental factors and that, in practice, where more diverse NSPs might be included for economic benchmarking, it would be necessary to explicitly model these environmental factors.[96] The back cast data requested by the AER from

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[94] ACCC Regulatory Development Branch, *Economic Benchmarking Model Technical Report*, p. 3.

[95] ACCC Regulatory Development Branch, *Economic Benchmarking Model Technical Report*, p. 5.

[96] ACCC Regulatory Development Branch, *Economic Benchmarking Model Technical Report*, p. 5.

TNSPs identifies 19 potential operating environment factors (grouped into weather factors, terrain factors, climate difficulty index and network characteristics); and

- in relation to the opex cost function regression, the model uses a variable 'Z_t' to reflect business specific operating expenditure factors, although the specific nature of these factors is not identified.

Fundamentally, I note that there is a limit to the extent to which the application of benchmarking can be considered 'in the abstract', without reference to actual data, actual model specifications and results. In the absence of real data it is not possible to assess the robustness of the model specification, and the appropriateness of the results, as these are essentially empirical matters. Indeed, the Technical Report acknowledges that the identification of a robust model specification, and sensitivity testing to different input-output parameters, is more appropriately undertaken once a robust NSP dataset is established.[97] The AER's recent Explanatory Statement also acknowledges this point.[98]

3.2. Best practice process for benchmarking model development

In this section I set out an appropriate and 'best practice' process for the development of the AER's proposed Economic Benchmarking Models. In essence, this process is based on the development of the models in the light of actual rather than hypothetical data, and in a manner that reflects a high degree of transparency, including robust justifications for the various choices that the AER will need to make in developing its benchmarking models.

Transparency in relation to the data used, as well as in relation to the assessment of alternative model specifications means that all parties are provided with an opportunity to test alternative specifications, and the stability and reliability of the results. This in turn will contribute to establishing the credibility of the model, and its role in the regulatory determination process.

It is appropriate that the process of model development and assessment occurs outside of the regulatory determination process itself. Ultimately, the assessment of the robustness of the benchmarking models should play a central role in determining the weight that should be placed on the benchmarking analysis, and therefore the role of that analysis in the regulatory determination process.

Currently, there is an apparent danger of the AER 'locking–in' its preferred benchmarking techniques and the way in which it intends to use the outcomes of its benchmarking analysis in a vacuum, without the benefit of any information on how well those techniques perform on the basis of real data. The development of benchmarking models and proposed applications of those models in isolation from an assessment of how those techniques perform in the light of actual data does not represent best practice.

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97 ACCC Regulatory Development Branch, *Economic Benchmarking Model Technical Report*, p. 3.

98 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 122.

3.2.1. Overall model development process

Best practice development of an economic benchmarking model should encompass four steps, ie:

1. identification of the appropriate economic theory;
2. collection of relevant data, and expression of that data on a consistent basis;
3. design and specification of alternative model forms; and
4. testing and amendment of model forms in the light of their performance (stability, statistical reliability, and agreement with theory/other evidence).

These steps are depicted in Figure 3.1 below. Importantly, the model development process can be expected to be highly iterative, with the results of the models (using actual data) being used to inform and test alternative model specifications, and potentially leading to further data collection.

This model development process is broadly applicable to all economic models, including those relating to economic benchmarking.

Best practice also requires that the development process be conducted in a transparent fashion. For example, the data and model specifications tested should be made available to stakeholders so that they can reproduce and confirm the results for themselves, and independently evaluate the models. In addition, the choices as to the inclusion or exclusion of particular variables should be transparently justified, and the results of the statistical tests and sensitivity analysis conducted on the model should be transparent.

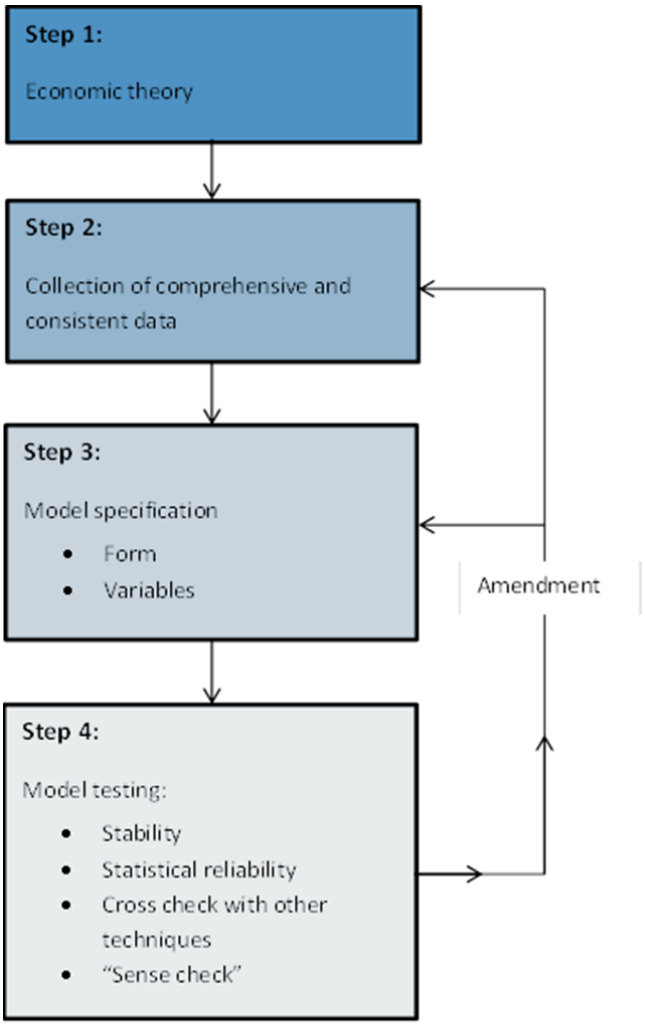
The importance of transparency and verifiability in supporting the credibility of a benchmarking model has also been highlighted by other commentators, including the Productivity Commission.[99] Indeed, the Productivity Commission has called for the AER to support:[100]

> *"[T]he development of publicly available databases and full transparency in the processes and methods the AER uses in its benchmarking. (The standard of reporting of benchmarking and testing of its rigour and robustness would need to be high before the results could play a major role in revenue determinations.)"*

[99] Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1*, 9 April 2013, p. 32. See also Cambridge Economic Policy Associates, *Background to work on assessing efficiency for the 2005 distribution price control review*, September 2003, p. 10.

[100] Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1*, 9 April 2013, p. 32.

Figure 3.1
Best Practice Model Development Process



The four steps identified above broadly accord with those identified by the AER/ACCC in an earlier working paper on benchmarking of energy networks.[101] In that working paper, the AER/ACCC identified four steps that should be 'carefully followed' to ensure that a DEA benchmarking model is robust:

- 'First, the input, output, and environmental variables should be carefully chosen to capture all of the important aspects of operations run by electricity distribution utilities. This should normally be based on sound economic theory and industry knowledge and probably be carried out using careful engineering analysis.'

[101] ACCC/AER , *Benchmarking Opex and Capex in Energy Networks Working Paper no.6,* May 2012, p. 135.

- 'Second, the basic features of the underlying production function need to be determined – such as the presence of economies of scale and the ability of individual businesses to scale up or down the activities of other businesses.'
- 'Third, as large a dataset as possible needs to be compiled [..].'
- 'Finally, the DEA benchmarking should generally be an iterative, collaborative process with industry participants (regulated businesses and customers), which allows for progressive improvement in the model specification and the enumeration of the factors necessary to differentiate different firms.'

In the remainder of this section I discuss each of the steps in the model development process in greater detail.

3.2.2. Identification of relevant economic theory

The first step in the development process is the identification of an appropriate theoretical basis for the model.

In the context of benchmarking models, starting by identifying the relevant theory means carefully identifying the range of different inputs used by the businesses, the outputs that the businesses produce, and the factors that are expected to drive NSPs' costs. This identification should be based on both *a priori* expectations as to economics relationships (for example, the importance of the quality of an NSP's capital stock in driving operating and maintenance costs), as well as detailed understanding of the cost drivers of the businesses. Not all drivers of cost may be known *a priori*, and some potential cost drivers may turn out not to be significant in practice. However, the aim should be to identify all of those factors that may potentially be relevant.

Starting from theory also means having a prior expectation as to the form of relationship between cost drivers and costs, eg, whether a particular cost driver is expected to be positively or negatively related to overall costs, and whether the relationship is expected to be linear or to reflect economies of scale. In the case of models that only encompass a partial consideration of an NSP's overall costs, such as the modelling of operating costs, there needs to be a clear identification of the assumptions made in relation to cost elements that are not modelled (such as capital inputs), and an assessment of the extent to which this assumption accords with economic theory.

The importance of proceeding from a clear theoretical base is that this then informs the collection of the data, the initial model forms tested and the later evaluation and interpretation of the model results. For example, not all the factors which are expected to influence an NSPs' costs may be directly measurable. However, omitting a factor in the modelling on the basis that it is not measurable inevitably introduces an error into the modelling results. The results therefore need to be interpreted in this light, with differences in performance between firms at least partially reflecting this uncaptured factor, rather than being able to be interpreted solely as 'inefficiency'.

Similarly, if there is a prior theoretical basis to expect that an NSP's costs will be negatively related to customer density, modelling results that indicate a positive relationship would need

to be subject to further scrutiny in order to be confident that the model was providing reliable results.

The AER/ACCC has previously highlighted the importance of identifying a list of explanatory variables at the outset of the model development process:

> 'The first step is to identify a list of explanatory variables, at the outset, which can explain the key differences in costs incurred by regulated businesses. Several recent papers (such as Burns, Jenkins and Riechmann 2005 and Turvey 2006) have emphasised the importance of careful independent assessment of the likely cost drivers and factors affecting differences in costs.'[102]

And:

> '*prima facie*, the selection of key cost drivers should be carried out independently of considerations of the available data'.[103]

3.2.3. Data collection and data cleaning

A critical component of the model development process is the use of actual data. The robustness and suitability of a benchmarking model is ultimately an empirical question. It is not possible to 'validate' the use of a model in the abstract, since the robustness of the model is inexorably linked with its performance in the light of actual data.

Data collection is therefore a key step in the development and assessment of any benchmarking model. The current absence of comprehensive and consistent data collected across NSPs means that this fundamental step in the AER's development process for its economic benchmarking models remains outstanding.

I understand from Grid Australia that the AER is currently in the process of requesting ten years of data from each TNSP for back-casting, in relation to a number of input, output and environmental factors. Collection of this data is an essential prerequisite to the further development of the benchmarking models. However, in instances where actual data are not available, I note that TNSPs are required to provide their best estimate of such data. This creates overall data quality and consistency concerns, especially when each TNSP itself adopts its own assumptions and techniques to estimate missing data.

It can also be expected that, once the data is collected, the AER will need to undertake a process of 'data cleaning' in order to ensure that, as far as possible, information is reported on a consistent basis across businesses and is therefore comparable. It is unlikely to be the case that all TNSPs currently collect and define data on the same basis. For example, the definition of what is included in opex may vary substantially between TNSPs, depending both on the categorisation adopted by the business and also on the approach that the business has taken in procuring certain inputs (eg, leasing (opex) or purchasing (capex) vehicles)).

It may also be the case that historical data has not been collected on a consistent basis, requiring adjustments to the reported data even for the same TNSP. In addition, it is

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[102] AER/ACCC, *Benchmarking Opex and Capex in Energy Networks Working Paper no.6,* May 2012, p. 82 - 83.

[103] ACCC/AER , *Benchmarking Opex and Capex in Energy Networks Working Paper no.6,* May 2012, p. 66.

important to consider whether there has been a 'structural break' which may affect the consistency of historic data. For example, the amalgamation of several NSPs within a single holding company may result in a change of scale in business activities which makes comparison of data 'before' and 'after' this event invalid.

It is important not to underestimate the time and effort that will be required in order to 'clean' the data to ensure valid comparisons between companies. The AER/ACCC has previously highlighted the importance of such data corrections and adjustments being conducted in a transparent way.[104]

The data collection and model development process can be expected to be highly interactive. The initial testing of the models on the basis of the collected data is likely to identify both problems with the data collected, and 'gaps' in relation to other data that may be needed. In this context I note the comment by Economic Insights (the AER's consultant in relation to the economic benchmarking models) in a report prepared for the AEMC, that:

> 'It is only by actually using available data for TFP analysis that the full extent of inconsistencies and problems in that data are identified and can then be rectified. [..] There is, hence, an important element of 'learning by doing' in using available data for TFP analysis.'[105]

In my opinion, this point applies equally to other economic benchmarking techniques.

I discussed in the previous section that a comprehensive prior theory of the drivers of expenditure should inform the data collection exercise, and so may be expected to help in eliminating gaps. However, it is not clear that the AER's current data request is based on detailed consideration of the expected cost drivers affecting TNSP expenditure, as distinct from a pragmatic assessment of what data may be most readily available.

It will not be possible to include all of the cost drivers that are identified as being potentially important from a theoretical perspective in a particular benchmarking model. Not all cost drivers will be capable of measurement. Even where cost drivers are measurable, the available data may be incomplete. Sample size also puts a limit on the number of variables that can be included, as recognised by the AER/ACCC.[106] It is therefore important to recognise that some variables will inevitably be left out of the models, and that this in turn may lead to a bias in the model,[107] and affect the conclusions that can be drawn from the results. Proceeding from a comprehensive theory of the factors that are expected to be important (Step 1) through to a comparison of the available data in relation to these factors (Step 2) helps in identifying the importance of excluded factors in a specific case.

Best practice also requires the full data set available for potential use in benchmarking analysis being available to relevant stakeholders, so that they can undertake their own

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104 ACCC/AER , *Benchmarking Opex and Capex in Energy Networks Working Paper no.6,* May 2012, p. 65.

105 Economic Insights, *Assessment of Data Currently Available to Support TFP–based Network Regulation, Report prepared for Australian Energy Market Commission , 9 June 2009,* p. vii-viii.

106 ACCC, *Benchmarking Opex and Capex in Energy Networks,* May 2012, p. 112.

107 Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1,* 9 April 2013, p. 235.

analysis of the data, and test alternative model specifications. Placing the data used for benchmarking in the public domain is supported by the Productivity Commission[108] as assisting with establishing the credibility of the benchmarking models, and by the AER's consultant, Economic Insights:

> "Another critical requirement for the introduction of a successful TFP-based regulatory regime is the **availability in the public domain** of consistent, objective and verifiable data on the value and quantity of all key outputs for all relevant network businesses. This allows interested parties to reach agreement on the veracity of the data used and to undertake their own TFP calculations and sensitivity analysis."[109] (emphasis added).

The New Zealand regulatory regime represents an example of best practice in this regard. All electricity network businesses in New Zealand are required to make Information Disclosure Data filings, which contain detailed information which can be used to reproduce the benchmarking analysis conducted by the regulator.

The data used by Ofwat in the UK in undertaking benchmarking of the water and sewerage businesses is also made available to the regulated businesses. In consequence, the water businesses are able to reproduce Ofwat's benchmarking results, and to undertake assessment and further analysis of those results. Similarly, Ofgem shares the data used in its benchmarking analysis with the electricity distribution businesses , although it does not publish all of the data publicly (particularly the detailed breakdowns of costs and outputs) due to confidentiality considerations. Nevertheless, the network businesses can usually re-construct the analysis.

I therefore support the AER's apparent intention of making public the data collected and used in its benchmarking models.[110]

3.2.4. Model specification

The third and fourth steps in the model development process are the development, and then the testing, of different model specifications.

The initial model specifications should be informed by the economic theory underlying the model being developed. In the case of benchmarking models, that implies that the model should reflect those input, output and environmental factors that are expected to be important in explaining the relationship between inputs and outputs. However, it would be expected that this initial specification will be tested against alternatives, in order to identify the particular factors that are key to explaining the relationships, and to ensure that the results obtained are both stable and sensible.

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[108] Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1*, 9 April 2013, p. 32.

[109] Economic Insights, *Assessment of Data Currently Available to Support TFP–based Network Regulation, Report prepared for Australian Energy Market Commission , 9 June 2009,* p. 18.

[110] AER, *Expenditure Forecast Assessment Guidelines Working Group meeting No. 13 Summary of meeting – 2 May 2013*, p. 6.

The process of model development and variable selection is a balancing act. The 'general-to-specific' approach is one method of selecting those variables that enhance the explanatory power of a model while maintaining statistical significance. Under this approach the following steps would be adopted:[111]

1. Ascertain that the general statistical model is compatible with the theory (ie, congruent);
2. Eliminate a variable (or variables) that satisfies the selection (ie, simplification) criteria;
3. Check that the simplified model remains congruent; and
4. Continue steps 2 and 3 until none of the remaining variables can be eliminated.

Alternative model development approaches may 'build up' from an initial specification, and examine whether adding additional variables improves the explanatory power of the model to a statistically significant extent.

In addition the model development process could be expected to consider the appropriateness of data transformations (such as the use of log values) and the model type (eg, linear, quadratic, inclusion of interaction terms).

Whichever approach is adopted, it is important that the model specification and development process is transparent. For example, the AER should document and provide justification for why certain variables have been included in its model specifications, and why others have been dropped.

The Productivity Commission has also identified transparency as being important in establishing the credibility of benchmarking results, and has highlighted the importance of:[112]

- the explanation and graphical presentation of inputs and outputs and their main statistical features (averages, variances);
- divulgence of model selection processes, how data may have been manipulated, and why potentially relevant variables have been omitted; and
- comparisons with alternative models, and why the ultimately selected model(s) is superior to others.

In relation to the current Economic Benchmarking Model, I note that the presentation of the MTFP index in the 'TFP Index' worksheet is not currently very accessible. A closer link between the presentation of the calculation in the spreadsheet (including appropriate column labelling) and the discussion of the MTFP formula in the accompanying Technical Report[113] would assist in making the calculation more readily understandable to external parties.

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111 Hoover, K.D., and S.J. Perez, *Data mining reconsidered: encompassing and the general-to-specific approach to specification search*, Econometrics Journal, Volume 2, 1999, p. 167 – 191.

112 Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1*, 9 April 2013, p. 182.

113 ACCC Regulatory Development Branch, *Economic Benchmarking Model Technical Report*, p. 4.

I recognise that in developing the Economic Benchmarking Model the AER has not currently considered the question of appropriate model specification in detail.[114] In consequence, there is no explanation currently provided in the Technical Report in relation to why particular variables have been chosen, and why the models have been specified as they have been. The AER should be encouraged to provide a greater degree of transparency in its discussion of model specification once it begins to develop and consult on potential benchmarking models based on actual data.

3.2.5. Model assessment

For economic benchmarking models to be accepted as robust and suited to the purpose for which they are intended to be used in the regulatory determination process, it is important that they are rigorously and transparently assessed. As noted above, the process of model assessment and model development are closely linked, since the assessment of a particular model specification can be expected to uncover issues that, in turn, lead to a re-specification of the model to address those issues.

A comprehensive assessment of a benchmarking model can be expected to test:

- the stability of the results of the model to small changes in the data sample used and the input assumptions;
- the statistical reliability of the model, on the basis of standard tests;
- the consistency of the results with those obtained using other benchmarking approaches;
- the extent to which the results look 'sensible', on the basis of other information, including the initial economic theory.

Below I discuss what an assessment of a benchmarking model against each of these criteria may encompass.

I note also that similar assessment approaches are referred to in the Technical Report[115] and have been suggested by the Productivity Commission.[116]

3.2.5.1. Stability

In the context of benchmarking, 'stability' may be understood as requiring the analysis to meet the following criteria:

- for benchmarking models that rank different businesses, the relative efficiency scores of a company should not fluctuate widely over short periods of time;

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[114] ACCC Regulatory Development Branch, *Economic Benchmarking Model Technical Report*, p. 3.

[115] ACCC Regulatory Development Branch, *Economic Benchmarking Model Technical Report*, p. 21-22. See for example: Bauer et al, *'Consistency Conditions for Regulatory Analysis of Financial Institutions: A Comparison of Frontier Efficiency Methods'*, No 1997-50 in Finance and Economics Series of Federal Reserve System (US), 1997, p. 3.; Cambridge Economic Policy Associates, *Background to work on assessing efficiency for the 2005 distribution price control review*, September 2003, p. 10.

[116] Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1*, 9 April 2013, p. 182.

- for benchmarking models based on econometric techniques (eg, regression of operating costs), the results from the model should be stable over the time period considered;
- adding or removing a few observations (such as removing a comparator firm, or adding or removing an environmental factors) should not alter the results significantly; and
- the results should not vary significantly due to subjective choices over the specification of a model (such as choosing one variable over another) or interpretation of the results (how much of the unexplained costs is attributed to 'inefficiency').

On the first criteria, it would be unrealistic to expect a company to improve its efficiency relative to both its prior performance and to its peers in a very short space of time. Benchmarking that results in substantial fluctuations in rankings between NSPs from year to year, say as new data is added, would therefore raise questions as to the credibility of the model.[117] I note that this has been a criticism of the MTFP benchmarking modelling applied to the electricity network businesses in New Zealand.

Where benchmarking studies do not meet the above criteria, the results must be treated with caution, at best. Indeed, the Productivity Commission comments that:

> 'If the results of a model are sensitive to small perturbations in the underlying data, the addition of control variables with little expected impact, the removal or addition of a single network business, or to modest changes in assumptions and estimation techniques, then benchmarking results are at best indicative, and at worst, useless.' [118]

Ultimately, where the results of a benchmarking analysis are not demonstrated to be stable (by reference to the above criteria), the manner in which the results are used in the regulatory determination process needs to be cognisant of this lack of stability. In this situation it is also important that any decision by the regulator to adopt one set of results over another be explained and justified.

3.2.5.2. Statistical reliability

In addition to testing and demonstrating the stability of the benchmarking results, good benchmarking practice also requires the regulator to assess the results of the benchmarking analysis using established statistical techniques, and to make this assessment transparent.

Of the three economic benchmarking techniques which the AER is proposing to adopt, statistical assessment tests can only be applied to the proposed regression analysis of opex. There are no equivalent statistical reliability tests that can be applied either to MTFP or to DEA analysis. This is because these latter models do not postulate a specific relationship between outputs and different input variables.

The results of a benchmarking model based on regression analysis can be subjected to a range of standard, statistical tests. These include tests of linearity, assessment of the residuals,

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[117] This point is also recognized by the Productivity Commission. See: Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1*, 9 April 2013, p. 182.

[118] Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1*, 9 April 2013, p. 179.

parameter stability with different sub-samples, statistical significance tests (eg, F-tests) and omitted variable tests.[119]

Analysis of the residuals can assist in throwing some light on the question of whether these represent relative efficiencies, or significant drivers of differences in cost between companies that has not been allowed for in the analysis. In general, the narrower the range of residuals, all else equal, the more likely it is that all significant cost drivers have been taken into account. A wider range of residuals suggests, again all else equal, that it is more likely that an important explanatory variable has been omitted.

Notwithstanding that the analysis in the current AER Economic Benchmarking Model is currently based on synthetic data, and so cannot be used to evaluate the results of the modelling techniques used, I note that, in relation to the regression results presented in the 'Opex efficiency' worksheet:

- Only the 'time trend' (TT), the 'other' variable (Z) and the intercept have statistically significant coefficients at the 5% level, which is the level which is typically considered to represent significance of that variable.[120] The other five variables do not have statistically significant coefficients. Given that the F-statistic of the regression is significant, this may indicate multicollinearity (which would need to be addressed) or that the additional variables included do not add to the model's explanatory power;
- The F tests in relation to the change in fit (R^2) from adding each coefficient are not reported. These tests highlight whether the increase in the explanatory power of the model from adding each variable is statistically significant;
- No analysis of the residuals is presented. Such analysis would throw some light on the appropriateness of the proposed regression. A preliminary assessment of the residuals does not highlight that there is a clear problem. However, as a matter of best practice, full residual analysis, including in relation to the selection of each variable, should be undertaken;
- The regression specification includes 'squared' terms for two variables (Y_1, Y_2). Standard model development would proceed from a basis of the relationship expected in theory, and then an examination of residual plots, ie, the non-squared term may be included first, and the residuals observed to assess whether it may be appropriate to include a squared term. There is no discussion of this process in the Technical Report.
- It is not clear that the results fit the expected theory. In particular, the negative coefficient relating to the time trend means that operating costs are *declining* over time. It is not immediately apparent that this relationship would be expected, given the assumption of increasing real input costs; and
- There are opposing signs on Y_1 and Y_1^2. This suggests that Y_1 has a positive effect on opex until a turning point is reached, beyond which Y_1 has a negative effect on opex.

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[119] The Productivity Commission also discusses a range of statistical reliability tests that can be carried out. See Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1*, 9 April 2013, p. 182.

[120] I note that these variables are actually shown as being significant at the 1% level.

Depending on the nature of Y1, it is not clear that this form of relationship would be supported by theory, and so these results should be discussed and explained.

When re-running the regression analysis on the basis of actual data, the AER should be encouraged to include a full analysis and discussion of its results, addressing the above points.

3.2.5.3. Cross check with other benchmarking techniques

The results of benchmarking analysis using one technique should also be compared with the results of analysis using alternative techniques. In other words, the rankings of NSPs, especially with respect to the 'best' and 'worst' performers, should be fairly consistent across approaches, regardless of the particular benchmarking technique used.

Consistency of results between different benchmarking techniques is a criterion noted in Technical Report. It is also referenced by the Productivity Commission (as a 'corroboration test'), and others. For example, Farsi and Fillippini (2005) make the following observation in a paper on benchmarking in the electricity distribution sector:

> *"It is assumed that the results are valid if they are independently obtained from several models"*[121]

If the relative rankings of firms differ significantly by model, the Productivity Commission notes that it would then be necessary for the regulator to explain the discrepancy, and to provide evidence to support its chosen model as the superior approach.[122]

In the Technical Report, the ACCC/AER comments that

> *'Consistency analysis should be performed to examine the robustness of benchmarking results in relation to alternative benchmarking methods and model specifications. Where the results differ materially, a justification for the use of the method and specification selected should be provided.'* [123]

I note the AER's proposed use of DEA analysis to confirm the results of its MTFP analysis.[124]

I agree that the use of different benchmarking techniques acts as a good 'check' on the robustness of the outcomes from one technique – since different techniques should give similar results. Different results would highlight inadequacies with at least one of the techniques.

However, it is also important to recognise that similar results do not automatically mean that the benchmarking models are 'accurate'. In other words, the presence of consistent results across models is a necessary, but not sufficient, condition to demonstrate that a model is robust. For example, it may be that both benchmark techniques are biased in the same way

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[121] Farsi and Fillippini, *Benchmarking and regulation in the Electricity Distribution Sector*, 2005, p. 17-18.

[122] Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1*, 9 April 2013, p. 182.

[123] ACCC, Regulatory Development Branch, *Economic Benchmarking Model Technical Report*, p. 21.

[124] ACCC, Regulatory Development Branch, *Economic Benchmarking Model Technical Report*, p. 2.

(for example, they may both omit the same explanatory factor), so that they produce similar – but inaccurate – results.

I note that at this stage the similarity between the AER's MTFP and DEA results in its Economic Benchmarking Model does not provide evidence of the robustness of the models, given that both techniques have been modelled based on simplified and synthetic assumptions.

3.2.5.4. 'Sense-check' of results

The estimation of relative efficiency through MFTP, DEA and econometric modelling is acknowledged to be fraught with difficulties. It is therefore important that the results of such models are subject to a 'sense check'. Results that look peculiar on the surface level to an industry expert may indicate a problem with the model that requires further investigation. Any discrepancy between the results and expectations from the initial economic theory should also be investigated and explained.

The Productivity Commission again makes similar observations, noting that the regulator should consult with independent engineering experts with technical knowledge of NSP operations to assess the credibility of model results and assumptions.[125]

The value of sense-checking the results of a benchmarking model is illustrated by the benchmarking of the water industry in the United Kingdom during the mid-1990s, when OFWAT (the economic regulator of the water industry in England and Wales) undertook an econometric analysis of the efficiency of water companies across the country.

A sense check of OFWAT's model found that the least efficient sewage treatment facilities were disproportionately located in geographic regions with a population greater than 25,000. Although it is possible that sewage works were consistently inefficiently managed in regions with higher populations, it seemed more likely that the aberration reflected an omitted variable or miscalculation in the model. Further analysis verified this. In particular, it was found that unallocated costs had been accounted for differently across the businesses, with a bias towards large works relative to smaller works.

3.2.6. Iterative process

Finally, as discussed earlier, the development of a robust benchmarking model will be an iterative process, with different model specifications being subject to assessment and modification in the light of actual data.

The iterative nature of the development of a reliable and credible benchmark model was stressed by the AER/ACCC in its 2012 Working Paper:

> 'A final step is to interact and co-operate with the industry stakeholders (service providers and customers) to further refine and improve the choice of variables, the quality of the data, the choice of functional form, and so on. Benchmarking is likely to be an iterative process.'[126]

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[125] Productivity Commission, *Electricity Network Regulatory Framework, Final Report – Volume 1*, 9 April 2013, p. 184.

The Technical Report also discusses the importance of developing an effective, iterative process to improve the application of economic benchmarking.[127] It is important that this process occurs as the result of a separate process *prior* to determination process.

As noted earlier, the ultimate application of the AER's economic benchmarking models as part of the regulatory determination process should be informed by the assessment of how the models perform in practice. Benchmarking models which exhibit a high degree of robustness and therefore have credibility will be suited to being used during the determination process in ways in which less robust models will not be. At this stage the AER should not be 'locking-in' either the particular benchmarking techniques it will adopt or how the results of its analysis will be used in the regulatory determination process, ahead of undertaking a transparent and robust development process of actual models, based on real NSP data.

3.3. AER proposed process for model development

The AER Explanatory Statement notes that the proposed economic benchmarking techniques will undergo a 'testing and validation' process before implementation, separate to the determination process for any individual NSP.[128]

The AER has proposed a model development process which comprises the following steps:[129]

- the application of the AER's preferred model specification to determine the productivity and efficiency performance of each NSP, using appropriate benchmarking method(s);
- sensitivity analysis on model specifications, benchmarking methods, and changes in key assumptions to test the robustness of the results;
- review the performance of benchmarking analysis in terms of estimation stability, sensitivity of the results, and the validity of conclusions drawn;
- the provisions of the benchmarking analysis and preliminary results to NSPs for comment before they are published; and
- the publication of the economic benchmarking results, together with the data underpinning the results.

The AER notes that its process aims to ensure that stakeholders interested in conducting their own analysis can replicate the AER's benchmarking results.

The process proposed by the AER appears to reflect many of the aspects of a 'best practice' process for model development discussed above. For example, although the AER has developed a preferred model specification for economic benchmarking, it also notes that it

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126 ACCC, *Benchmarking Opex and Capex in Energy Networks*, 6 May 2012, p. 82 - 83.

127 ACCC Regulatory Development Branch, *Economic Benchmarking Model Technical Report*, p. 20-21.

128 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, pp. 63 & 69.

129 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 120.

intends to collect information and test alternative model specifications.[130] Specifically, the AER notes in its Explanatory Statement that:[131]

> *"The preferred model specifications are our view of NSPs' outputs, inputs and environmental variables that should be used for efficiency measurement… We have also set out alternative specifications to use as a basis of comparison for our preferred specification during our testing and validation process."*

The AER also notes in its Explanatory Statement that it is not proposing to set an appropriate benchmark level of efficiency until the testing and validation process concludes.[132]

I agreed with the general approach the AER has flagged in relation to the development of its economic benchmarking models. The intended process does not pre-commit the AER to a particular model specification and allows alternative specifications to be tested. The AER has also stated its intention to provide the data which underpins its benchmarking results.

The AER Explanatory Statement also sets out a number of principles that the AER will use when evaluating economic benchmarking models (as well as in relation to other expenditure assessment techniques).[133] These proposed principles are: validity; accuracy and reliability; robustness; transparency; parsimony; and fitness for purpose. Although I consider the use of such guiding principles as being generally consistent with a best practice approach, I note the following cautions:

1. the qualities that the AER attributes to the principle of 'validity' appear to be catered for under the other principles of 'accuracy and reliability' and 'fitness for purpose' and so have little apparent need to be included as a separate principle; and
2. the principle of 'parsimony' would tend to suggest a bias towards 'simple' or 'convenient' assessments, which are not in themselves relevant considerations under the NEL or the NER. Rather than endorsing the benefits of using particular data or techniques, the AER should focus on the extent to which an assessment technique materially assists in evaluating whether forecast expenditure amounts reasonably reflect the expenditure criteria.

3.4. Adequacy of input, output and environment measures

I have also been asked by Grid Australia to express a view on the adequacy or inadequacy of the input, output and environmental measures that the AER is proposing to use in its application of economic benchmarking.

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130 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 79.

131 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 79.

132 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 86.

133 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 55-56.

This question is closely tied to the robustness of the models themselves. Where the models are not robust, or provide a poor explanation of trends over time, then the problem may lie with the range of input, output and environmental factors adopted.

I highlighted in the preceding section that an assessment of the adequacy of an economic benchmarking model is essentially an empirical issue, and so requires assessment in the light of actual data and the proposed model specification. It follows that the adequacy of the input, output and environmental factors proposed by the AER is also a matter of empirical analysis. It is therefore difficult to determine beforehand whether an identified list of factors is adequate. The process adopted for model development must therefore be sufficiently flexible to accommodate changes and variations in the factors considered, as part of the assessment process itself.

With these qualifications, I summarise below the AER's selection of input, output and environmental factors as set out in its Explanatory Statement, and provide a brief commentary.

3.4.1. Proposed approach

The Explanatory Statement describes the AER's 'preferred' model specification in terms of the NSPs' output and input variables that should be used for efficiency measurement. However, the AER notes that economic benchmarking is an 'iterative process' and that the preferred model specification will be included in the testing and validation process.[134] Overall, the AER states it will take a 'holistic approach to data' (ie, seeking data that is broader than that needed for the preferred model specifications) so that different model specifications can be tested.[135]

The AER's preferred model specification for TNSPs is set out in the table below.[136]

[134] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 79.

[135] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 80.

[136] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 80.

Outputs	Inputs
System capacity (kVA*kms)	Nominal opex/weighted average price index
Entry and exit points (no.)	Overhead lines (MVA-kms)
Loss of supply events (no.)	Underground cables (MVA-kms)
Aggregate unplanned outage duration (customer mins)	Transformers and other (MVA)

In addition to the 'preferred' model specification, the AER also sets out 'alternative' specifications for output and input variables that it intends to use as a basis for comparison with its preferred specification during the testing and validation process.

The AER does not list either a 'preferred' or 'alternative' model specification for environmental variables, instead providing a 'shortlist' of variables.[137] The AER states that it does not currently have data on these environmental variables, and that the ultimate decision to incorporate environmental variables will depend on their materiality and statistical relationship, which will be assessed once data have been collected.[138] Overall, the AER draft guidelines state that environmental variables will form a significant part of the data validation and model testing process.[139]

The AER specifies a number of criteria for selecting economic benchmarking variables, is listed in the table below.[140]

[137] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 115.

[138] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 112.

[139] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 116.

[140] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, pp. 96-98.

Output variables	Input variables	Environmental variables
The output aligns with the NEL and NER objectives	Reflective of the production function	The variable must have a material impact
The output reflects services provided to customers	Measures of capital input quantities accurately reflect the quantity of annual capital service flow of assets the NSP employs	The variable must be exogenous to the NSP's control
The output is significant	Capital user costs are based on the NSP's RAB	The variable must be a primary driver of the NSP's costs
	Consistency with the NEL and NER	

The AER's Explanatory Statement notes that econometric analysis will be required to identify any correlations between variables included in the model specifications, ie, to check for multicollinearity.[141] The AER states that if there are environmental variables that are correlated, including only the 'primary cost driver' will limit the issue of multicollinearity in the econometric estimates.[142] It also states that multicollinearity may not be an issue if the analysis is to predict efficiency performance, but rather it is relevant if accurate estimates of the individual impact of environmental variables are required.[143]

3.4.2. Commentary on approach

A common challenge with the definition of inputs in benchmarking models is that they generally fail to take adequate account of the nature of the existing capital stock – focusing instead on additions to that stock. Service performance and new expenditure (both capex and opex) will however be critically dependent on the age and capability of the existing asset base.

The AER notes that asset age may affect the level of inputs without a change in the outputs in the context of DNSPs.[144] This is an important issue and one that is equally applicable to TNSPs, although it is not explicitly discussed in relation to the proposed TNSP model specification in the AER's Explanatory Statement.

The AER states that capex is not an appropriate measure of capital inputs given it represents new capital assets and does not measure the annual use of capital assets, or 'capital service

[141] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 98.

[142] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 98.

[143] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 98.

[144] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 104.

flow'.[145] The AER recognises the importance of considering physical capital measures to proxy the annual capital service flow, ie, the quantity of capital inputs used in the production process each year.[146] The AER's Explanatory Statement outlines a number of possible approaches that could be adopted to proxy capital inputs and notes the shortfall(s) associated with each approach, namely:[147]

- a 'one hoss shay' depreciation profile: it is false to assume an asset provides a constant level of service over its lifetime;
- a geometric depreciation profile: will overestimate the rate of decay and this may result in a situation where an older asset appears to be more efficient than a new asset of the same rating; and
- RAB depreciation: inappropriate because regulatory depreciation is the recovery over time of an investment made, it has no relationship to the outputs that are achieved, fully depreciated assets may still in service, and it may be affected by changes in prices over time and by the assumed remaining life of the asset.

The inclusion of appropriate capital input variables is an important issue and it is paramount that the AER examine a range of options as part of the model testing and validation process, as well as being aware of the shortfalls associated with each approach.

I note that deciding whether a particular variable satisfies the AER's criteria for selecting economic benchmarking variables is inherently subjective. For example, the requirement that an output variable is 'significant' and that an environmental variable must have a 'material' impact both involve subjective assessments regarding the extent of significance/materiality. It is not obvious how an assessment regarding the 'significance' of various outputs of a TNSP would be undertaken, given they are denominated in different units (ie, system capacity vs. the number of entry and exit points). The AER provides no guidance on how these assessments are to be undertaken.

I note also that Grid Australia identified additional environmental variables that could potentially affect a TNSP's costs and which are outside of the TNSP's control.[148] Although the AER states that 'some of these environmental variables were considered' as a part of the inputs and outputs specifications, not all of these suggested variables appear to have been explicitly included in either the AER's preferred or alternative specifications. For example, it is not obvious that the following variables have been considered:

- major circuit structures (for example, single circuit or double circuit, which can affect credible contingencies in the NEM);

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[145] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 111.

[146] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 110.

[147] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, pp. 110-111.

[148] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, pp. 115-116.

- age and rating of existing network assets;
- timing of a TNSP in its investment cycle, given the lumpy nature of investments; and
- the extent of implications of NER 'technical envelope' requirements (for example, voltage stability, transient stability, voltage unbalance, and fault levels).

The AER states that, although all the variables suggested by Grid Australia may affect a TNSP's costs, 'the nature of economic benchmarking means only the most material environmental variables can be included'.[149] Further, in recommending the environmental variables to consider for TNSPs, Economic Insights noted in relation to Grid Australia's submission that:[150]

> *"Economic Insights agrees that, in an ideal world, it would be desirable to adjust for many of the factors identified by Grid Australia while noting that there is overlap between some of the factors listed and items identified in section 2 as outputs. However, given degrees of freedom and multicollinearity constraints, it will only be possible to adjust for the most important operating environment factors initially."*

The AER Explanatory Statement also notes that environmental variables could be accounted for qualitatively.[151]

A fundamental weakness of economic benchmarking is that it often overlooks environmental factors that are business-specific. Many such models proceed on the assumption that costs unable to be explained by the model represent 'inefficiency', when they may simply represent environment or other variables not taken into account.

The AER's conclusion that not all environmental factors can be incorporated, or that some factors will have to be considered qualitatively, has important implications for its later interpretation of the results of the benchmarking analysis. In particular, the recognition of this inherent limitation of economic benchmarking when applied to firms operating in diverse circumstances limits the conclusions that can be drawn from the results.

Differences amount to unexplained variations in costs, which may or may not be due to 'inefficiency'. The consequence is that the results are unlikely to be suitable for use as the primary basis for determining forecast expenditure.

In its earlier Briefing Paper, the AER states that:[152]

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149 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 116.

150 Economic Insights, *Measurement of Outputs and Operating Environment Factors for Economic Benchmarking of Electricity Transmission Network Service Providers*, Briefing Notes prepared for Australian Energy Regulator, 16 April 2013, p. 24.

151 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 116.

152 AER, *Economic benchmarking workshop 7 — Application of economic benchmarking techniques*, June 2013, p. 3.

> '*where operating environment factors cannot be incorporated, judgement should be applied in interpreting the relative efficiency scores, taking into account available empirical evidence on the effect of relevant operating environment factors.*'

It is important that the acknowledged use of 'judgement' in these circumstances is adequately recognised in the later application of the benchmarking results as part of the regulatory process.

The AER also refers to the issue of multicollinearity between variables, and expresses the view that this may only be an issue if accurate estimates of the individual impact of environmental variables are required and not if the analysis is to predict efficiency performance.[153]

Notwithstanding this statement – which in itself is of doubtful validity – the econometric benchmarking that the AER proposes to undertake for opex does involve estimating the individual effect of environmental variables, in order to arrive at an overall expenditure projection. It is therefore important that the AER does test for multicollinearity between variables as part of its testing and validation process, since this may have a fundamental effect on the robustness of the results.

In response to the Issues Paper, Grid Australia submitted that it did not consider energy delivered and peak demand to be outputs of a transmission network – given these parameters cannot be controlled by a TNSP and are instead determined by the interaction between generators and consumers. Grid Australia stated that system capacity better reflected the service provided by TNSPs.[154]

I note that the AER has included both energy delivered and peak demand as 'alternative' TNSP output specifications.[155] This will enable the AER to test alternative specifications as part of its model testing and validation process. Further, as part of the economic benchmarking undertaken in the New Zealand electricity sector it was stated that, in the Australian context, demand side models of NSP outputs (ie, energy delivered and peak demand) tend to find urban distributors with dense networks more efficient while supply side models (ie, system capacity) tend to favour rural distributors with sparse networks (but long line lengths).[156] The AER should bear this in mind where it uses its benchmarking models for comparative analysis.

Grid Australia also suggested the system capacity measure should include transformer capacity as well as line and cable capacity.[157] The AER states that including system capacity

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153 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 98.

154 Grid Australia, *Expenditure Forecast Assessment Guideline Issues Paper*, 18 March 2013, pp. 22–23.

155 AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, p. 108.

156 Meyrick and Associates, *Regulation of Electricity Lines Businesses Resetting the Price Path Threshold – Comparative Option*, Report prepared for Commerce Commission, 3 September 2003, p. 36.

157 Grid Australia, *Expenditure Forecast Assessment Guideline Issues Paper*, 18 March 2013, pp. 22–23.

as an output provides a means of recognising lines as well as transformer requirements but it does not appear to disaggregate system capacity across transformer capacity and as line/cable capacity.[158] These alternative capacity specifications could be included as part of the AER testing and validation process, in order to assess whether they would enhance the reliability of the benchmarking results.

[158] AER, *Draft Expenditure Forecast Assessment Guidelines for Electricity Transmission and Distribution*, Explanatory Statement, August 2013, pp. 80 & 102.

4. Conclusions

I have prepared this report at the request of Grid Australia in light of the AER's proposed application of economic benchmarking techniques to TNSPs in the NEM. Having considered all relevant material on this topic to date, I draw the four distinct conclusions as set out below.

Small sample size of TNSPs in the NEM

The small sample size available for the benchmarking of TNSPs in the NEM severely limits the explanatory power of any economic benchmarking model applied to TNSPs, particularly for comparative analysis. This is a fundamental problem, which adversely affects the suitability of economic benchmarking techniques for transmission businesses.

No clear guidance provided on application of techniques

The AER has not yet provided clear guidance on the intended interaction of its three suggested applications for economic benchmarking techniques, and how they fit with the decisions the AER is required to make as part of a regulatory determination.

In particular, the proposed use of benchmark total costs to compare with the total costs implied by an NSP's expenditure proposal would appear to provide limited insight into the decisions that the AER is required to make on incremental operating and capital expenditure. Some of the AER's other first pass assessment techniques may be more relevant in this regard.

Interpretation of results as being 'inefficient'

The language used by the AER also appears to indicate a predisposition to interpret differences between actual and benchmarked costs as 'inefficient', and to adjust forecast expenditures solely on the basis of these differences. A determination made on the basis that all unexplained differences represent inefficient costs is likely to result in an inappropriate revenue allowance, which does not provide a TNSP with the opportunity to recover its efficient costs, as required by the section 35 of the NEL. Such a potential shortcoming is exacerbated where the robustness and applicability of the AER's economic benchmarking models are still to be demonstrated.

Thorough testing of any technique is imperative

It is imperative that any economic benchmarking models used by the AER are the product of a rigorous and transparent assessment as to their robustness. Best practice model development implies a transparent process, based on actual data that is also made available to stakeholders to undertake their own, independent assessment. The process should proceed from the identification of the relevant economic theory through to the design and specification of alternative model forms, which are then rigorously tested and amended in the light of their performance using actual data.

Consistent with these principles, the process for model development should be iterative, where choices as to the model specification and the inclusion or exclusion of particular variables are transparently justified and subject to rigorous assessment. It is also important that this process is undertaken *prior* to the application of the benchmarking models in the

regulatory determination process, rather than being treated as part of the determination process itself.

The ultimate application of the AER's economic benchmarking models as part of the regulatory determination process should be informed by the assessment of how the models perform in practice. Benchmarking models that exhibit a high degree of robustness and therefore have credibility will be better suited for application during the price determination process in ways in which less robust models will not be. At this stage the AER should not be 'locking-in' either the particular benchmarking techniques it will adopt or how the results of its analysis will be used in the regulatory determination process, ahead of undertaking a transparent and robust development process of actual models, based on real NSP data.

Appendix A. Curriculum vitae

Gregory Houston

Director

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Overview

Greg Houston has twenty five years' experience in the economic analysis of markets and the provision of expert advice in litigation, business strategy, and policy contexts. His career as a consulting economist was preceded by periods working in a financial institution and for government.

Greg has directed a wide range of competition, regulatory and financial economics assignments since joining NERA in 1989. His work in the Asia Pacific region principally revolves around the activities of the enforcement and regulatory agencies responsible for these areas, many of whom also number amongst his clients. In his securities and finance work Greg has advised clients on a number of securities class action, market manipulation and insider trading proceedings, as well as on cost of capital estimation. On competition and antitrust matters he has advised clients on merger clearance processes, competition proceedings involving allegations of anticompetitive conduct ranging from predatory pricing, anti-competitive agreements, anti-competitive bundling and price fixing. Greg also has deep experience of infrastructure access regulation matters, and intellectual property and damages valuation.

Greg's industry experience spans the aviation, beverages, building products, cement, e-commerce, electricity and gas, forest products, grains, medical waste, mining, payments networks, petroleum, ports, rail transport, retailing, scrap metal, securities markets, steel, telecommunications, thoroughbred racing, waste processing and water sectors.

Greg has acted as expert witness in valuation, antitrust and regulatory proceedings before the courts, in various arbitration and mediation processes, and before regulatory and judicial bodies in Australia, Fiji, New Zealand, the Philippines, Singapore, the United Kingdom and the United States.

Greg serves on the Competition and Consumer Committee of the Law Council of Australia, the United States Board of Directors of National Economic Research Associates Inc as well as its Management Committee, and is head of NERA's Australian operations.

Qualifications

1982 **UNIVERSITY OF CANTERBURY, NEW ZEALAND**
B.Sc. (First Class Honours) in Economics

Prizes and Scholarships

1980 University Junior Scholarship, New Zealand

Career Details

1987-89 **HAMBROS BANK, TREASURY AND CAPITAL MARKETS**
Financial Economist, London, United Kingdom

1983-86 **THE TREASURY, FINANCE SECTOR POLICY**
Investigating Officer, Wellington, New Zealand

Project Experience

Regulatory Analysis

2013 **Actew Corporation**
Interpretation of economic terms
Advice on economic aspects of the draft and final decisions of the Independent Competition and Regulatory Commission in relation to the price controls applying to Actew.

2012-13 **Gilbert + Tobin/Rio Tinto Coal Australia**
Price review arbitration
Analysis and expert reports prepared in the context of an arbitration concerning the price to be charged for use of the coal loading facilities at Abbott Point Coal Terminal.

2012-13 **Ashurst/Brisbane Airport Corporation**
Draft access undertaking
Advice, analysis and expert reports in the context of the preparation of a draft access undertaking specifying the basis for determining a ten year price path for landing charges necessary to finance a new parallel runway at Brisbane airport.

2012 **King & Wood Mallesons/Origin Energy**
Interpretation of economic terms
Expert reports and testimony in the context of judicial review proceedings before the Supreme Court of Queensland on the electricity retail price determination of the Queensland Competition Authority.

2012	**Contact Energy, New Zealand** **Transmission pricing methodology** Advice on reforms to the Transmission Pricing Methodology proposed by Electricity Authority.
2011-12	**Energy Networks Association** **Network pricing rules** Advice and expert reports submitted to the Australian Energy Market Commission on wide-ranging reforms to the network pricing rules applying to electricity and gas transmission and distribution businesses, as proposed by the Australian Energy Regulator.
2010-12	**QR National** **Regulatory and competition matters** Advisor on the competition and regulatory matters, including: a range of potential structural options arising in the context of the privatisation of QR National's coal and freight haulage businesses, particularly those arising in the context of a 'club ownership model' proposed by a group of major coal mine owners; and an assessment of competitive implications of proposed reforms to access charges for use of the electrified network.
2002-12	**Orion New Zealand Ltd, New Zealand** **Electricity lines regulation** Advisor on regulatory and economic aspects of the implementation by the Commerce Commission of the evolving regimes for the regulation of New Zealand electricity lines businesses. This role has included assistance with the drafting submissions, the provision of expert reports, and the giving of expert evidence before the Commerce Commission.
2011	**Meridian Energy, New Zealand** **Undesirable trading situation** Advice to Meridian Energy on the economic interpretation and implications of the New Zealand electricity rule provisions that define an 'undesirable trading situation' in the wholesale electricity market.
2011	**Ausgrid** **Demand side management** Prepared a report on incentives, constraints and options for reform of the regulatory arrangements governing the role of demand side management in electricity markets.

2010-11	**Transnet Corporation, South Africa** **Regulatory and competition policy** Retained to advise on the preparation of a white paper on future policy and institutional reforms to the competitive and regulatory environment applying to the ports, rail and oil and gas pipeline sectors of South Africa.
2010-11	**Minter Ellison/UNELCO, Vanuatu** **Arbitral review of decision by the Vanuatu regulator** Expert report and evidence before arbitrators on a range of matters arising from the Vanuatu regulator's decision on the base price to apply under four electricity concession contracts entered into by UNELCO and the Vanuatu government. These included the estimation of the allowed rate of return including its country risk component, and the decision retrospectively to bring to account events from the prior regulatory period.
2007-11	**Powerco/CitiPower** **Regulatory advice** Wide ranging advice on matters arising under the national electricity law and rules, such as the framework for reviewing electricity distribution price caps, the treatment of related party outsourcing arrangements, an expert report on application of the AER's efficiency benefit sharing scheme, the potential application of total factor productivity measures in CPI-X regulation, and arrangements for the state-wide roll out of advanced metering infrastructure.
1999-2004, 2010-11	**Sydney Airports Corporation** **Aeronautical pricing notification** Wide ranging advice on regulatory matters. This includes advice and expert reports in relation to SACL's notification to the ACCC of substantial reforms to aeronautical charges at Sydney Airport in 2001. This involved the analysis and presentation of pricing principles and their detailed application, through to discussion of such matters at SACL's board, with the ACCC, and in public consultation forums. Subsequent advice on two Productivity Commission reviews of airport charging, and notifications to the ACCC on revised charges for regional airlines.
2010	**Industry Funds Management/Queensland Investment Corporation** **Due diligence, Port of Brisbane** Retained to advise on regulatory and competition matters likely to affect the future financial and business performance of the Port of Brisbane, in the context of its sale by the Queensland government.

2009-10	**New Zealand Electricity Industry Working Group, New Zealand** **Transmission pricing project** Advice to a working group comprising representatives from lines companies, generators, major users and Transpower on potential improvements to the efficiency of New Zealand's electricity transmission pricing arrangements.
2007-09	**GDSE, Macau** **Electricity tariff reform** Advice to the regulator of electricity tariffs in Macau on a series of potential reforms to the structure of electricity supply tariffs.
2001-09	**Auckland International Airport Limited, New Zealand** **Aeronautical price regulation** Advice and various expert reports in relation to: the review by the Commerce Commission of the case for introducing price control at Auckland airport; a fundamental review of airport charges implemented in 2007; and the modified provisions of Part IV of the Commerce Act concerning the economic regulation of airports and other infrastructure service providers.
2008	**Western Power** **Optimal treatment and application of capital contributions** Advice on the optimal regulatory treatment of capital contributions, taking into account the effect of alternative approaches on tariffs, regulatory asset values, and network connection by new customers.
2000-08	**TransGrid** **National electricity market and revenue cap reset** Regulatory advisor to TransGrid on a range of issues arising in the context of the national electricity market (NEM), including: the economics of transmission pricing and investment and its integration with the wholesale energy market, regulatory asset valuation, the cost of capital and TransGrid's 2004 revenue cap reset by the ACCC.
2007	**Johnson Winter & Slattery/Multinet** **Review of outsourced asset management contracts** Expert report developing a framework for assessing the prudence of outsourcing contracts in the context of the Gas Code, and evaluating the arrangements between Multinet and Alinta Asset Management by reference to that framework.
2007	**Ministerial Council on Energy** **Review of Chapter 5 of the National Electricity Rules** Advice on the development of a national framework for connection applications and capital contributions in the context of the National Electricity Rules.

2006-07	**Ministerial Council on Energy** **Demand side response and distributed generation incentives** Conducted a review of the MCE's proposed initial national electricity distribution network revenue and pricing rules to identify the implications for the efficient use of demand side response and distributed generation by electricity network owners and customers.
2006	**Ministerial Council on Energy** **Electricity network pricing rules** Advice on the framework for the development of the initial national electricity distribution network pricing rules, in the context of the transition to a single, national economic regulator.
2005-06	**Minister for Industry** **Expert Panel** Appointment by Hon Ian Macfarlane, Minister for Industry, Tourism and Resources, to an Expert Panel to advise the Ministerial Council on Energy on achieving harmonisation of the approach to regulation of electricity and gas transmission and distribution infrastructure.
2005-06	**Australian Energy Markets Commission** **Transmission pricing regime** Advice to the AEMC on its review of the transmission revenue and pricing rules as required by the new National Electricity Law.
1998-2006	**Essential Services Commission of Victoria** **Price cap reviews** Wide ranging advice to the Essential Services Commission (formerly the Office of the Regulator-General), on regulatory, financial and strategic issues arising in the context of five separate reviews of price controls/access arrangements applying in the electricity, gas distribution, ports, rail and water sectors in Victoria. This work encompassed advice on the development of the Commission's work program and public consultation strategy for each review, direct assistance with the drafting of papers for public consultation, the provision of internal papers and analysis on specific aspects of the review, drafting of decision documents, and acting as expert witness in hearings before the Appeal Panel and Victorian Supreme Court.
2004-05	**Ministerial Council of Energy** **Reform of the National Electricity Law** Retained in two separate advisory roles in relation to the reform of the institutions and legal framework underpinning the national energy markets. These roles include the appropriate specification of the objectives and rule making test for the national electricity market, and the development of a harmonised framework for distribution and retail regulation.

2004-05 **Johnson Winter Slattery, ETSA Utilities**
Price determination
Advice on a wide range of economic and financial issues in the context of ETSA Utilities' application for review of ESCOSA's determination of a five year electricity distribution price cap.

2004 **Deacons/ACCC**
Implementation of DORC valuation
Prepared a report on the implementation of a cost-based DORC valuation, for submission to the Australian Competition Tribunal in connection with proceedings on the appropriate gas transportation tariffs for the Moomba to Sydney gas pipeline.

2003-04 **Natural Gas Corporation, New Zealand**
Gas pipeline regulation
Advisor in relation to the inquiry by the Commerce Commission into the case for formal economic regulation of gas pipelines. This role included assistance with the drafting of submissions, the provision of expert reports, and the giving of evidence before the Commerce Commission.

2001-03 **Rail Infrastructure Corporation**
Preparation of access undertaking
Advised on all economic aspects arising in the preparation of an access undertaking for the New South Wales rail network. Issues arising included: pricing principles under a `negotiate and arbitrate' framework, asset valuation, efficient costs, capacity allocation and trading, and cost of capital.

2002 **Clayton Utz/TransGrid**
National Electricity Tribunal hearing
Retained as the principal economic expert in the appeal brought by Murraylink Transmission Company of NEMMCO's decision that TransGrid's proposed South Australia to New South Wales Electricity Interconnector was justified under the national electricity code's 'regulatory test'.

2001-02 **SPI PowerNet**
Revenue cap reset
Advisor on all regulatory and economic aspects of SPI PowerNet's application to the ACCC for review of its revenue cap applying from January 2003. This included assistance on regulatory strategy, asset valuation in the context of the transitional provisions of the national electricity code, drafting and editorial support for the application document, and the conduct of a `devil's advocate' review.

2002 **Corrs Chambers Westgarth/Ofgar**
Economic interpretation of the gas code
Provision of expert report and sworn testimony in the matter of Epic Energy v Office of the Independent Gas Access Regulator, before the Supreme Court of Western Australia, on the economic interpretation of certain phrases in the natural gas pipelines access code.

Securities and Finance

2013 **Sydney Water Corporation**
Cost of capital estimation
Preparation of two expert reports for submission to the Independent Pricing and regulatory Tribunal (IPART) on the framework for determining the weighted average cost of capital for infrastructure service providers.

2011-13 **Slater & Gordon/Modtech**
Shareholder damages assessment
Expert reports and testimony in representative proceedings before the Federal Court alleging misstatement and/or breach of the continuous disclosure obligations of the ASX-listed entity, GPT.

2012-13 **HWL Ebsworth/Confidential client**
Insider trading
Expert advice and analysis in the context of criminal proceedings alleging insider trading in certain ASX-listed securities.

2011-12 **Freehills/National Australia Bank**
Shareholder damages assessment
Expert advice in connection with representative proceedings before the Federal Court alleging misstatement and/or breach of the continuous disclosure obligations of an ASX-listed entity.

2012 **Johnson Winter & Slattery/Victorian gas distributors**
Cost of equity estimation
Expert report submitted to the Australia Energy Regulator on the appropriate methodology for estimating the cost of equity under the Capital Asset Pricing Model.

2009-13 **Minter Ellison/Confidential client**
Misleading and deceptive conduct
Expert report and related advice in light of investor claims and pending litigation following the freezing of withdrawals from a fixed interest investment trust that primarily held US-denominated collateralised debt obligations (CDOs), as offered by a major Australian financial institution. Analysis undertaken includes the extent to which the investment risks were adequately described in the fund documents, and the quantum of any potential damages arising.

2011 **Barringer Leather/Confidential client**
Market manipulation
Expert report prepared in the context of criminal proceedings brought in the Supreme Court of NSW alleging market manipulation in the trading of certain ASX-listed securities.

2010-11	**Wotton Kearney/Confidential client** **Misleading and deceptive conduct** Expert report and analysis in light of investor claims and pending litigation following the freezing of withdrawals from two fixed interest investment trusts that primarily held US-denominated collateralised debt obligations (CDOs).
2010-11	**Maurice Blackburn/Confidential client** **Shareholder damages assessment** Analysis prepare for use in connection with representative proceedings before the Federal Court alleging misstatement and/or breach of the continuous disclosure obligations of an ASX-listed entity.
2010-11	**Mallesons/ActewAGL** **Judicial review of rate of return determination** Expert report and testimony in Federal Court proceedings seeking judicial review of a decision by the Australian Energy Regulator of its determination of the risk free rate of interest in its price setting determination for electricity distribution services.
2009-11	**William Roberts/Clime Capital** **Shareholder damages assessment** Preparation of two expert reports in representative proceedings before the Federal Court alleging misstatement and/or breach of the continuous disclosure obligations of ASX-listed entity, Credit Corp.
2009	**Jemena Limited** **Cost of equity estimation** Co-authored an expert report on the application of a domestic Fama-French three-factor model to estimate the cost of equity for regulated gas distribution businesses.
2008-09	**Clayton Utz/Fortescue Metals Group** **Materiality of share price response** Preparation of expert report and testimony before the Federal Court addressing alleged breaches of the ASX continuous disclosure obligations and the associated effect on the price of FMG securities arising from statements made by it in 2004.
2008-09	**Energy Trade Associations – APIA, ENA and Grid Australia** **Value of tax imputation credits** Preparation of expert report on the value to investors in Australian equities of tax imputation credits, for submission to the Australian Energy Regulator.

2008-09	**Freehills/Centro Properties** **Shareholder damages assessment** Assistance in the estimation of potential damages arising in representative proceedings concerning accounting misstatements and/or breach of the continuous disclosure obligations of an ASX-listed entity.
2008	**Slater & Gordon/Boyd** **Shareholder damages assessment** Preparation of an expert report for submission to a mediation on the damages arising in representative proceedings before the Federal Court alleging accounting misstatements and/or breach of the continuous disclosure obligations of EDI Downer.
2007-08	**Maurice Blackburn/Watson** **Shareholder damages assessment** Preparation of advice estimating the damages arising in representative proceedings before the Federal Court alleging accounting misstatements and/or breach of the continuous disclosure obligation by the ASX-listed entity, AWB Limited.
2007	**Freehills/Telstra Corporation** **Shareholder damages assessment** Advice and assistance in the preparation of the expert report of Dr Fred Dunbar submitted to the Federal Court in the context of proceedings alleging breaches of the continuous disclosure obligations by Telstra. The principal subject of this work was the assessment of the extent to which of material alleged not to have been disclosed was already known and incorporated in Telstra's stock price.
2006-07	**Maurice Blackburn/Dorajay** **Shareholder damages assessment** Advice and assistance in the preparation of the expert report of Dr Fred Dunbar submitted to the Federal Court in the context of proceedings between Dorojay and Aristocrat Leisure. The principal subject of this work was the assessment of the extent and duration of share price inflation arising from various accounting misstatements and alleged breaches of the continuous disclosure obligations.

Valuation and Contract Analysis

2013 **Johnson Winter & Slattery/Origin**
Gas supply agreement price review
Analysis and advice on the implications of certain contract terms for the price of gas, to be determined in a potential arbitration concerning the terms of a substantial long term gas supply agreement.

2013 **Herbert Smith Freehills/Santos**
Gas supply agreement price review
Analysis and advice on factors influencing the market price of gas in eastern Australia, to be determined in a potential arbitration concerning the terms of a substantial long term gas supply agreement.

2012-13 **Herbert Smith Freehills/North West Shelf Gas**
Gas supply agreement arbitration
Expert reports on the implications of certain contract terms for the price of gas under a substantial long term gas supply agreement.

2012-13 **Allens/BHP Billiton-Esso**
Gas supply agreement arbitration
Analysis, advice and expert report on the implications of certain contract terms for the price of gas under a substantial long term gas supply agreement.

2011 **Kelly & Co/Cooper Basin Producers**
Wharfage dues agreement arbitration
Expert report and testimony in arbitration proceedings to determine the 'normal wharfage dues' to be paid for use of a facility that assists the transfer of petroleum products to tanker ships from a processing terminal in South Australia.

2010 **Barclays Capital/Confidential Client**
Due diligence, Alinta Energy
Retained to advise on the key industry related risks and issues facing Alinta Energy's gas and electricity assets during the due diligence process associated with its recapitalisation and sale.

2009 **Freehills/Santos**
Gas supply agreement price review
Analysis and advice on factors influencing the market price of gas in eastern Australia, to be determined in a potential arbitration concerning the terms of a substantial long term gas supply agreement.

2008-09 **Clayton Utz/Origin Energy**
Gas supply agreement arbitration
Expert reports and testimony in an arbitration concerning the market price of gas, which was determined and applied in a substantial long term gas supply agreement.

2008-09	**Minter Ellison/Confidential client** **Treatment of past capital contributions** Expert report and evidence given in arbitration proceedings on the extent to which a discount should apply under a long term water supply contract, in recognition of a capital contribution made at the outset of the agreement.
2008	**Freehills/Tenix Toll** **Logistics contract arbitration** Advice on the appropriate methodology for adjusting prices under a long term logistics contract in light of changing fuel costs.
2008	**BG plc** **Market analysis** Advise on economic aspects of the operation of the east Australian wholesale gas market in the context of the potential development of coal seam gas for use in LNG production and export.
2008	**Gilbert + Tobin/Waste Services NSW** **Damages estimation** Damages assessment in the context of a Federal Court finding of misleading and deceptive conduct in relation to the extent of environmental compliance in the provision of waste services.
2007	**Meerkin & Apel/SteriCorp** **Damages assessment** Expert report and testimony in the context of an international arbitration on commercial damages arising from alleged non-performance of a medical waste processing plant.
2006-07	**Middletons/Confidential Client** **Damages assessment** Retained to provide an expert report on the methodological framework for assessing alleged damages arising from contractual non-performance and associated forecast for demand and supply conditions and prices for natural gas and ethane prices and over a ten year period.
2006	**Confidential Client/Australia** **Valuation of digital copyright** Advice in relation to the negotiation for a licence for digital copyright. This included the discussion of the matters that should be considered in determining fees for a digital copyright licence, including the extent to which digital material should be valued differently from print material and whether the charging mechanism for print is appropriate for digital copyright.

2006 **Minter Ellison/Australian Hotels Association**
Valuation of copyright material
Expert report in the context of proceedings before the Copyright Tribunal concerning the appropriate valuation of the rights to play recorded music in nightclubs and other late night venues.

2005-06 **Minter Ellison and Freehills/Santos**
Gas supply agreement arbitrations
Principal economic expert in two separate arbitrations of the price to apply following review of two substantial gas supply agreements between the South West Queensland gas producers and, respectively, a large industrial customer and major gas retailer.

2002-03 **ActewAGL**
Consumer willingness to pay
Directed a one year study of consumers' willingness to pay for a range of attributes for electricity, gas and water services in the ACT. This study involved the use of focus groups, the development of a pilot survey and then the implementation of a stated preference choice modelling survey of household and commercial customer segments for each utility service.

2002-03 **National Electricity Market Management Co**
Participant fee determination
Advice to NEMMCO in the context of its 2003 Determination of the structure of Participant Fees, for the recovery of NEMMCO and NECA's costs from participants in the national electricity market.

Competition and Mergers

2012-13 **Minter Ellison/Confidential Client**
Merger clearance
Expert reports submitted to the ACCC in the context of a confidential application for clearance of a proposed acquisition in the industrial gases industry.

2011-12 **Gilbert + Tobin/Pact Group**
Merger clearance
Expert reports submitted to the ACCC on the competitive implications of the proposed acquisition of plastic packaging manufacturer Viscount Plastics by Pact Group.

2010-12	**Mallesons/APA** **Merger clearance** Expert reports submitted to the ACCC on the competitive implications of the proposed acquisition of the gas pipeline assets of Hastings Diversified Utilities Fund by APA Group.
2010-11	**Johnson Winter & Slattery/ATC and ARB** **Competitive effects of agreement** Expert reports and testimony in Federal Court proceedings concerning the competitive effects of restrictions on the use of artificial breeding techniques in the breeding of thoroughbred horses for racing.
2010-11	**Victorian Government Solicitor/State of Victoria** **Competitive effects of agreement** Expert report prepared for the State of Victoria on the effects of certain restrictions applying to the trading of water rights on inter-state trade in the context of a constitutional challenge brought against the state of Victoria by the state of South Australia.
2009-11	**Arnold + Porter/Visa Inc, Mastercard Inc and others** **Payment card markets** Expert reports and deposition testimony on behalf of defendants in the United States Re Payment Card Interchange Fee and Merchant Discount Antitrust Litigation, on the effects of regulatory interventions in the Australian payment cards sector.
2010	**Australian Competition and Consumer Commission** **NBN Points of Interconnection** Report and advice on the competition implications in the markets for both telecommunications backhaul and retail broadband services of different choices as to the number of 'points of interconnection' in the proposed architecture of the national broadband network.
2010	**JWS, Gilbert & Tobin/Jetset Travelworld, Stella Travel Services** **Merger clearance** Advice on the competitive implications of the merger between Jetset Travelworld and Stella Travel Services.
2009-10	**Australian Government Solicitor/ACCC** **Misuse of market power** Expert report and testimony in the context of Federal Court proceedings brought by the ACCC against Cement Australia in relation to conduct alleged to have breached sections 45, 46 and 47 of the Trade Practices Act.

2008-10	**Gilbert & Tobin/Confidential** **Merger assessment** Advice on the competitive implications of the then proposed merger and then subsequently the proposed iron ore production joint venture between BHP Billiton and Rio Tinto.
2008-10	**Allens Arthur Robinson/Amcor** **Cartel damages assessment** Advice and preparation of an expert report on the approach to and quantification of economic loss in the context of two separate actions seeking damages arising from alleged cartel conduct.
2009	**State Solicitor's Office/Forest Products Commission** **Alleged breach of s46** Expert advice in the context of Federal Court proceedings alleging breaches of section 46 of the Trade Practices Act.
2009	**Clayton Utz/Confidential Client** **Joint venture arrangement** Reviewed the competitive implications under s50 of the Trade Practices Act of a proposed joint venture transaction in the rail industry.
2009	**Blake Dawson Waldron/Airservices** **Effect of potential industrial action by Air Traffic Controllers** Prepared an expert report in the context of a potential application to the Australian Industrial Relations Commission for termination or suspension of a bargaining period addressing the economic effect that certain forms of industrial action by Air Traffic Controllers would be likely to have on passengers, businesses, and the Australian economy.
2005-06, 08-09	**Phillips Fox/Fortescue Metals Group** **Access to bottleneck facilities** Expert report and testimony in the Federal Court proceedings concerning whether or not access to the BHP Billiton and Rio Tinto rail lines, serving iron ore export markets in the Pilbara, amounted to use of a production process. Subsequently, prepared expert reports on matters arising in interpreting the criteria for declaration under Part IIIA, and testified before the Competition Tribunal in late 2009.
2009	**Clayton Utz/Confidential Client** **Competitive implications of agreement** Advice on the competitive effects of a joint venture arrangement in the port terminal sector, in the context of Federal Court proceedings brought by the ACCC under section 45 of the Trade Practices Act.

2009	**Australian Competition and Consumer Commission** **Competitive effects of buy-sell agreements** Advice to the ACCC on the extent to which buy-sell arrangements between the four major refiner-marketers of petroleum products in Australia may be inhibiting competition in a relevant market.
2008-09	**Watson Mangioni/ICS Global** **Alleged misuse of market power** Expert report prepared in the context of Federal Court proceedings alleging breaches of section 46 of the Trade Practices Act.
2008-09	**Australian Competition and Consumer Commission** **Competitive effects of various agreements** Expert advice on potential theories of competitive harm arising from agreements between competitors in the oil and gas, and petroleum retailing industry sectors.
2008	**Johnson Winter & Slattery/Pepsico** **Merger analysis** Advice on the competitive implications certain potential transactions in the soft drinks sector.
2008	**Australian Competition and Consumer Commission** **Exemption from access undertaking** 'Peer review' report of the ACCC's draft decision on applications by Telstra for exemption from its standard access obligations (SAOs) for the supply by resale of the local carriage service (LCS) and wholesale line rental (WLR) in 387 exchange service areas in metropolitan Australia.
2008	**Deacons/eBay** **Exclusive dealing notification** Expert report submitted to the ACCC analysing the competitive effects of eBay's proposal that users of its online marketplace be required to settle transactions using eBay's associated entity, PayPal
2007-08	**Australian Energy Market Commission** **Wholesale market implications for retail competition** Retained to provide an overview of the operation and structure of the wholesale gas and electricity markets within the National Electricity Market (NEM) jurisdictions and to identify the issues that the AEMC should consider when assessing the influence of the wholesale markets on competition within the retail gas market in each jurisdiction.

2006-07	**Essential Services Commission of South Australia** **Competition assessment** Directed the preparation of a comprehensive report analysing the effectiveness of competition in retail electricity and gas markets in South Australia.
2006-07	**Allens Arthur Robinson/Confidential Client** **Merger clearance** Retained to provide advice on competition issues arising in the context of s50 clearance of a proposed merger in the board packaging industry.
2006-07	**Johnson Winter & Slattery/Confidential Client** **Damages assessment** Advice on the quantification of damages arising from alleged cartel conduct in the electricity transformer sector.
2006	**Minter Ellison/Confidential Client** **Misuse of market power** Expert economic advice in relation to market definition, market power and taking advantage in the context of an alleged price squeeze between wholesale and retail prices for fixed line telecommunications services, for proceedings brought under section 46 of the Trade Practices Act. The proceedings were withdrawn following regulatory amendments by the ACCC.
2006	**DLA Phillips Fox/Donhad** **Merger clearance** Preparation of an expert report on competition issues arising in the context of s50 clearance for the proposed Smorgon/One Steel merger.
2006	**Johnson Winter & Slattery/Qantas Airways** **Competition effects of proposed price fixing agreement** Assessed the competition effects of the proposed trans-Tasman networks agreement between Air New Zealand and Qantas Airways.
2006	**Phillips Fox/ACCC** **Vertical foreclosure** Advice in the context of proceedings before the Federal Court concerning the acquisition of Patrick Corporation by Toll Holdings. The proceedings were subsequently withdrawn following a S87B undertaking made by Toll.
2006	**Gilbert + Tobin/AWB** **Arbitration, access to bottleneck facilities** Expert report and testimony in an arbitration concerning the imposition of throughput fees for grain received at port and so bypassing the grain storage, handling and rail transport network in South Australia.

2006 **Qantas Airways, Australia/Singapore**
Assessment of single economic entity
Advice in the context of Qantas' Application for Decision to the Competition Commission of Singapore that the agreement between it and Orangestar did not fall within the ambit of the price-fixing and market sharing provisions of the Singapore Competition Act.

2005-06 **Qantas Airways, Australia/Singapore**
Competition effects of price fixing agreement
Expert report submitted to the Competition Commission of Singapore evaluating the net economic benefits of a price fixing/market sharing agreement, in relation to an application for exemption from the section 34 prohibition in the Competition Act of Singapore.

2005-06 **Australian Competition Consumer Commission**
Electricity generation market competition
Advice on the competition effects under S50 of the Trade Practices Act of three separate proposed transactions involving the merger of generation plant operating in the national electricity market.

2005 **Gilbert + Tobin/Hong Kong Government, Hong Kong**
Petrol market competition
Directed a NERA team working with Gilbert + Tobin that investigated the effectiveness of competition in the auto-fuel retailing market in Hong Kong.

2005 **Phillips Fox/National Competition Council**
Access and competition in gas production and retail markets
Retained as expert witness in the appeal before the WA Gas Review Board of the decision to revoke coverage under the gas code of the Goldfields pipeline. Proceedings brought by the pipeline operator were subsequently withdrawn.

2004-05 **Gilbert + Tobin/APCA**
Competition and access to Eftpos system
Economic advisor to the Australian Payments Clearing Association in connection with the development of an access regime for the debit card/Eftpos system, so as to address a range of competition concerns expressed by the Reserve Bank of Australia and the ACCC. This work included an expert report examining barriers to entry to Eftpos and the extent to which these could be overcome by an access regime.

2003-05 **Phillips Fox/Austrac**
Misuse of market power
Retained to assist with all economic aspects of a potential Federal Court action under s46 of the Trade Practices Act alleging misuse of market power in the rail freight market.

2004 **Clayton Utz/Sydney Water Corporation**
Competition in sewage treatment
Retained to assist with Sydney Water's response to the application to have Sydney's waste water reticulation network declared under Part IIIa of the Trade Practices Act.

2004 **Blake Dawson Waldron/Boral**
Competition analysis of cement market
Advice on Boral's proposed acquisition of Adelaide Brighton Ltd, a cement industry merger opposed in Federal Court proceedings by the ACCC. Boral subsequently decided not to proceed with the transaction.

2004 **Minter Ellison/Singapore Power**
Merger clearance
Advice on competition issues arising from the proposed acquisition of TXU's Australian energy sector assets by Singapore Power. This included the submission of an expert report to the ACCC.

2004 **Mallesons/Orica**
Competition in gas production and retail markets
Retained as expert witness in the appeal by Orica against the Minister's decision to revoke coverage under the gas code of the substantial part of the Moomba to Sydney gas pipeline. The case was subsequently settled.

2004 **Courts, Fiji**
Merger clearance, abuse of market power
Prepared a report for submission to the Fijian Commerce Commission on the competition implications of the Courts' acquisition of the former Burns Philip retailing business, and related allegations of abuse of market power. The Commission subsequently cleared Courts of all competition concerns.

2003-04 **Mallesons/Sydney Airport Corporation**
Competition in air travel market
Expert report and testimony before the Australian Competition Tribunal on economic aspects of the application by Virgin Blue for declaration of airside facilities at Sydney Airport under Part IIIa of the Trade Practices Act.

2003-04 **Bartier Perry/ DM Faulkner**
Alleged collusive conduct
Submitted an expert report to the Federal Court in connection with allegations under s45 of the Trade Practices Act of collusive conduct leading to the substantial lessening of competition in the market for scrap metal. The 'substantial lessening of competition' element of this case was subsequently withdrawn.

2002-04 **Essential Services Commission**
Effectiveness of competition
Advisor on six separate reviews of the effectiveness of competition and the impact of existing or proposed measures designed to enhance competition in the markets for wholesale gas supply, port channel access services, liquid petroleum gas, retail electricity and gas supplies, and port services.

2003 **Gilbert + Tobin/AGL**
Vertical integration in electricity markets
Prepared a report on the international experience of vertical integration of electricity generation and retailing markets, in connection with proceedings brought by AGL against the ACCC. This report examined the principles applied by competition authorities in assessing such developments, and evidence of the subsequent impact on competition.

2002-03 **National Competition Council**
Gas market competition
Expert report in connection with the application by East Australian Pipeline Limited for revocation of coverage under the Gas Code of the Moomba to Sydney Pipeline System. The report addressed both the design of a test for whether market power was being exercised through pipeline transportation prices substantially in excess of long-run economic cost, and the assessment of existing prices by reference to this principle.

2001-03 **Blake Dawson Waldron/Qantas Airways**
Alleged predatory conduct
Directed a NERA team advising on all economic aspects of an alleged misuse of market power (section 46 of the Trade Practices Act) in Federal Court proceedings brought against Qantas by the ACCC. The proceedings were withdrawn soon after responding expert statements were filed.

2002 **Phillips Fox/AWB Limited**
Access and competition in bulk freight transportation
Expert report on the pricing arrangements for third party access to the Victorian rail network and their impact on competition in the related bulk freight transportation services market, preparation for the appeal before the Australian Competition Tribunal of the Minister's decision not to declare the Victorian intra-state rail network, pursuant to Part IIIA of the Trade Practices Act.

2002 **Australian Competition and Consumer Commission**
Anti-competitive bundling or tying strategies
Prepared two (published) reports setting out an economic framework for evaluating whether the sale of bundled or tied products may be anti-competitive. These reports define the pre-conditions for such strategies to be anti-competitive, and discuss the potential role and pitfalls of imputation tests for anti-competitive product bundling.

2002 **Minter Ellison/SPI PowerNet**
Merger clearance
Advice on competition issues arising in the acquisition of energy sector assets in Victoria.

2001 **Gilbert + Tobin/AGL**
Gas market competition
Advised counsel for AGL in connection with the application by Duke Energy to the Australian Competition Tribunal for review of the decision by the National Competition Council to recommend that the eastern gas pipeline should be subject to price regulation under the national gas code.

2000 **One.Tel**
Competitive aspects of Mobile Number Portability
Advised on the competitive aspects of proposed procedures for Mobile Number Portability and whether these arrangements breached the Trade Practices Act in relation to substantial lessening of competition.

2000 **Baker & McKenzie/Scottish Power**
Impact of consolidation on competition
Expert report on the extent to which the acquisition of the Victorian electricity distribution and retail business, Powercor by an entity with interests in the national electricity market may lead to a 'substantial lessening of competition' in a relevant market.

Institutional and Regulatory Reform

2008-11 **Department of Sustainability and Environment**
Management of bulk water supply
Various advice on the concept and merits of establishing market based arrangements to guide both the day-to-day operation of the bulk water supply system in metropolitan Melbourne, as well as the trading of rights to water between the metropolitan water supply system and those throughout the state of Victoria.

2008	**Department of Treasury and Finance** **Access regime for water networks** Prepared a report on the principles that should be applied in developing a state-wide third party access regime for water supply networks.
2007	**Economic Regulatory Authority** **Options for competitive supply bulk water** Prepared a report on institutional and structural reforms necessary to encourage the development of options for the procurement of alternative water supplies from third parties.
2006	**Bulk Entitlement Management Committee** **Development of urban water market** Prepared a report for the four Melbourne water businesses on options for devolution of the management of water entitlements from collective to individual responsibility, including the development of associated arrangements for oversight and co-ordination of the decentralised management and trading of water rights.
2003-05	**Goldman Sachs/Airport Authority, Hong Kong** **Framework for economic regulation** Lead a team advising on the options and detailed design of the economic regulatory arrangements needed to support the forthcoming privatisation of Hong Kong Airport.
2003-04	**Ministry of Finance, Thailand** **Framework for economic regulation** Lead a team advising on the detailed design and implementation of a framework for the economic regulation of the Thai water sector in order to support the proposed corporatisation and then privatisation of the Metropolitan Water Authority of Bangkok.
2003	**Metrowater and Auckland City, New Zealand** **Water industry reform options** Report on alternative business models for the Auckland City water services supplier, Metrowater, in the context of proposals for structural reform elsewhere in the industry. This work examined the long term drivers of water industry efficiency and the costs and benefits of alternative structural reform options.

Sworn Testimony, Transcribed Evidence[159]

2013

Expert evidence before the Supreme Court of Victoria on behalf of Maddingley Brown Coal in the matter of Maddingley Brown Coal v Environment Protection Agency of Victoria
Expert reports, sworn evidence, Melbourne, 12 August 2013

Expert evidence before the Federal Court on behalf of Modtech v GPT Management and Others
Expert reports, sworn evidence, Melbourne, 27 March 2013

2012

Expert evidence before the Supreme Court of Queensland on behalf of Origin Energy Electricity Ltd and Others v Queensland Competition Authority and Others
Expert reports, sworn evidence, Brisbane, 3 December 2012

2011

Expert evidence before the Federal Court on behalf of the Australian Turf Club and Australian Racing Board in the matter of Bruce McHugh v ATC and Others
Expert report, transcribed evidence, Sydney, 12 and 14 October 2011

Expert evidence in arbitration proceedings before J von Doussa, QC, on behalf of Santos in the matter of Santos and Others v Government of South Australia
Expert report, transcribed evidence, Adelaide, 13-15 September 2011

Expert evidence before a panel of arbitrators on behalf of UNELCO in the matter of UNELCO v Government of Vanuatu
Expert report, transcribed evidence, Melbourne, 23 March and 21 April 2011

Expert evidence before the Federal Court on behalf of ActewAGL in the matter of ActewAGL v Australian Energy Regulator
Expert report, sworn evidence, Sydney, 17 March 2011

Deposition Testimony in Re Payment Care Interchange and Merchant Discount Litigation, in the United States District Court for the Eastern District of New York
Deposition testimony, District of Colombia, 18 January 2011

[159] Past ten years.

2010

Expert evidence before the Federal Court in behalf of the Australia Competition and Consumer Commission in the matter of ACCC v Cement Australia and others
Expert report, sworn evidence, Brisbane, 19-21 October 2010

Expert evidence on behalf of Orion NZ, at the Commerce Commission's Conference on its Input Methodologies Emerging View Paper
Transcribed evidence, public hearings, Wellington, 24 February 2010

Deposition Testimony in *Re Payment Card Interchange and Merchant Discount Antitrust Litigation*, in the United States District Court for the Eastern District of New York
Deposition Testimony, District of Columbia, 18 February 2010

2009

Expert evidence before the Australian Competition Tribunal on behalf of Fortescue Metals Group Ltd, in the matter of Application for Review of Decision in Relation to Declaration of Services Provided by the Robe, Hamersley, Mt Newman and Goldsworthy Railways
Expert report, sworn evidence, Melbourne, 12-13 October and 5-6 November 2009

Expert evidence on behalf of Orion NZ, at the Commerce Commission's Conference on its Input Methodologies Discussion Paper
Transcribed evidence, public hearings, Wellington, 16 September 2009

Expert evidence before the Federal Court on behalf of Fortescue Metals Group Ltd, in the matter of ASIC v Fortescue Metals Group and Andrew Forrest
Expert report, sworn evidence, Perth, 29 April–1 May 2009

Expert report and evidence in arbitration proceedings before Hon Michael McHugh, AC QC, and Roger Gyles, QC, between Origin Energy and AGL
Expert report, sworn evidence, Sydney, 19-24 March 2009

2008

Expert evidence on behalf of Orion NZ, at the Commerce Commission's Conference on its Draft Decision on Authorisation for the Control of Natural Gas Pipeline Services
Transcribed evidence, public hearings, Wellington, 21 February 2008

2007

Expert report and evidence in arbitration proceedings before Sir Daryl Dawson between SteriCorp and Stericycle Inc.
Expert report, sworn evidence, 11 July 2007

2006

Expert report and evidence in arbitration proceedings before Sir Daryl Dawson and David Jackson, QC, between Santos and others, and AGL
Expert report, sworn evidence, November 2006

Expert report and evidence before the Federal Court on behalf of Fortescue Metals Group in the matter of BHP Billiton v National Competition Council and Others
Expert report, sworn evidence, November 2006

Expert report and evidence in arbitration proceedings before Sir Daryl Dawson and David Jackson, QC, between Santos and Others, and Xstrata Queensland
Expert report, sworn evidence, September 2006

Expert report and evidence before the Copyright Tribunal on behalf of the Australian Hotels Association and others in the matter of PPCA v AHA and Others
Expert report, sworn evidence, May 2006

Expert report and evidence in arbitration proceedings before Hon Michael McHugh, AC QC, on the matter of AWB Limited v ABB Grain Limited
Expert report, sworn evidence, 24 May 2006

Expert report and evidence to Victorian Appeal Panel, in the matter of the appeal by United Energy Distribution of the Electricity Price Determination of the Essential Services Commission
Expert report, sworn evidence, 10 February 2006

2005

Expert evidence on behalf of Orion NZ, at the Commerce Commission's Conference on its Notice of Intention to Declare Control of Unison Networks
Transcribed evidence, public hearings, Wellington, 17 November 2005

Expert evidence on behalf of Orion NZ, at the Commerce Commission's Conference on Asset Valuation choice and the electricity industry disclosure regime
Transcribed evidence, public hearings, Wellington, 11 April 2005

2004

Expert report and evidence to the Australian Competition Tribunal, in the matter of Virgin Blue Airlines v Sydney Airport Corporation
Expert reports, sworn evidence, 19-20 October 2004

Expert evidence on behalf of Orion NZ, at the Commerce Commission's Conference on the ODV Handbook for electricity lines businesses
Transcribed evidence, public hearings, Wellington, 26 April 2004

2003

Expert evidence on behalf of Orion NZ, in response to the Commerce Commission's draft decision on re-setting the price path threshold for electricity lines businesses
Transcribed evidence, public hearings, Wellington, 5 November 2003

Expert evidence on behalf of NGC Holdings, in response to the Commerce Commission's draft framework paper for the gas control inquiry.
Transcribed evidence, public hearings, 3 September 2003

Affidavit submitted to the Federal Court, in the matter of ACCC v DM Faulkner and Others
Expert report, Federal Court of Australia, May 2003

Expert evidence on behalf of Orion NZ, in response to the Commerce Commission's draft decision on a targeted control regime for electricity lines businesses
Transcribed evidence, public hearings, Wellington, 25 March 2003

2002

Expert evidence on behalf of Orion NZ, in the Commerce Commission's review of asset valuation methodologies for electricity lines businesses
Transcribed evidence, public hearings, Wellington, 25 November 2002

Expert report and evidence on behalf of Optus Networks and Optus Vision Ltd, in the matter of an arbitration with United Energy Ltd
Expert report, prior to settlement, 18 October 2002

Expert report and evidence on behalf of TransGrid before the National Electricity Tribunal, in the matter of Murraylink Transmission Company v NEMMCO, TransGrid, and others
Sworn Testimony, National Electricity Tribunal, Melbourne, 26 August 2002

Expert evidence on behalf of Orion NZ, in the Commerce Commission's review of control regimes for electricity lines businesses
Transcribed evidence, public hearings, Wellington, 21 August 2002

Affidavit and testimony before the Supreme Court of Western Australia, in the matter of Epic Energy v Dr Ken Michael – Independent Gas Access Regulator
Sworn testimony, Supreme Court of Western Australia, November 2002

2001

Expert evidence on behalf of Auckland International Airport, in the Commerce Commission's review of airfield price control
Transcribed evidence, public hearings, Wellington, 4-5 September 2001

Expert evidence on behalf of Optus Networks, in the matter of Optus Networks v United Energy
Mediation before Trevor Morling QC, Sydney, August and September 2001

Expert evidence on behalf of Sydney Airports Corporation in the Productivity Commission's review of airport regulation
Transcribed evidence, public hearings, Melbourne, 3 April 2001

Affidavit submitted to Supreme Court of Victoria, in the matter of TXU v Office of the Regulator-General
Sworn testimony, Supreme Court of Victoria, 23-26 March 2001

Speeches and Publications[160]

2013	**Energy in WA Conference** Capacity Payments in the WEM – Time to Switch? Panel Discussion, Perth, 21 August 2013
	ACCC/AER Regulatory Conference Designing Customer Engagement Speech, Brisbane, 25 July 2013
	Victorian Reinsurance Discussion Group Australian Mining – When Opportunities and Risk Collide Speech, Melbourne, 1 March 2013
	NZ Downstream Conference Investment and Regulation Panel Discussion, Auckland, 25 July 2013
2012	**Rising Stars Competition Law Workshop** Expert Evidence in Competition Cases Speech, Sydney, 24 November 2012
	KPPU – Workshop on the Economics of Merger Analysis Theories and Methods for Measuring the Competitive Effects of Mergers Speech, Bali, 19-21 November 2012
	University of South Australia – Competition and Consumer Workshop Reflections on Part IIIA of the Competition Act Speech, Adelaide, 12 October 2012
	NZ Downstream Conference Lines company consolidation – what are the benefits and risks? Panel discussion, Auckland, 6-7 March 2012
2011	**Law Council of Australia - Competition Workshop** Coordinated effects in merger assessments Speech, Gold Coast, 27 August 2011
	ACCC Regulatory Conference Adapting Energy Markets to a Low Carbon Future Speech, Brisbane, 28 July 2011

[160] Past seven years

2010	**IPART Efficiency and Competition in Infrastructure** Improving Performance Incentives for GTE's Speech, Sydney, 7 May 2010
	Law and Economics Association of New Zealand Shareholder Class Actions – A Rising Trend in Australia Speeches, Auckland and Wellington, 15-16 November 2010
2009	**ACCC Regulatory Conference** Substitutes and Complements for Traditional Regulation Speech, Gold Coast, 30 July 2009
	Minter Ellison Shareholder Class Action Seminar Investor Class Actions – Economic Evidence Speech, Sydney, 18 March 2009
	Competition Law and Regulation Conference Commerce Amendment Act: Impact on Electricity Lines Businesses Speech, Wellington, 27 February 2009
2008	**Non-Executive Directors** Shareholder Class Actions in Australia Speech, Sydney, 28 July 2008
	Mergers & Acquisitions: Strategies 2008 Competition Law Implications for Mergers & Acquisitions Speech, Sydney, 27 May 2008
	Institute for Study of Competition and Regulation Role of Merits Review under Part 4 and Part 4A of the Commerce Act Speech, Wellington, 20 February 2008
2007	**Law Council of Australia - Trade Practices Workshop** **Hypothetical breach of s46** Economic expert in mock trial, 20 October 2007
	Assessing the Merits of Early Termination Fees, *Economics of Antitrust: Complex Issues in a Dynamic Economy,* Wu, Lawrence (Ed) NERA Economic Consulting 2007
	Assessing the Impact of Competition Policy Reforms on Infrastructure Performance **ACCC Regulation Conference** Speech, Gold Coast, 27 July 2007

2006 **Trade Practices Workshop**
Access to Monopoly Infrastructure Under the Trade Practices Act: Current Issues with Part IIIa and Section 46
Conference Paper Co-Author, Canberra, 22 July 2006

Report qualifications/assumptions and limiting conditions

This report is for the exclusive use of the NERA Economic Consulting client named herein. There are no third party beneficiaries with respect to this report, and NERA Economic Consulting does not accept any liability to any third party.

Information furnished by others, upon which all or portions of this report are based, is believed to be reliable but has not been independently verified, unless otherwise expressly indicated. Public information and industry and statistical data are from sources we deem to be reliable; however, we make no representation as to the accuracy or completeness of such information. The findings contained in this report may contain predictions based on current data and historical trends. Any such predictions are subject to inherent risks and uncertainties. NERA Economic Consulting accepts no responsibility for actual results or future events.

The opinions expressed in this report are valid only for the purpose stated herein and as of the date of this report. No obligation is assumed to revise this report to reflect changes, events or conditions, which occur subsequent to the date hereof.

All decisions in connection with the implementation or use of advice or recommendations contained in this report are the sole responsibility of the client. This report does not represent investment advice nor does it provide an opinion regarding the fairness of any transaction to any and all parties.

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