Submission to PC Consultation on Electricity Network Regulation

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April 2012

1 Introduction

The Productivity Commission (PC) inquiry is focussed on two aspects of electricity industry regulation: (a) the scope for greater use of benchmarking in network price regulation; and (b) whether there is efficient investment in electricity transmission interconnectors, and how any regulation or market design shortcomings can be remedied. The aim is to achieve a better overall balance between the benefits and costs of regulation. The Issues Paper indicates that a wide range of matters will be considered in the inquiry. The purpose of this submission is to contribute to the inquiry. However, it does not address all of the questions raised by the PC in its issues paper, focussing on the use of benchmarking in electricity network regulation.

Previous reviews of energy regulatory frameworks by the Expert Panel on Energy Access Pricing (2006) and the Australian Energy Markets Commission (AEMC 2011b) compared the building block model (BBM) to total factor productivity (TFP) based regulation. They did not examine and compare the option of 'yardstick competition', in which the regulator uses comparisons with other private firms to infer a firm's attainable cost level (Shleifer 1985). The PC's inquiry is an opportunity to build upon those previous inquiries by having regard to such options.

The AEMC is currently assessing a related rule change request, and the SCER is currently considering electricity network unbundling issues. The author has made submissions to each of those processes, which may include observations relevant to the PC's inquiry.[2] This submission does not repeat any of the points made in those previous submissions.

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[1] The views expressed in this submission are the personal views of the author and are not the views of his employer, the Essential Services Commission of Victoria.

[2] http://www.ret.gov.au/Documents/mce/_documents/submissions/MCunningham_submission_MCE_04-11-11.pdf; http://www.aemc.gov.au/Media/docs/Michael%20Cunningham%20(private%20submission)-a85aeaec-d0db-42ab-8aa6-b558ddd5990c-0.PDF, sourced 22-04-12

This submission is organised as follows. Section 2 addresses questions about the kinds of benchmarking available and strengths and weaknesses of some of the alternative approaches and examples of their use in regulation. It then discusses the appropriate benchmarking standards. Section 2 also addresses questions relating to whether the National Electricity Rules (NER) permit or restrict the use of benchmarking in network regulation.

Section 3 discusses options for the reform of the economic regulation framework for electricity networks. It examines the use of benchmarking in economic regulation theory and draws conclusions about the way in which benchmarking can be incorporated into pricing rules. Section 3 also identifies other options for reform of the price and revenue controls. And it considers whether there are shortcomings in the NER that may impact on the incentives to invest efficiently, and other options for reforming the regulatory framework that may assist to meet the objectives. Section 4 concludes the submission.

2 Benchmarking & regulation

A fundamental aim of utility regulation has been to ensure that price levels reflect the prudent and efficient cost of supply. The two most established ways of identifying the prudent and efficient costs are administrative rate cases and benchmarking (McDermott et al. 2007a p.33). The former is a thorough examination of management choices or plans. Benchmarking utility costs and performance can be an alternative to this process, but benchmarking specific elements of cost or performance can also be employed within the former process.

2.1 The building block approach

Australian regulators have consistently used the BBM for pricing, without substantial modification or innovation for almost two decades. The essential characteristics of the BBM include forecasting certain categories of costs separately and determining a CPI-X price-cap consistent expected revenues meeting projected costs. It relies on regulatory lag to provide efficiency incentives by temporarily removing the link between realised costs and allowed prices. However, a firm will not be continuously financially penalised for persistent inefficiency.

Limitations include the following. First, the regulatory process is perceived to be increasingly forensic and ‘micro-managing’ (AEMC 2009). There is growing interest in stakeholder-driven processes that may better prioritise attention on the matters of most value to consumers (see: Littlechild 2007). Second, the BBM methodology involves separately forecasting capital and non-capital cost components that are substitutable, and employs incentive mechanisms are not symmetrical between activities. Concern about possible distorted incentives has led to experimentation in the UK with 'totex' benchmarking (combined capital and operating expenditure). Third, there appears to be relatively low incentives for efficiency and innovation. This has led to new incentive frameworks in the UK under the 'RIIO' model which, among other things, will provide financial rewards for innovation.

The types of benchmarking used within the BBM have included:

- statistical benchmarking of opex or capex — e.g. Meyrick & Associates (2005)
- studies combining engineering cost estimates with activity-level cost benchmarks — e.g. studies of gas industry opex and capex carried out by the Economics Consulting Group (ECG)[3]
- indicative unit cost benchmarks, sometimes used for testing the reasonableness of company-specific projections, especially where there is limited historical or audited information available for the regulated firm — e.g. the determination of access prices at South Dynon intermodal terminal (ESC 2006).

2.2 Alternatives to BBM

This section briefly considers two alternatives to the BBM, TFP-based regulation and yardstick competition. Although these methods of regulation can be seen as discrete alternatives, this submission will seek to show that there is complementarity between them.

2.2.1 TFP-based regulation

In the USA, the main alternative to conducting rate cases every 1 to 3 years has been 'performance based regulation' which are multi-year rate plans using inflation–X formulas, with X usually derived from productivity index studies.

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[3] ECG (August 2004) 'Review of AGLGN Gas Access Arrangement For Independent Pricing and Regulatory Tribunal'; (June 2005) 'Review of Country Energy Gas Access Arrangement For Independent Pricing and Regulatory Tribunal'; ECG (March 2006) 'Envestra Limited Capital and Operating Expenditure Review For Essential Services Commission of South Australia'; (April 2006) 'Allgas Energy Pty Ltd Capital and Operating Expenditure Review For Queensland Competition Authority'; (May 2006) 'Envestra Pty Ltd Capital and Operating Expenditure Review For Queensland Competition Authority'.

TFP-based price regulation has been examined in Australia as an alternative to BBM. The TFP approach is based on setting the X-factor in the CPI-X formula on the basis of past industry-wide trends in productivity, and assuming these trends are stable over time (Makholm 2007 p.99). Or projections of productivity trends may be developed. Initial prices are usually based on unit costs in a test year close to the price review (adjusted for abnormal factors) or prices rolled over from the previous period.

TFP index methods, such as the Törnqvist index, can be used for estimating industry trends in productivity and basing price paths on these trends.[4] When used in this way:

> TFP is a kind of benchmarking method because each firm's performance is effectively compared to an external productivity benchmark—in this case the rate of change of the firm's prices is determined by the historical observed rate of productivity growth across a comparator group of firms (Brown & Carpenter 2009 p.5).

Reliance on the external TFP benchmark is intended to provide high-powered incentives to achieve efficiency. But, absent other adjustments, a regulated firm may face a projected economic profit or loss over the access period if there are systematic factors that would cause its productivity trends to differ from the industry-wide average (not just effort or effectiveness of business strategy). Thus, it is sometimes complemented by other mechanisms responsive to outturns, which assist to manage risk. If so, they will also influence incentives (Expert Panel 2006 p.101; Farrier Swier Consulting 2002).

The TFP methodology is not substantially different to BBM in terms of underlying economic principles. Price paths are intended to track projected unit cost movements over the period. However, the method of projecting unit costs is simpler. It is a method well suited to negotiated settlements or adjudication processes, where the price plan need not precisely equate expected revenues with forecast costs, but is sufficient to achieve a balancing of producer and consumer interests.

The AEMC's recent review of the usefulness of TFP-based regulation in energy regulation found that it 'has the potential to create stronger incentives for service providers to pursue cost efficiencies compared to the building block approach' (AEMC 2011b pp.i-ii). It should also provide firms with a reasonable opportunity to recover

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[4] The Törnqvist index uses revenue shares as weights in the output index and cost share weights in the input index, which is appropriate in competitive market contexts. However, regulated utility businesses do not accord with competitive market assumptions. An appropriate approach in these circumstances is described in: Melvyn Fuss, 'Productivity Growth in Canadian Telecommunications', *The Canadian Journal of Economics*, 27(2) (May 1994).

prudently incurred costs, and should maintain investment incentives. However, it concluded that:

> … the current lack of a sufficiently robust and consistent data-set means that it could be too problematic to reconstruct existing data for the purpose of a TFP-methodology. … We advise that the initial focus should therefore be on establishing a better, more consistent data-set. (AEMC 2011b p.ii)

The AEMC observed that the TFP methodology could be used as a benchmarking tool to complement the BBM, or as a separate regulation methodology in which TFP-indices are employed in a mechanistic manner to determine price or revenue paths. However, it did not reach a conclusion on which of these roles should be preferred for TFP-regulation. This would depend on future assessments once more information is at hand.

Some principles for TFP indices have been formulated by the AEMC (2011a p.65), but it sees a future need for the detailed design of a TFP-based methodology to be incorporated into the NER. This is consistent with the view of the Expert Panel, which suggested it would be necessary to design a TFP regulation method in detail before it could be properly compared to the BBM (Expert Panel 2006 p.104). However, the extent to which the methodology must be specified in advance of a price review may depend on the kind of process in which it will be used. For example, in a negotiated settlement or adjudication process, the methodologies may themselves form part of the considerations.

2.2.2 *Yardstick competition*

'Yardstick competition' is a method of regulation in which the allowed prices or revenues of one firm depend on the costs of similar firms. It thereby separates a firm's allowed prices from its own cost outcomes to provide strong efficiency incentives. An inefficient cost choice by the firm is not allowed to influence the price it receives (Shleifer 1985 p.323).

Specifically, yardstick competition involves setting a firm's price using the unit cost of a 'shadow firm', which is the mean unit cost of all other identical firms (Shleifer 1985 p.322). This method relies heavily on the ability to control for firm-specific factors when making these comparisons.

> Of course, the regulator is unlikely to be able to find a large set of truly identical firms. However, hedonic regression, frontier cost function estimation and related

> statistical techniques can be used to normalize cost variations for exogenous differences in firm attributes to develop normalized benchmarks costs. … these benchmarks costs can then be used by the regulator in a yardstick framework or in other ways to reduce its information disadvantage, allowing it to use high powered incentive mechanisms without incurring the cost of excessive rents ... However, data to perform this type of benchmarking are not always available, a variety of benchmarking techniques can be utilized, and the failure to integrate cost and quality variables can lead to misleading results. (Joskow 2006a p.14)

Approaches of this kind sometimes specify a two-part X factor comprising: a common allowance for the industry relative productivity trend; and a firm-specific 'stretch factor' (representing expected reduced inefficiency). For example, one approach to this involved:

> … decomposing the X factor into two components: a 'B' factor reflecting the overall or average productivity trend for electricity lines businesses and a 'C' factor broadly reflecting the circumstances of each distribution business or a small number of distribution businesses. … The distributors performing better than the industry average would possibly be set a less onerous X factor (ie be allocated a negative C factor) and those performing worse than the industry average would possibly be set a more onerous X factor (ie be allocated a positive C factor). (Lawrence 2003 p.iii)

2.2.3 *Conclusion*

The TFP-based approach assumes that if all firms make the same amount of effort, their unit costs will be likely to decline at a rate similar to the historical industry average rate of productivity growth. However, if firms have different levels of efficiency at the outset, less efficient firms have greater scope to achieve reductions in unit costs comparatively easily. Unit costs would not be expected to move at the same rate for the same level of effort. The yardstick competition approach can complement the TFP-based approach by having greater regard to comparative efficiency when determining the price cap. Benchmarking can also complement the BBM by improving efficiency incentive mechanisms.

Aside from the different information and analysis used by the benchmarking methods and the BBM, key potential differences between them relate to: whether the chosen price path will ensure that expected revenues will equal expected costs for all firms, and associated with this, the method for determining the P_0 adjustment (in neither case well defined).

2.3 Benchmarking methods for yardstick competition

Comprehensive benchmarking methods may be used within the BBM for screening firm cost forecasts, or may be used as part of alternative price-setting mechanism. They include frontier methods, norm models and index methods.

2.3.1 *Frontier methods*

Frontier methods are commonly used for the estimation of cost functions, production functions, distance functions or profit functions. The most well established methods being stochastic frontier analysis (SFA) and data envelopment analysis (DEA). The fundamental techniques and how they can be applied in regulation are presented in Coelli et al (2003), with more detail on key methodologies in Fried et al (2008). An example of analysis of this kind is the recent Essential Services Commission (ESC) study of water industry productivity (ESC 2012a; b). However, application of these methods within regulatory decision-making remains uncommon in Australia.

2.3.1.1 Comparison of alternative approaches

Although most frontier benchmarking studies used in regulation have used DEA, comparative studies suggest that SFA may be better suited to regulatory applications. DEA does not account for noise in data arising from measurement error, and this can lead to biased estimates of the frontier, and volatility of estimates with small changes in the sample (Atkinson et al. 2003; O'Donnell & Coelli 2005). The greater suitability of SFA for regulatory applications compared to corrected ordinary least squares (COLS) is discussed in Weyman-Jones et al (2006).

To-date most econometric benchmarking analyses used for regulation have involved estimating cost functions. This has the advantage of providing a useful cross check against 'bottom up' methods of cost estimation. Increasingly, distance functions are being used because they do not require price data. The input-oriented distance function is the dual to the cost function — it reflects the same technology — but it has no price variables. And, the (generalised) Malmquist productivity index uses elasticities of the distance function with respect to outputs and inputs as the weights in the total output and input indices, rather than value shares. But if price data are available, then there may be advantages in using a method that utilises that data also, such as the cost function.

2.3.1.2 *Practical issues in application*

SFA analysis will usually require panel data for a significant number of comparable businesses (perhaps 25 or more) over a reasonable period, in order to identify not only the underlying technology but also the distribution of inefficiency between firms. The choice between SFA and other econometric methods (e.g. fixed or random effects specifications) will depend in part on whether firm-specific efficiency measures are skewed in the right direction. The quality of the results will depend importantly on the availability and quality of data on the exogenous factors that influence the performance of businesses differently. Capital services inputs may be particularly difficult to measure accurately. The estimated inefficiency of a firm can be sensitive to model specification and data sample, and this may make the findings controversial.

A second issue relates to decomposition of productivity trends, specifically the ability to separately identify technical change from broad-based movements toward or away from the efficiency frontier. Technical change is usually measured by time, and its interaction with other variables in the model. But trends in inefficiency may also be identified by interaction with a time variable (e.g. in the Battesse-Coelli SFA specification). It may not be a simple matter to truly separate technical change from changes in average technical inefficiency.

A third issue is the ability to separate out factors that are outside management's control, such as topography, climate, customer density or regional input cost differences. These exogenous factors produce heterogeneity, but the determinants may be unknown or not measured, and thus cannot be included as variables in the analysis. This is the general problem of unobserved firm-specific heterogeneity. An assumption that all firm-specific effects are entirely due to differences in technical inefficiency would be incorrect. Some stochastic frontier methods have been developed relatively recently to better deal with this problem, including latent variable models. These are surveyed by Greene (2005), and an example of a latent variable model used for econometric benchmarking of electricity distribution is Cullman (2008).

2.3.1.3 *Use in regulation*

Lowry & Getachew (2009) provide a brief summary of the use of comprehensive benchmarking by economic regulators in various countries, and Dassler et al. (2006) discusses the UK's use of benchmarking (comprehensive and partial). Examples where comprehensive benchmarking has been used to determine prices for electricity networks include The Netherlands, Norway and New Zealand (the latter having abandoned it). Statistical benchmarking is sometimes used by utilities in the USA to support rate filings, but is not used in any systematic way. Overall, benchmarking for the purpose of yardstick competition is not a widely established regulatory practice.

In the UK energy sector there has been some indicative opex benchmarking and econometric analysis of opex drivers within the BBM, and commissioned international cost benchmarking studies. But, formal benchmarking has not played a significant part in energy regulation decisions. Benchmarking has had some role in UK water industry regulation (utilising DEA analysis). But generally, 'each of the regulatory offices has struggled to develop effective and reliable benchmarking that can be applied in the determination of price caps' (Dassler et al. 2006 p.173).

Experience to-date suggests that 'the hopes of the most ardent benchmarkers have not been met. They have rarely been used automatically or semi-automatically to set price caps' (Stern 2005). Benchmarking can, of course, be used for filtering proposals of regulated businesses within a propose-respond BBM process, and allocating analytical effort to those proposals or aspects least consistent with available benchmarks. In this way, it can reduce the costs of making a regulatory price determination and improve incentives. With regard to its use as a regulatory method in its own right, reviewers have not supported placing full reliance on such studies:

> To the extent that there are concerns about the accuracy of a benchmarking study — e.g. a first generation study — its use in ratemaking should be limited. However, where there is confidence in the results of a benchmarking study, it can aid in setting rates in an incentive regulation regime. (Lowry & Getachew 2009 p.1329).

There is support for 'putting reasonable weight on the results from properly carried out benchmarking analysis, if also supported by other information' (Stern 2005 p.275).

2.3.2 *Norm models*

The PC also notes that benchmarking may involve constructing a detailed simulation model of a fictitious efficient firm. Computer based 'cost proxy models', or 'norm models', seek to simulate the detailed cost functions and demand conditions of regulated businesses. In this approach firms are compared to a normative benchmark model. Such methods are often used in the telecommunications industry, but applications in the energy industry remain relatively uncommon.

The use of this method in the telecommunications industry has given rise to a fully articulated alternative approach to regulation (Gasmi et al. 2002). Only two or three counties (Sweden, Spain and perhaps Chile), have developed models of this kind for electricity network regulation, but Sweden has recently abandoned its use (Vanhanen et al. 2010 p.12).

These models represent a significant investment, but can have uses in addition to benchmarking efficient costs, such as improving price signals and regulatory incentive mechanisms. Great care would be needed to govern the use of models within a regulatory process. Since they are detailed and complex, they can impose substantial information requirements, and could put the regulator in the position of advising firms how to run their businesses (Tardiff 2010 pp.186-187). There is a risk that the benchmark standard embedded in a model will be an even higher standard than the most efficient firm in the industry, when the parameters for each element of operations are chosen to reflect 'best practice'. Even the most efficient firm in the industry will not be at maximum theoretical efficiency with regard to every aspect of their operations. Norm models may also ignore uncertainty about demand or technology changes, and its effects on capacity decisions, rates of asset redundancy etc (Tardiff 2010). A number of other important issues associated with norm models are discussed in Jamasb & Pollitt (2008).

Notwithstanding the limitations, one of the strengths of norm models is their ability to simulate the long-run, whereas frontier methods based on historical data can at best be used as a guide to the short-run. For example, norm models might assist in formulating efficient incentives for investment and service quality for application over longer regulatory periods (Jamasb & Pollitt 2008 p.1796). Such modelling may be a valuable area of research. Jamasb & Pollit's appraisal is that norm models can play a role as a regulatory benchmarking tool, but this should not be as the primary benchmarking tool but rather as a supplement to frontier benchmarking methods (Jamasb & Pollitt 2008 p.1800).

2.3.3 Index methods

The comparative productivity of firms can also be estimated using the index method of level accounting, which produces a bi-lateral relative productivity measure between firms (in this context). Alternatively, the multilateral TFP method can be used. (Meyrick & Associates 2005 pp.39-40).

For example, level accounting is often used for comparing the levels of productivity between two countries, often at industry level. The index weight used for an individual output (or input) in this method is the average of the weights for that output in the separate productivity indices of the two firms in question. Instead of output and input growth rates, ratios of outputs and inputs for the two firms are used (Timmer et al. 2010 pp.191-200).

2.3.4 *Conclusions*

Benchmarking methods do not appear to be sufficiently well established that they could be relied upon solely as a method of regulation. However, they can contribute as one part of a regulatory price setting process.

2.4 Benchmarking standards

There is an important distinction between the use of benchmarking by businesses seeking to identify and implement best practice and its role in regulation. This role is to provide incentives for businesses to improve their efficiency and ultimately reach best practice. Consequently, the relevant benchmark standard may be different. This section discusses the appropriate benchmarking standard to use in regulation and related issues that arise in regard to partial benchmarking.

Benchmarking measures need not be referenced against the best practice utility. They can be referenced against the average utility or an intermediate standard such as the margin of the top quartile (Lowry & Getachew 2009 p.1323). In the UK, the electricity regulator has preferred to use the average performance in the industry whereas the water regulator has placed more emphasis on the efficiency frontier (Dassler et al. 2006 p.172).

A number of authors have suggested that the average firm is the most useful benchmark standard for regulation because it corresponds to the competitive market standard used as a basic aim of regulation (Kaufmann & Beardow 2001 p.8; Lowry & Getachew 2009; Tardiff 2010). The concept of a 'normal' rate-of-return is the return earned by firms with average efficiency. 'Companies that manage to be "efficient" (i.e. on the frontier) will earn returns *above* the average' (Shuttleworth 1999 p.2).[5] These arguments are particularly relevant to industries in private ownership, which have effective profit maximisation incentives, but may not be suitable for industries largely

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[5] Although the NER (cl. 6.5.4(e)(3)) states that the elements of the rate-of-return should be based on 'a benchmark efficient Distribution Network Service Provider', this is not interpreted to mean the supra-normal rate-of-return accruing to firm of above average efficiency, but rather, the cost of raising finance for an efficient firm with an efficient financial structure.

in government ownership (a higher threshold such as an upper quartile may be appropriate in that context). However, a general argument is that the use of frontier efficiency standards in regulation is likely to lead to unrealistically high and, indeed unachievable, targets being set (Lawrence 2003 p.63).

If the average firm (or another threshold) were the benchmark, a regulated firm would be penalised when it underperforms the average (or other threshold) and would be rewarded when it outperforms the average (or threshold). The incentives would encourage improvement, so that the average performance moves closer to the frontier over time.

Some are cautious about the benefits of including measures of capital inputs into benchmarking models because of the difficulty in measuring capital inputs, and because historical capex is not under the control of current management. However, one problem with partial benchmarking is that inputs may be substitutable. Firms may pursue different business strategies and be better in some dimensions of performance than others. Consequently, the practice of separately benchmarking cost elements may result in bias. This is particularly the case if each component were benchmarked against best practice:

> The separate benchmarking of operating and capital costs makes little sense, given the trade-off between the two. That is, combining (1) the minimum operating cost from one company with (2) the minimum capital cost from another will set a cost target that no individual company has ever met, nor could reasonably be expected to meet. (Makholm 1999 p.22)

2.5 Constraints to the use of benchmarking in the NER

The AEMC maintains that under the NER, the AER could use the TFP approach to determine the X factor. Alternatively, it could use TFP analysis within the BBM to benchmark business cost proposals and better focus the analysis of firms’ cost forecasts (AEMC 2011a p.1).

Although the AER has significant latitude in how it sets the X factor for direct control services, it must: (a) be consistent with the total revenue requirement over the regulatory period; and (b) the difference between the forecast revenue and the revenue requirement in the final year of the period must be minimised (cl. 6.5.9). The revenue requirement is determined using the BBM (cl. 6.4.3). Using the TFP method to set the

X-Factor would determine a specific P_0 adjustment for each firm compatible with requirement (a), but it may not be possible to also satisfy requirement (b).

There does not appear to be any constraint on the AER using benchmarking within the BBM. The NER provides significant latitude to the AER when forming its view about the reasonableness of cost proposals submitted to it. The AER must assess whether a DNSP's opex and capex submissions each represent: (i) the efficient cost; (ii) the costs that a prudent operator would require; and (iii) a realistic expectation of the demand forecast and input requirements; to meet the operating expenditure and capital expenditure objectives.[6] If the AER is not satisfied that it meets all three criteria, it must reject the proposal (i.e. failure on any one criterion would be sufficient to reject a proposal). The AER's reasons for rejecting an opex or capex proposal need to be sound. And fairness would require it to make a detailed assessment of assumptions underlying the cost forecasts submitted to it. But it is not required to approve or reject elements of the opex and capex proposals. The NER only requires the AER to form an assessment of whether 'the total of' the proposed opex reasonably meets the criteria, and similarly for the capex proposal (cl 6.5.6(c)).

When undertaking this assessment, the AER must have regard to certain matters listed cl 6.5.6(e), but may have regard to other things also. The mandatory considerations include: (a) analysis undertaken by or for the AER and published before the final distribution determination is made; (b) benchmark operating expenditure that would be incurred by an efficient DNSP over the regulatory control period. There is no restriction on the nature of the analysis or benchmarking.

In summary, there does not appear to be any constraint on the AER using benchmarking analysis when assessing opex and capex separately under the NER. There is an explicit requirement to consider the benchmark opex and capex that would be incurred by an efficient DSNP. The AER must form a view about whether total opex and total capex reasonably meet the criteria of efficiency, prudency and being based on realistic expectations. The AER can form its own view on the evidence it considers pertinent when making that decision.

These observations are consistent with the view of the AEMC that there is no constraint on the use of benchmarking within the NER if used within the building block approach.

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[6] The objectives are in clauses 6.5.6(a) and 6.5.7(a) of the NER.

> … the use of TFP indices in setting cost benchmarks for the building block approach is already allowed for under the Rules. However, to date, the AER has made limited use of benchmarking in its determinations. (AEMC 2011b p.ii)

Scope to use of benchmarking as an alternative to the BBM would be limited under the NER because cl. 6.2.6(a) requires that 'standard control services' must be regulated under the CPI-X model 'or some incentive-based variant of the prospective CPI minus X form' consistent with the building block model (BBM) set out in the Rules. Subject to these restrictions, the AER has some discretion to choose the price control methodology for standard control services.

There may be scope for the AER to adopt a benchmarking method different to the BBM for a subset of services. The AER can also determine which services are classified as standard control services, alternative control services and negotiated services.[7] While the form of regulation is well-defined for standard control services and negotiated services, alternative control services may be regulated in a manner decided by the AER, subject to having some form of price or revenue control mechanism (cl. 6.2.5(b)). There is no obligation to conform to the BBM model, or any need for the control mechanism to be similar to CPI-X for alternative control services. The NER doesn't contain any broad principle to provide guidance on which kinds of services should be classified to each category. However, it is implied that, where appropriate, a less stringent form of price or revenue control can be used.

In summary, there are few constraints under the NER to using benchmarking methods within the BBM. However, there are limitations to any departure from the BBM process.

3 Options for reforming the regulatory price-setting model

The foregoing discussion has explored different approaches to regulation and benchmarking. This section aims to develop specific options as candidates for improving the electricity network regulation frameworks.

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[7] The AER defines all network services and new connections requiring augmentation works to be standard control services. Metering services and the operation, repair, replacement and maintenance of DNSP public lighting assets to be alternative services, while alteration and relocation of DNSP public lighting assets and new public lighting assets are negotiated services.

3.1 Benchmarking within an incentive framework

This section seeks to formulate the complementary roles of benchmarking methods and firm-specific costs within the context of incentive regulation theory.

3.1.1 Benchmarking in the theory of regulation

A theory of incentive regulation has been formulated in terms of two polar extreme regulatory contracts: (i) a fixed price, or a fixed price escalation formula tied to exogenous input price indices or performance benchmarks and committed to over a long period; and (ii) a 'cost of service' contract in which the firm is assured that it will be compensated for all of the costs that it actually incurs (Joskow 2006a). A feasible range of regulatory models is characterised by equation (1.1) where firm *i*'s allowed revenue (R_i) (or revenue per unit) is a function of its realised costs (C_i) (or unit cost) and the cost of the benchmark firm used for comparison with firm *i* (B^i). This is a useful framework for considering alternative regulation design options.

$$R_i = aC_i + (1-a)B^i \qquad (1.1)$$

In cost of service regulation, a = 1. In pure price cap regulation: a = 0 and B^i may be fixed in real terms or decline in line with a productivity index. In yardstick regulation:

$$B^i = \sum_j f_j C_j; \; j \neq i \qquad (1.2)$$

Where C_j is the unit cost of each peer firm, *j*, and f_j is the weight assigned to firm *j* (McDermott et al. 2007a p.39).

The objective is to find the value of a yielding the lowest long-term price path consistent with prices being sufficient to recover efficient costs. The emphasis on the long-term highlights the trade off between:

- providing a higher-powered incentive, with associated greater efficiency gains, but at the cost of permitting the regulated firm to retain a higher proportion of the efficiency gains
- providing a weaker incentive and achieving lower efficiency gains but ensuring that a higher proportion of those gains are passed on to consumers.

There is also a trade-off between the strength of incentives to reduce costs and risk-mitigation. Incentive mechanisms require the regulator to commit in advance to not bail out a company going bankrupt — otherwise there would perverse incentives

(Weyman-Jones et al. 2006 p.359). So with any choice of a, there would need to be a high likelihood of sustainability.

> Perhaps not surprisingly, the optimal regulatory mechanism (in a second best sense) will lie somewhere between these two extremes. In general, it will have the form of a profit sharing contract or a sliding scale regulatory mechanism where the price that the regulated firm can charge is partially responsive to changes in realized costs and partially fixed ex ante (Joskow 2006b p.7)

This suggests that a weighted average of the firm-specific costs and an external yardstick benchmark (B), where $0 < a < 1$, should be superior to full reliance on either: the firm-specific cost ($a = 1$); or the benchmarking method ($a = 0$).

In practice, there will be other additional trade-offs in the choice of the weight a. For example:

- Equity issues associated with the sharing of efficiency gains between regulated businesses and their customers, and the sharing of risks. Lawrence et al. (2006) suggest that the sustainability of regulatory plans depends importantly on a reasonable distribution of benefits between stakeholders.
- The administrative costs of regulation will be influenced by the value of a. This will also influence the trade-off between the benefits and costs of the regulatory framework overall.
- The degree of confidence that can be placed in the accuracy of external benchmarks compared to firm-specific costs will need to be factored the weighting they are assigned.

3.1.2 *Stretch factors*

The model in (1.1) and (1.2) can be expressed in terms for a conventional price cap with a stretch factor. Firstly, costs can be expressed as the product of input price (W) and quantity (X) indices: $C = W.X$. The cost efficiency (CE) of firm i is defined by reference to the minimum inputs needed to produce the outputs produced by firm i (X^*) and the value of the input price index when the cost minimising input mix is used (W') (Coelli et al. 2005 p.53):

$$CE_i = \frac{W'.X^*}{W'.X_i} \qquad (1.3)$$

The benchmark cost is the cost of the marginal firm at the chosen threshold (*t*) (e.g. the average efficiency firm), which produces the same services: $B = W.X^t$. According to (1.3), its cost efficiency is: $CE^t = (W'.X^*)\big/(W'.X^t)$. The relative cost efficiency is:

$$\frac{CE_i}{CE^t} = \left(\frac{W'.X^*}{W'.X_i}\right)\left(\frac{W'.X^t}{W'.X^*}\right) = \frac{W'.X^t}{W'.X_i} = \frac{(W'/W_t)B}{(W'/W_i)C_i} = \left(\frac{W_i}{W_t}\right)\frac{B}{C_i} \qquad (1.4)$$

If we assume the input price ratio $(W_i/W_t) = 1$, the benchmark, *B*, can be expressed as:

$$B = C_i\left(\frac{CE_i}{CE^t}\right) = C_i(1 + b_i) \qquad (1.5)$$

Where ($1 + b_i$) is the cost efficiency of firm *i* relative to the benchmark standard firm. It so happens that the assumption concerning the input price ratio also means that the ratio of technical efficiencies is equal to the ratio of cost efficiencies, because we have assumed away differences in the degree of allocative efficiency between firm *i* and the benchmark standard firm (*t*).

Using expressions (1.1) and (1.5), the revenue allowance would be:

$$R_i = C_i\left\{1 + (1 - a)b_i\right\} \qquad (1.6)$$

The term $(1 - a)b_i$ can be interpreted as a stretch factor. An optimal stretch factor will depend not only on the distance of a firm from the benchmark standard of efficiency, but also on the weight given to the benchmark in the incentive scheme.

This shows that the results of benchmarking can be included within the price control framework through the inclusion of a stretch factor that is explicitly related to comparative cost or technical efficiency of a firm against the benchmark standard.

3.1.3 Efficiency carry-over

BBM relies on the Efficiency Carryover Mechanism (ECM) to ensure that regulated firms retain incentives to pursue efficiency throughout the regulatory period. This incentive mechanism can be seen as an alternative to benchmarking (Lowry & Getachew 2009). The ECM is a formula that allows firms to retain part of the benefit from cost savings they achieve (in excess of the cost savings built into the cost forecasts) for a defined period (five years). Since the period over which those benefits are to be recovered may straddle regulatory periods, the formula enables part of the benefit to be carried over from one regulatory period to the next. This contrasts with the mechanism described in the previous section, in which the firm's share of any relative efficiency gains it achieves is governed by the parameter (1 – *a*).

The ECM has some possible limitations which may lead to weak efficiency incentives:

- *Firms retain a relatively small share of efficiency gains:* The ECM applies to efficiency gains additional to those already assumed by the regulator in cost forecasts. It has been estimated that under the mechanism, a firm will retain approximately 30% of the benefit of cost savings additional to those assumed in the cost forecast, the remainder being passed on to consumers. (The firm's retained share of all efficiency gains will be lower than 30%.)
- *Lack of timing incentive:* The ECM is designed to ensure that, no matter when an efficiency enhancing innovation is undertaken, it will produce the same return to the firm (i.e. the firm retaining the first five years of benefit from the efficiency gain). Hence there will be little cost to deferring a cost saving innovation. This differs from a competitive firm, which has a strong incentive to make a cost saving innovation as soon as possible. In effect, the ECM creates a delay option for the regulated business.
- *The ECM may bias the types of efficiencies that are made:* The ECM usually only applies to opex. Higher financial benefits will accrue to savings in opex that are achieved through capital deepening because the firm receives a return on the investment made, as well as benefits through the ECM from the associated opex saving. Productivity improvements that reduce opex but do not involve capital deepening (e.g. through improved organisation, process or effort) receive lower financial rewards.

3.1.4 Conclusion

The results of benchmarking can be incorporated into the price control via stretch factors. These warrant consideration as an alternative to the ECM, particularly if the ECM is not fully effective.

3.2 Price control, risk sharing and the term of reviews

This section discusses some other reform options for reducing risk (and therefore cost) and enhancing efficiency incentives.

3.2.1 *Price control*

It is a well established proposition that the longer the period between regulatory price determinations, the greater are the incentives for cost efficiency — this being the original rationale for price cap regulation (Biggar 2011 p.27).[8] This is because the regulated business will on average retain a greater share of any cost reductions, before they (at least in part) are passed through to consumers at the next review.[9] However, a longer regulatory period would rely on the regulator to forecast cost and demand conditions over a longer period with sufficient accuracy.

This forecasting burden may be partially ameliorated by 'automatically' incorporating information about input prices into the price escalation formula.

> Indexing prices to observables beyond the firm's control can allow for less frequent reviews while preventing gross divergences between price and cost and the consequent losses in allocative efficiency. (Lyon 1994, p. 5)

In competitive markets, suppliers can typically pass on through product prices, cost increases that affect the entire industry, such as essential input prices. Changes in unit costs will generally depend on movements in input prices and gains in productivity. Price adjustment mechanisms that are relatively effective at tracking average unit costs over time can enable the period between resets to be longer. In principle, this can achieve a better trade-off between the risks of prices becoming out of kilter with efficient costs, possibly leading to inadequate or excessive returns, and the incentives to achieve efficiency when price redeterminations are less frequent.

The general rate of consumer goods inflation measured by the CPI may not be the best available index for escalating prices between regulatory reviews. Another option is to construct a Composite Input Price Index (CIPI) from independently published indices, using weights reflecting the relative importance of those inputs in the regulated industry.[10] This approach was used by the ESC in its 2007-08 Taxi Fare Review to escalate fares for a period of up to 5 years (ESC 2008 p.82-84). When the input price index is used, the forecast TFP rate of change is the appropriate X-factor, rather than

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[8] Ofgem's RIIO approach will extend regulatory periods to 8 years.

[9] The power of the incentive scheme is defined the percentage of the gains from efficiency improvement that a firm is allowed to retain. The incentive to undertake the improvement is directly related to this.

[10] In practice, CPI may be part of the CIPI because some input prices, such as capital inputs, may be indexed to CPI, or the CPI may be used as a proxy for some index not available.

the movement in productivity relative to the economy as a whole (see: ESC 2008 pp.237-44).

This approach may also have advantages over the prevailing practice, in which cost forecasts include real cost escalators for forecast movements in the price of inputs relative to the CPI. These escalators address key input cost drivers such as copper and aluminium prices, sector labour costs and general labour costs. This is done because 'the AER has considered that cost escalation at CPI did not reasonably reflect a realistic expectation of the movement in some of the input costs faced by providers.'[11]

3.2.2 *Risk-sharing schemes*

Incentive regulation in the USA encompasses a wide range of pricing schemes, including banded rate-of-return, rate case moratoriums, price-cap and revenue-cap plans, as well as earnings and revenue sharing mechanisms (Sappington & Weisman 1996 ch.3). The latter two options are risk/reward-sharing schemes, which have received little attention in Australia.

Earnings sharing plans establish a feedback loop between a firm's earnings outcomes and price changes. They are designed to pass on a proportion of efficiency gains to consumers while leaving firms with sufficient incentive to pursue efficiency.

> A typical … plan specifies a target rate of return on investment (like the 12% target …). It also specifies a "no sharing" range of earnings around the target return (e.g., earnings that generate rates of return between 10 and 14% …). The firm is authorized to keep all earnings that it secures within the no sharing range, ... Incremental earnings above and below the no sharing range of earnings are shared with customers. (Sappington & Weisman 2010 p.230)

Although efficiency incentives under earnings sharing regulation are not as strong as under a pure price cap, the firm is exposed to less risk. Because less reliance is placed on accurate long-term forecasts, the length of regulatory periods can be extended, and hence incentives may actually be improved. For instance, Lyon found that 'at least a small amount of profit sharing always improves upon pure price caps when cost uncertainty is present.' (Lyon 1994, p. 13)

Sappington & Weisman show that in telecommunications, earnings sharing plans became popular in the USA by around 1990, but by 1995 they had lost popularity in favour of price cap plans (2010 p.233). Although earnings sharing provided greater

[11] *Application by Ergon Energy Corp (No 3)* [2010] ACompT 11 at 7-10.

flexibility to adapt to changing industry conditions compared to pure price cap regulation, it had important drawbacks: weaker incentives to improve efficiency, and reliance on precise measurement of earnings, which proved to be difficult and contentious (Sappington & Weisman 2010 p.246).

More recently revenue sharing has emerged as a popular risk-sharing arrangement within price cap plans negotiated directly between infrastructure businesses and their customers, or customer representatives. Littlechild has noted several arrangements of this kind in negotiated settlements (Littlechild 2007; 2010). Like earnings sharing, this provides for sharing of revenue outturns outside a most probable range. But revenue sharing provides for the sharing of risk only in regard to demand levels, which are largely outside the control of the utility, and not the sharing of cost risks, which can best be managed by the regulated business. This is consistent with the principles of risk allocation. Unlike the earnings-sharing model, it should not impair cost efficiency incentives. Further, revenue can be more readily measured than earnings, so it is not subject to the same practical implementation difficulties.

The regulatory framework in the NER does not appear to explicitly take account of uncertainty, aside from the provision of cost pass-through mechanisms. The PC may wish to consider methods of sharing and managing risk – such as a revenue sharing formula – if this would enhance economic welfare or lower the expected costs to consumers.

A price cap is said to have advantages when costs are largely variable, whereas a revenue cap may be preferred when costs are largely fixed (Kema Consulting 2010 p.14). At present the regulatory treatment of transmission and distribution businesses differs in this respect, although their cost structures may not greatly differ. A price-cap combined with a revenue sharing formula would be somewhere between a simple price cap and a revenue cap, potentially providing an option for uniformity between the control mechanisms for electricity distribution and transmission.

3.2.3 *Timing and nature of periodic price reviews*

The nature of the review process at the end of a regulatory period is important for efficiency incentives. If it involves passing through to consumers all or most of the cost reductions achieved, efficiency incentives may be weak. But, if the review is primarily about whether there was systematic forecast error, or any major structural changes in the industry since the last review, and focuses on adjusting price path parameters just for such factors, efficiency incentives are likely to be stronger (Sappington & Weisman 2010 p.242).

There is no constraint within the NER to having longer regulatory periods within the NER. It is within the discretion of the AER to adopt a period longer than 5 years. However, a rule change would be required to make longer periods mandatory.

3.3 Other options to improve the NER

This section identifies some modifications to the NER that could improve investment incentives and reduce costs to consumers.

3.3.1 Cost of capital

In addition to suggestions made in the author's submission to the AEMC, two ways in which the cost of capital provisions of the NER may be improved are as follows. Firstly, clause 6.5.2(b) is ambiguous in regard to how gearing in the WACC should be defined. It defines E as the 'the value' of equity and D and 'the value' of debt, without clarifying whether these should be market values or book values. Nor is the relationship between the sum of these values (V) and the regulatory asset base made clear. UK regulators equate V with the regulatory asset base, and E = V – D, where D is the book value of debt. This would be the preferable approach.

Second, clause 6.5.3 imposes an inappropriate treatment of tax in the WACC. It defines the projected tax cost as the forecast taxable income multiplied by the expected *statutory* tax rate, and adjusted for franking credits. However, the cost of capital is usually defined in terms of the imputation-adjusted *effective* tax rate, not the statutory tax rate. In reality, a company's effective tax rate may be quite different to the statutory tax rate. This may stem from extended timing differences associated with incurring tax liabilities and payment of tax. Using the statutory tax rate in the WACC enables privately owned utilities to retain gains from tax–advantaged finance structures. Thus, many of the regulated entities actually pay very little tax at the present time. For example, 2009-10 annual reports indicate that APA Group, Envestra, DUET and SP AusNet, taken together, paid tax on average amounting to only 1.0% of their cash flow from operations before tax and interest.

These two changes would be likely to improve cost of capital estimates and reduce incentives toward excessive debt financing.

3.3.2 *Depreciation charges*

Clause 6.5.5 severely limits the AER's ability to ensure that depreciation charges are appropriate.[12] The AER must accept depreciation schedules proposed by a utility if they conform to a set of quite weak standards, namely: (a) they use a depreciation profile 'that reflects the nature of the assets or category of assets'; (b) the depreciation charges (in real terms) add up to the original investment; (c) once set, the depreciation schedule should remain consistent over subsequent regulatory reviews. This framework enables regulated firms considerable latitude in setting asset depreciation profiles, and this may enable them to accelerate the depreciation of assets through their choices of asset lives and depreciation profiles. This ability for regulated businesses to nominate their depreciation profiles may provide an incentive to over-invest.[13]

Strengthening the AER's powers to reject proposed asset lives and depreciation profiles would be likely to improve investment incentives and may reduce depreciation charges.

3.3.3 *Capex prudency test*

Regulatory frameworks usually include a 'prudency test', which is used before allowing actual capital expenditure over the preceding period to enter the regulatory asset base at the start of a new price control period. Prudency refers to whether a reasonable person would have made that capital expenditure decision based on the information available to them at the time the decision was made (McDermott et al. 2007b).[14] Although the Gas Rules provide for such a test, there is no such test in the Electricity Rules (Brown & Carpenter 2009).

Prudency tests help provide investment efficiency incentives. They can also be used to actively promote efficiency as the following example from the UK attests.

> Ofgem has developed tools to help test whether capex is necessary by encouraging the regulated firms to obtain contractual commitments from future users before investing.

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12 From a financial capital maintenance perspective, and under certain assumptions, the depreciation profile choice may not affect the NPV of the regulated business. However, this does not address whether there is any effect on incentives for investment, or the impacts on consumers. It may be expected that investors prefer a rapid return of capital. This may adversely affect present consumers through higher prices in the medium term. There is the possibility that network service providers will then seek to renew assets prematurely if they expect to earn a suitable return on replacement values.

13 Notably, Ofgem's new RIIO model of regulation will greatly lengthen average depreciation periods for energy infrastructure from around 20 years to over 40 years.

14 Prudency also extends to project risk management practices that reflect accepted standards.

> Thus, for example, customers are required to bid at auction for long term rights to flow gas onto the transmission network. If the auctions show that additional capacity may be needed, the regulator will agree additional funding during the price control. (Brown & Carpenter 2009 p.14)

The inclusion of a prudency test for electricity network capital expenditure is likely to improve investment incentives.

3.3.4 Information gathering & transparency

An important aspect of a regulator's role is monitoring the extent to which outcomes under the regulatory framework are consistent with the objectives, and that the conduct of regulated firms is consistent with the applicable rules, guidelines and determinations. Information collection and monitoring is itself a regulatory tool:

> … the regulator can engage in more intensive monitoring and auditing of the regulated firm. The incentive intensity principle states that the greater the intensity of monitoring and auditing of the regulated firm by the regulator, the greater the precision of the signal the regulator observes and the greater the power of the optimal incentive. In fact, intensive monitoring by the regulator and high powered incentives are complementary activities—each tends to increase the value of the other. (Biggar 2005 p.3)

Regulators often have extensive powers of information gathering and reporting, but these may not be fully or effectively utilised. The AER has recently developed its strategy for information collection, analysis and reporting for electricity distribution and transmission networks.[15] And the AEMC is proposing to make rule changes to require specific regulatory disclosure data that will support benchmarking (AEMC 2011a appendix J). These follow concerns raised about the adequacy of information collection:

> … the availability and quality of information has been raised as a significant issue during AEMC's TFP review. Having good quality information about out-turn costs is a pre-requisite for any method of setting prices, but we do not think that any significant methodological issues are associated with this: it is a matter of developing and enforcing a system of regulatory accounts that is fit for purpose. (Brown & Carpenter 2009 p.16)

There may be merit in the NER explicitly setting out some of the mandatory minimum information collection and public reporting by the AER. This would include the

[15] <http://www.aer.gov.au/content/index.phtml/itemId/746841> (accessed on 21 April 2012).

information needed by stakeholders to carry out, or verify, benchmarking and other analysis. The reporting process proposed by the AEMC as part of its TFP review would contribute to this aim.

3.3.5 Summary

This submission has focussed on the benchmarking aspects of the PC's terms of reference. This section has discussed some possible changes to the NER that may improve investment incentive efficiency. The author's submission to the AEMC also discusses the practice of rolling certain kinds of capital expenditure into regulatory asset bases, which may also be relevant to efficient investment incentives. Although there are a wide number of other aspects of electricity industry regulation that may affect the efficiency of investment, these suggested changes may contribute to improving efficiency.

4 Conclusions

This submission has canvassed methods in which benchmarking is used in economic regulation. One of the most interesting of these is yardstick competition, in which prices that a utility may charge reflect the cost efficiency of its peers, rather than its own cost efficiency. However, while benchmarking methods may be useful in improving regulatory decision-making and incentive frameworks, they do not at present provide an independent alternative form of regulation. They are best used in conjunction with other regulation methodologies, such as TFP and/or BBM regulation.

Among the frontier methods of benchmarking, SFA appears to have relative strengths, and improvement of the techniques is ongoing. Another interesting approach is 'cost proxy' or 'norm models'. These may be best used to supplement frontier benchmarking, rather than as a primary benchmarking method. They may also have important applications in assisting to improve the design of incentive mechanisms and test the efficiency of price structures.

This submission has also made the following suggestions:

- Benchmarking might be used as an alternative to the prevailing efficiency carryover mechanism. Benchmarking could be formally incorporated into price controls through a stretch factor.
- Consideration could be given to whether a composite input price index may be used in the price control in place of the CPI.

- A revenue sharing arrangement might be combined with a price-cap, for application to both electricity distribution and transmission.
- One of the aims in formulating any changes to the regulation framework should be to lengthen the regulatory period. Mandatory lengthening could be considered if the price and revenue control framework is adequate to support it.
- Provisions in the NER relating to the weighted average cost of capital could be revised to specify that:
    - the total of debt plus equity is to be equal to the value of the regulatory asset base, and the value of equity is the residual after debt is deducted from it
    - the effective tax rate be used rather than the statutory tax rate.
- The AER could have greater powers to reject asset depreciation profiles it considers inappropriate.
- A capital expenditure prudency test could be applied to electricity network investments.
- Consideration may be given to explicitly setting out in the NER some mandatory minimum information collection and public reporting obligations for the AER, which might include information to facilitate benchmarking analysis by stakeholders.

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