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6 March 2009

Dr John Tamblyn
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Dear Dr Tamblyn

Total Factor Productivity Review – Framework and Issues Paper, EMO0006

The Essential Services Commission of Victoria (ESC) is pleased to present its submission to the Australian Energy Market Commission (AEMC) review into TFP regulation.

In its response the ESC highlights a number of strategic issues that the Commission will need to address as it conducts its review into TFP:

- the challenges of regulating energy network prices are growing more, and not less, pronounced over time.
- the benefit of allowing some in-built flexibility for the regulatory regime to evolve alongside the existing rule change process.
- recognising the contribution that energy networks must make to meet broader energy policy objectives especially dealing with the growing climate change challenge.

Regulating energy network prices under the building block (cost of service) regime is becoming more, not less, problematic due to changing corporate and financial structures and the difficulty in understanding the costs of providing network services.

There is a strong argument to support greater flexibility in the regulatory rules given the clear jurisdictional differences in ownership, business structure, maturity and productivity/efficiency performance amongst network service providers in Australia.

A single regulatory approach will constrain the refinement of the incentives (especially for dynamic efficiency) that will be required for the energy industry to meet many of the climate challenges it will be facing in the coming decades.

Meeting Australia's energy market goals will require greater incentive to pursue creativity and innovation in the technologies as well as the prices, products and services that supplied and demanded by consumers. The ESC urges the Commission to not foreclose any potential source of innovative and efficient market behaviour that can encourage greater energy efficiency and reduced GHG emissions.

ESC research and modelling has confirmed that the dynamic efficiency incentives are superior under TFP indexing approaches as against repeated application of building block methodologies. The ESC's response to the Commission's Framework and Approach Paper explains why this is so. The attached submission also notes that building block regulation has been costly and contentious in practice, and its deficiencies will be increasingly difficult to rectify given the lack of physical and legal separation that is normally essential to support rigorous cost of service regulation.

TFP measurement is viable for Australia's energy networks. Rigorous TFP studies have already been performed for Victoria's electricity distribution and gas distribution industries. This work provides a foundation that the Commission, AER and industry can build on and use as a foundation for creating a TFP-based regulatory option.

Partly because of this research, TFP-based regulation is likely to be a low-cost and effective regulatory approach, compared with building blocks. Because there is a high probability that TFP-based regulation will prove beneficial to regulators and at least some companies, the ESC strongly recommends that it be added as an option to Australia's current regulatory framework.

Finally, the ESC wishes to draw the attention of the AEMC to the most recent international example of TFP regulation being the Ontario Energy Board's (OEB) "third generation incentive regulation" (IRM3) plan released in September 2008. This is a comprehensive, index-based incentive regulation plan covering Ontario's 80 electricity distributors. The Brattle Group's report on TFP case studies omitted any reference to this example of TFP regulation. Given that OEB electricity distribution regulatory process was viewed as a success by companies, customer groups, regulatory staff, and OEB Commissioners, the ESC strongly urges the AEMC to pay particular attention to this case study as it undertakes its review into TFP regulation.

Yours sincerely,

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SUBMISSION TO THE AEMC REVIEW INTO THE USE OF TOTAL FACTOR PRODUCTIVTY FOR THE DETERMINATION OF PRICES AND REVENUES

FRAMEWORK AND ISSUES PAPER

MARCH 2009

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1 INTRODUCTION

The Essential Services Commission of Victoria (ESC) is pleased to present this submission in response to the Australian Energy Market Commission's (the Commission's) *Review into the use of Total Factor Productivity for the determination of prices and revenues: Framework and Issues Paper* (the *Framework and Issues Paper*). This issue has been the subject of considerable interest and research in Victoria, having initially been raised by the Victorian electricity distribution businesses (DBs) in the context of the first (2001-2005) electricity distribution price review (EDPR). The DBs' interest was, in turn, motivated by Clause 5.10 of Victoria's Electricity Supply Industry Tariff Order which said that the update of Victoria's price controls was to utilise "price based regulation adopting a CPI-X approach and not rate of return regulation."

The DBs' original price controls were calibrated using building block methods, and the companies believed that continued applications of this methodology would lead the controls to revert to a variant of rate of return regulation which would have been incompatible with Victorian Law.[1] In a search for viable regulatory alternatives, in 1997 the DBs commissioned a report from individuals who are now with Pacific Economics Group (PEG) which analysed the merits of the building block and total factor productivity (TFP)-based regulatory approaches[2]. The respective experiences were illustrated with concrete examples of how each method had been practically implemented in the UK (building blocks) and the US (TFP-based). Following this 1997 report, the DBs released a number of similar reports which discussed related topics, including the data and implementation issues that are involved with a TFP-based regulatory regime.[3]

In the run-up to the DBs' second EDPR (2006-2010), the focus for research on the TFP-based regulatory option shifted to the ESC. This ESC sponsored a series of inter-related projects on TFP-based regulation that were designed to run in parallel to the EDPR. This program was again carried out in conjunction with PEG, but it moved beyond the analytical reports that had been done to date and concentrated on the actual measurement of TFP growth for Australian energy networks. The first such study was completed in December 2004 and estimated the Victorian

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[1] This view was supported in a letter from Dan Fessler (former President of the California Public Utilities Commission) to John Tamblyn, Regulator-General Victoria, on behalf of the DBs.

[2] Kaufmann, L. and M.N. Lowry (1997), *Updating Price Controls for Victoria's Power Distributors: Analysis and Options,* Report for Victorian Distribution Businesses.

[3] For example, see *Incentive Regulation and External Performance Measures: Operationalising TFP – Practical Implementation Issues*, Further Report to the Utility Regulation Forum submitted by CitiPower.

DBs' TFP growth for their entire post-privatisation period (1995-2003).[4] These TFP estimates have been updated annually to include DB data for the years of 2004,[5] 2005,[6] 2006,[7] and 2007,[8] as these data became available. In 2006 PEG and the ESC also developed very preliminary TFP trend estimates for distributors in other Australian States and Territories.[9] In 2008 PEG also estimated TFP trends for Victoria's gas distribution businesses for their entire post-privatisation period (1998-2007).[10]

In addition to this empirical work, in 2005 PEG also developed an "incentive power" simulation model that compared the incentive effects of different regulatory options and their implications for utility prices and profits over multi-year periods.[11] This research was motivated by an earlier investigation into the merits of TFP-based regulation by Farrier Swier Consulting, which was undertaken on behalf of the Utility Regulators Forum. In their report, Farrier Swier stated:

> *(w)e consider that it is difficult to understand the effect of the design of different parameters of a TFP based price cap on profitability, pricing and incentive outcomes without undertaking some form of simulation modelling. Therefore, we suggest it may be beneficial to develop high level modelling tools to help better understand the potential incentive properties of different detailed designs (and to compare these with other regulatory approaches).*[12]

PEG's incentive power model attempted to shed light on this concern, and their results showed that various applications of TFP-based regulation created unambiguously stronger incentive effects and greater customer welfare than the building block alternatives. Indeed, building blocks often fared worse than conventional cost of service regulation because of companies' ability to game expenditure forecasts in a manner that boosted prices over what could have been

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[4] Kaufmann, L., et al., *TFP Research for Victoria's Power Distribution Industry*, Report to the Essential Services Commission, December 2004.

[5] Kaufmann, L. and D. Hovde, *TFP Research for Victoria's Power Distribution Industry: Update*, Report to the Essential Services Commission, April 2006.

[6] Kaufmann, L. and D. Hovde, *TFP Research for Victoria's Power Distribution Industry: 2005 Update*, Report to the Essential Services Commission, November 2006.

[7] Kaufmann, L. and D. Hovde, *TFP Research for Victoria's Power Distribution Industry: 2006 Update*, Report to the Essential Services Commission, February 2008.

[8] Kaufmann, L., D. Hovde and K. Haemig, *TFP Research for Victoria's Power Distribution Industry: 2007 Update*, Report to the Essential Services Commission, December 2008.

[9] Essential Services Commission and Pacific Economics Group, *Total Factor Productivity and the Australian Electricity Distribution Industry: Estimating a National Trend*, December 2006.

[10] Kaufmann, L., D. Hovde and K. Haemig, *TFP Research for Victoria's Gas Distribution Industry*, November 2008.

[11] Kaufmann, L., *Incentive Power and Regulatory Options in Victoria*, Report to the Essential Services Commission, May 2005.

[12] Farrier-Swier Consulting, *Comparison of Building Blocks and Index-Based Approaches*, Report to Utility Regulators' Forum, June 2002, p. 78.

justified solely on the basis of their observed, historical costs (which are typically used to set prices under cost of service regulation).

The ESC believes that this historical background is important, because it shows there is already an extensive body of knowledge and practical empirical work that the Commission and stakeholders can draw on for this Review. We believe this work provides a solid foundation on which a workable TFP-based regime can be established. The substantial amount of empirical research that has been conducted also reduces the incremental costs that would need to be incurred to update, refine and extend this work to all of Australia. In this submission, the ESC will draw on its work and PEG's research in these areas, although our comments are structured so that they respond directly to the issues that the Commission has raised for consideration in this Review.

In the ESC's opinion, the main issues to be kept in mind as the Commission undertakes this review are the following:

- **Challenges in regulating energy network prices**
  There are some clear challenges in regulating energy network prices using the building block framework that is currently mandated by the rules. The ESC's experience is that these challenges are growing more, and not less, pronounced over time, due to changing corporate structures and the difficulties in understanding the costs of providing network services. It would be highly desirable if there was an option available to regulators, and companies, that facilitated more effective economic regulation and at least partly mitigated the challenges and costs associated with the building block approach.
- **The Need for Flexibility**
  There are clear jurisdictional differences in ownership, business structure, maturity and (perhaps) productivity/efficiency performance among network service providers in Australia. These differences will present additional regulatory challenges for the AER. Given the diversity of circumstances for energy networks, the ESC believes a "one size fits all" regulatory model – like that current proscribed in the rules - is not appropriate for network regulation and will constrain the refinement of the incentives that will be required for the energy industry to meet many of the challenges it will be facing in the coming decades.
- **Pros and cons of TFP-based regulation**
  We believe the pros and cons of the TFP-based approach should be carefully assessed and compared with ongoing and exclusive reliance on building block regulation. The Commission should consider whether the inherent merits of a TFP-based approach would prove to be attractive to regulators and at least some companies, compared with the counterfactual of mandatory building blocks for all.
- **Indexing Logic and TFP Measurement**
  There has been extensive debate in Australia about the details of TFP measurement for energy networks. However, the ESC believes that this debate has sometimes been too "academic" and has not adequately considered the fundamental question of how TFP should be measured if it is being used for the specific purpose of regulating network tariffs. There is a well-established analytical framework that links TFP growth rates to tariff indexing formulas, but it is not generally recognised that this framework also has implications on how TFP

should be measured if it is used to regulate network prices. The ESC believes that, if the Review considers this issue carefully and objectively, it can largely resolve the TFP measurement debate.

- **Implementation Issues that Need to Be Addressed**
  The Review should focus on whether a workable TFP-based regulatory model can be established, not on a definitive resolution of every potential issue that could arise in a TFP-based application. The latter is an unrealistic standard, particularly since the issue is only whether TFP-based regulation is to be offered as an option, not a substitute for building block regulation. Indeed, the ESC believes that a considerable number of fundamental issues in building block regulation (such as identifying efficient costs or eliminating gaming from expenditure forecasts) have not been definitely resolved in Australia, yet this has clearly not prevented building blocks from being applied. The ESC believes a relatively small number of implementation issues need to be addressed to implement a workable and effective TFP-based regulatory approach, and our submission will concentrate on what we believe are the key issues.

- **International Experience with TFP-Based Regulation**
  As part of this Review, the Commission has engaged Brattle Group (and to a lesser extent, London Economics) to review the experience with TFP-based regulation. The ESC welcomes this research, but we have been informed by PEG that the documents that have been presented to the Commission do not provide a comprehensive, balanced or – in some cases – accurate overview of this experience. There are other studies in the public domain that the Commission can rely on to supplement the reports that have been provided specifically for this Review. The ESC does not believe it would be productive to engage in an extensive debate over the past historical record at the expense of addressing more immediate concerns, but it is important for the Commission to be provided with a generally accurate record of how TFP-based regulation has been implemented in practice. This is especially true in those instances where the Issues and Framework Paper has relied on this record to identify concerns with how TFP-based regulation has in fact been implemented. The ESC believes that a more comprehensive review indicates that the experience with TFP-based regulation has been overwhelmingly positive and has involved far fewer, and less contentious, debates than are customary in either building block methodologies or traditional cost of service regulation. We will, where relevant, draw the Commission's attention to other studies that should be considered and which provide a more complete view of how TFP-based regulation has operated in practice.

- **Potential Contribution of Energy Networks to Broader Energy Policy Objectives**
  Australian energy policies have shifted substantially in recent years, with far more emphasis now placed on reducing energy demand and greenhouse gas emissions. These policy objectives create enormous challenges for the entire energy sector, and the ESC believes that energy networks can and should be active participants in meeting these challenges. Indeed, energy networks are in some cases uniquely positioned to make valuable contributions to promoting demand-side energy efficiency, particularly with regard to smart metering, distributed generation (DG) and related investments. However, we believe that building block methodologies will not encourage energy networks to make their

maximum potential contribution in achieving these goals. In contrast, a TFP-based methodology creates stronger incentives for networks to diversify appropriately into areas that can be both profitable for the networks and help to achieve broader energy policy objectives.

Discussions of alternative methods for network regulation in Australia have almost entirely neglected this issue as indeed previous studies that have assessed the regulatory barriers to meeting climate change challenges. Most of the debate has implicitly treated energy networks as if they were separable from the remainder of the energy value chain and broader energy market goals. Instead the focus has been on the challenges of regulating natural monopoly networks. The ESC believes that this attitude is mistaken, and energy networks should not be viewed as inert links between energy producers and end-users. Indeed, a number of recent technological developments make energy networks more important than ever for managing the challenges of dispatching renewable energy sources, sending appropriate price signals to customers, and encouraging market-driven conservation and demand response. We also believe that regulation is critical for either encouraging or discouraging networks to be innovative and pursue these opportunities to the greatest possible extent – and as evidenced in the telecommunications industry contributing to the gradual shrinking of the natural monopoly network itself. For reasons that we explain in detail later in this submission (in response to Issue 25), the ESC believes that TFP-based regulation is likely to be more effective in creating these positive and pro-active incentives than building block methods.

We believe this is one of the strongest rationales for including a TFP-based regulatory option in the Rules. Meeting Australia's energy market goals will require creativity and innovation. Policymakers should not foreclose any potential source of innovative behaviour that can encourage greater energy efficiency and reduced GHG emissions. Any opportunity for regulation to promote innovation should be strongly supported. Given the challenges we are facing, the ESC believe it is critical for the Commission not to prohibit a regulatory alternative that may encourage energy networks to become more active and valuable participants in achieving broader energy market goals. These potential benefits substantially increase the option value of the TFP-based regulatory alternative without raising its implementation costs, which the ESC believes are modest in light of the substantial work that has already been done on this issue.

The ESC has extensive, hands-on experience with building block regulation, and we have also sponsored considerable research on the TFP-based regulatory alternative. We therefore believe that the ESC is in a unique position in Australia to provide perspective on the relative merits of adding TFP-based regulation to the current building blocks regulatory framework. Based on this experience and research, the ESC believes:

- Building block regulation has been costly and contentious in practice, and its deficiencies will be increasingly difficult to rectify given the lack of physical and legal separation that is normally essential to support rigorous cost of service regulation

- Continued application of building block regulation will increasingly draw the regulator into: 1) more detailed and forensic examination of utility costs; 2) extensive use of cost benchmarking; or 3) both of the above. The ESC believes this prognosis is confirmed by the experience with building block regulation in the UK.
- TFP measurement is viable for Australia's energy networks. In fact, rigorous TFP studies have already been performed for Victoria's electricity distribution and gas distribution industries. This work provides a foundation that the Commission, AER and industry can build on and use as a foundation for creating a TFP-based regulatory option.
- Partly because of this research, TFP-based regulation is likely to be a low-cost and effective regulatory approach, compared with building blocks. Because there is a high probability that TFP-based regulation will prove beneficial to regulators and at least some companies, the ESC strongly recommends that it be added as an option to Australia's current regulatory framework.

Our submission is organised as follows. The following Section addresses each of the Issues detailed in the Framework and Issues Paper. Section Three provides brief concluding remarks. Section Four is an Appendix that provides additional perspective on the experience with TFP-based regulation; this Appendix was prepared by Larry Kaufmann of PEG.

2 RESPONSE TO ISSUES

1. Is the Commission's proposed scope of the Review appropriate?

The scope, and objective, of the Commission's Review is twofold. The first aim is to advise the MCE on the circumstances in which a permitted application of a TFP-based methodology would contribute to either the National Electricity Objective (NEO) or the National Gas Objective (NGO). The second is to recommend draft rules for the MCE's consideration that allow a TFP-based methodology to be used by service providers. In both instances, the Review focuses on what the Commission calls a "full" application of a TFP-based methodology, where TFP growth rates determine the X factor in an indexing formula which sets the allowed rate of change in prices (or revenues) for a service provider. This "full" application is contrasted with the case where TFP measures can be used as "benchmark" evidence in a building block methodology. Importantly, the Review is considering whether a TFP-based methodology can be permitted in addition to the existing framework, not as a substitute or replacement of the building block approach.

The ESC believes this proposed scope is appropriate. However, we note that while TFP can sometimes be used as a type of "benchmarking" evidence, neither the Commission nor other observers should draw the conclusion that a full TFP-based methodology is a type of "benchmarking." The ESC believes these regulatory approaches are very distinct, primarily because benchmarking evidence almost always focuses on drawing inferences on relative cost (or productivity) levels, whereas the TFP-based methodology examined in this Review applies only to rates of change. Strictly speaking, a TFP-based application is not an application of benchmarking, and it is important for these concepts not to be confused.

2. Are the Commission's proposed assessment criteria appropriate? Are there other desirable criteria?

The ESC believes the assessment criteria set out in Section 2 of the *Issues and Framework Paper* are appropriate. We believe the counterfactual assessment described in Section 2.4 is particularly valuable, since the Review is focused on whether a TFP-based methodology should be considered as an option, alongside the present arrangements. A comparison of the productivity-based option with the continuation of current arrangements is a natural and straightforward basis for assessing whether a TFP-based methodology would be a valuable potential addition to Australia's energy regulatory frameworks. It should be emphasised, however, that this counterfactual does not hinge on a direct comparison of the expected net social benefits generated under the TFP-based and building block approaches. This would be appropriate if the question before the Commission was whether to *replace* the existing building block approach with a TFP-based approach. Because the issue is whether TFP-based regulation is to be offered as

an option in addition to building blocks, the Commission should consider whether the adoption of a TFP-based approach can create net benefits (*i.e.* additional consumer surplus + additional profits – regulatory implementation costs) for any particular company that may which to utilise it, compared with the counterfactual of mandating exclusive and universal reliance on the building block method.

The Commission should also recognise that the 'investment incentives' discussed in discussed in Section 2.3.2 go beyond the efficiency of energy network services *per se*. The *Framework and Issues Paper* correctly notes that

> *Future gas and electricity distribution systems can be described as 'active networks' that interact with both demand and supply sides. Industrial combined heat and power, distributed renewable generation, and micro-generation units installed by households equipped with smart meters will all pose new challenges to distribution networks to innovate and adopt new technologies. Therefore, it will be important that the regulatory framework provides sufficient incentives on the businesses to adopt relevant innovations.*[13]

This point has implications that go well beyond energy network regulation and setting efficient prices for energy network services. 'Active networks' will be critical for achieving Australia's broader energy market objectives. Networks can and should play a critical role in encouraging efficient distributed resources and market-driven conservation and demand response that reduces GHG emissions. These roles go beyond networks' traditional "energy delivery" function, and to the greatest extent possible regulation should encourage networks to undertake these actions voluntarily, in pursuit of profit, rather than in response to regulatory mandates and policy interventions. The most profitable approach for realising these broader goals could involve institutional and/or organisational changes that allow companies to capture economies of scope (cost efficiencies or revenues that would otherwise be 'split' among different market entities). Again, to the greatest extent possible, these organisational structures should evolve organically rather than in response to mandates or policy directives. Regulators will never be in a position to know the most effective means of implementing or advancing cutting edge technologies, but utility managers have decades of accumulated expertise that can be instrumental in discovering more effective energy market solutions if they are properly motivated to be innovative and forward-looking.

The ESC believes that the development of effective 'active networks' depends crucially on the regulatory environment. As we explain in detail in our response to Issue 25, TFP-based regulation is likely to be more effective than building block regulation in facilitating innovative behavior that furthers energy market goals. The institutional economics literature also emphasises the importance of different institutional rules on fostering innovation and improving economic performance. Perhaps the premier figure in this field is Douglass North, who was awarded the 1993 Nobel Prize in Economics for his work. Dr. North writes that

> *(D)ifferent institutional rules will produce different incentives...the particular institutions will not only determine the kinds of economic*

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[13] *Framework and Issues Paper*, p. 9.

> *activity that will be profitable and viable, but also shape the adaptive efficiency of the internal structure of firms and other organisations...rules that encourage the development and utilisation of tacit knowledge and therefore creative entrepreneurial talent will be important for efficient organisation*[14]

Given the daunting energy market challenges, the ESC believes this is an especially important time for the institutional environment to "encourage the development and utilisation of...creative entrepreneurial talent," and we believe TFP-based regulation has greater potential to enhance these capabilities than building block methods.

The ESC is not aware of any other criteria that should be considered, but we believe it would be valuable for the Commission to provide additional detail on how it intends to implement those criteria. In the ESC's opinion, the most relevant means of undertaking a "counterfactual" analysis is to consider the actual experience of jurisdictions that have operated under building block and TFP-based regulatory regimes. This submission will provide a significant amount of information on the ESC's hands-on experience with building block regulation. The ESC believes a broader perspective on the merits of the building block methodology, and the direction in which repeated applications of building blocks may lead, can be obtained by examining the experience in the United Kingdom, which has the longest experience with this regulatory approach. The jurisdiction with the longest sustained use of TFP-based regulation is Massachusetts, although the experience in the Canadian Province of Ontario is also notable in many respects. Attached to this submission is an Appendix that contains information on the experience with TFP-based regulation in Massachusetts, Ontario and other relevant jurisdictions, as well as a discussion of building block regulation in the UK, which has not yet been introduced into the Review and which we believe will be helpful to the Commission as it undertakes its counterfactual and comparative analyses.

3. If TFP were to be available for revenue and pricing decisions, what would be the correct industry definitions for the respective each sectors? Also, in determining an industry definition for a TFP based approach, would adjustments for operating environment conditions be necessary and, if so, under what conditions?

The ESC believes that, ultimately, the industry for a given sector should be defined as all regulated firms in that sector. Greater coverage is obviously more comprehensive and representative of conditions for the entire regulated industry.

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[14] D. North, *Institutions, Institutional Change, and Economic Performance*, Cambridge: Cambridge University Press, p. 81. While the term "tacit knowledge" can be used in different ways, it most often refers to productive knowledge that is embedded in organisations and firms and takes effect through those organisations' routines and internal processes. In this sense, productive tacit knowledge is closely related to the idea of a productive "corporate culture."

The ESC also believes that any attempts to carve a given industry into different subgroups will be at least somewhat arbitrary and fraught with controversy. In such a situation, there are a variety of business conditions that firms could argue are relevant for differentiating one "industry" definition from another. Multiple industries within a sector can also give businesses ongoing incentives to redefine industry definitions to their advantage *e.g.* to define the industry aggregates so that their business is placed with firms that have the lowest observed historical TFP growth rates and, hence, the lowest X factor under TFP-based regulation. The ESC believes that specifying multiple industry definitions could thereby create gaming incentives which potentially undermine both the benefits and stability of a TFP-based regulatory regime.

Moreover, we believe that dividing a sector into several different "industries" is unnecessary, for at least two reasons. One is that differences in operating environment conditions primarily affect a service provider's cost and productivity *levels*, not their growth rates. Only differences in TFP growth rates should logically be accommodated via different industry definitions, since a TFP-based approach applies only to the tariff adjustment mechanism and not initial tariff levels. Prices at the outset of a TFP-based regime would be based on the costs of the enterprises themselves, which would naturally reflect each company's own operating conditions and any other matters deemed relevant to achieve a sustainable start point.

Second, and relatedly, the ESC believes that there is no other empirical evidence to support the view that different operating conditions have a substantial impact on the TFP growth of different types of utilities within a sector. Indeed, empirical studies by PEG in Victoria and by Cambridge Economic Policy Associates (CEPA) in the UK find that differences in operating conditions have had a very modest impact on TFP growth rates.[15] Accordingly, the ESC believes there is no sound empirical basis for dividing a sector into multiple industries based on differences in operating conditions that would, in turn, lead to differences in TFP growth potential.

Because it does not favour multiple industry subgroups, the ESC's view is that a single X factor (for each sector) is most appropriate for TFP-based regulation in Australia. One development supporting a single X factor is that the State regulators have undertaken at least one, and in many cases, two building block cost reviews. The ESC believes that these reviews have established an acceptable relationship between prices and costs. The ESC is also confident that these and any subsequent Building Block reviews would allow any differences in company conditions to be reflected in start prices at the outset of TFP-based regulation. This reduces the need to have different X factors because of different exogenous conditions.

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[15] For example, see Kaufmann, L., et al., *TFP Research for Victoria's Power Distribution Industry*, December 2004. It should also be noted that differences in operating conditions often have more of an impact on more disaggregated productivity measures, such as opex partial factor productivity (PFP) growth. One reason is that more PFP trends can be affected by input substitution activity, which can be driven by differences in operating conditions such as the share of gas distribution main constructed using aged cast iron or bare steel materials. TFP measures reflect input substitution and are therefore less sensitive to these effects.

There are also a number of important advantages with having a single X factor, including the following:

- A single X factor is easier to implement and administer
- A single X mitigates the incentives that could otherwise exist of companies trying to game their value of X by arguing that they face different exogenous conditions than the industry as a whole
- Similarly, a single X factor mitigates the incentives that could otherwise exist of companies trying to game their value of X by arguing that they are more efficient than the industry as a whole (and thus requiring lower TFP "stretch factors"). More generally, a single X factor places less weight on the need for supplemental performance benchmarking studies than would a TFP-based regime where there are multiple values of X.

But while the ESC believes that the definition of the industry should ultimately include all regulated firms in the sector, in our view this universal coverage can and should take place gradually. More generally, the ESC believes that it is important for a TFP-based regulatory regime to evolve organically over time. It is not realistic or practical for the Commission to try to resolve all implementation issues at the outset. The ESC favours a flexible, evolutionary model that is sensitive to jurisdictions' differing regulatory experiences and the extent to which they have achieved preliminary objectives, such as data collection and understanding the costs of the enterprises they are regulating. Differences in "initial conditions" across jurisdictions suggest it would be desirable to allow flexibility in how different States and territories move towards being integrated into TFP calculations.

The ESC's preferred model for TFP-based regulation is consistent with such flexibility. The ESC is recommending a TFP-based regulatory approach in which data can be "rolled in" at different times for different States. This feature of the preferred model is consistent with the fact that the data series needed to estimate industry TFP are either not as extensive or as well developed in some States as in Victoria.

The flexibility of the ESC's approach can also accommodate differences in regulatory experience across Australian States. For example, regulators must have confidence that the revenues at the outset of a TFP-based regime bear a sustainable relationship with the underlying costs of the businesses. Building block regulation allows regulators to gain a more detailed understanding of the costs associated with energy utility services and can set each firm's allowed prices so that they roughly recover those costs. Having generally cost-reflective start prices is an important first step before moving towards TFP-based regulation. The ESC is satisfied that this is the case in Victoria, since it has undertaken two building block reviews for both electricity distribution and gas distributors. However, for other States it may be necessary for the AER to undertake an additional building block review before data from service providers in these States and territories can be rolled into TFP growth calculations.

We note that allowing data from different service providers to be rolled into TFP computations at different times also supports the idea of having a single X factor. Permitting new data to be rolled into one of several possible industry subgroups would complicate the operation of a TFP-based regulatory option. In such an

application, the regulator could be in the position of continuously deciding where (i.e. into which industry subgroup) the data from new companies should be added. These decisions could invite ongoing consultation, and associated regulatory costs and delays, associated with administering a TFP-based regime. The ESC does not believe these administrative costs are necessary and, indeed, can be harmful to the operation of TFP-based regulation, since they can create new opportunities for gaming.

A necessary consequence of the ESC's flexible, evolutionary approach to TFP estimation is that the single X factor would be "rolling" rather than fixed. A fixed X factor would only be updated when price controls expire. With a "rolling X factor," the value of X would be updated automatically during the controls according to formulas and rules that are established at the outset of the review. For example, the X-factor can be updated annually on the basis of new industry TFP data. If productivity growth increases during the period, the X-factor will therefore also increase. Updating the X-factor in this fashion flows through a portion of benefits achieved under the controls to customers. Similarly, if TFP growth declines during the access period because of factors such as increasing capital replacement expenditures, the X factor will decline. The updated X factor therefore automatically recovers some of the costs associated with capital replacement.

It should be emphasised that one of the main benefits of a rolling X factor is that it facilitates the extension of PBR to other States, as data in those States become available. It should also be noted that other Australian observers have pointed to a rolling TFP regime as a kind of "ideal" that Australian regulation should strive for.[16] The ESC believes that a workable approach to implementing a rolling X factor would have the following specific attributes:

(i) A formula for measuring TFP and input prices will be established at the outset of a PBR regime. Unless these formulas are demonstrated to have led to grossly inappropriate price adjustments, they will not be adjusted when price controls are reviewed. Consistent measurement of industry TFP and input prices over time will enhance overall regulatory stability, increase investor confidence and reduce the potential for gaming (e.g. opportunistic adjustments of TFP computations) on the part of both regulators and companies.

(ii) The value of X will be based on industry TFP trends and input price trends over the last 10 years for which data are available at the time the X factor is updated. The "trend" in each variable will be measured as the average (arithmetic) rate of change in the metric over the 10 year period.

(iii) The initial value of X will be calculated in 2010 and will, at a minimum, be based on TFP and input price trends for Victorian distributors for the years 1998-2008. TFP and input price trends

[16] E. Diewert and D. Lawrence, "Measurement Problems in Regulation," Presentation to the Australian Competition and Consumer Commission, July 22, 2004, p. 12.

for other distributors will also be included if high quality data are available for those distributors over the same period.

(iv) The rolling X factor will updated annually by adding the most recent year's TFP and input price data for available companies, and dropping the TFP and input price observations for those companies for the earliest year used to compute the previous year's computation of the X factor. For example, assuming the initial X factor is based only on Victorian data, the X factor in 2012 would be the TFP trend for the Victorian distributors over the 1999-2009 period. The X factor would therefore be a 10-year moving average of industry-wide TFP and input price trends. This basic approach was also adopted in the US railroad indexing plan (although that plan eventually settled on a five-year moving average).

(v) New companies would be rolled into the computation of industry TFP trends following the last building block review of costs for those companies. For each such company, historical data needed to estimate TFP (given the TFP estimation formula established in step one) will be added to industry TFP calculations for all years in which high quality data are available for that company, up to a maximum time series of eleven sample years (needed to compute a 10 year rate of change in TFP). New information will be added for each company until 11 years of TFP and input price data are available, at which point the "rolling" process described in step four will take effect for that sample company.

4. What is the appropriate method for determining TFP growth estimates?

(a) How should the outputs and inputs for the different energy sectors be classified?

The ESC believes that there is a strong analytical foundation for determining the choices for outputs and inputs for energy sectors. We believe this foundation flows directly from the indexing logic which establishes the link between industry TFP growth rates and the calibration of tariff indexing formulas. This indexing logic is generally accepted in Australia, but its implications for output and input choices are not widely recognised. We believe this Review provides an excellent opportunity to explore this issue and, in the process, ideally resolve many of the debates regarding TFP measurement that have taken place to date in Australia. We present this logic below and then discuss its implications for appropriate TFP measurement, including input and output choices.

The indexing logic relies on what is sometimes referred to as the competitive market paradigm i.e. that utility tariff adjustments should be set at a rate that is consistent with how prices evolve in competitive markets. The indexing logic therefore examines long-run changes in revenues and costs for an industry. In the long run, the trend in revenue (R) for an industry equals the trend in its cost (C).

$$Trend\ R = Trend\ C \quad (1)$$

The trend in the revenue of any industry will be equal to the sum of trends in revenue-weighted output price indexes (P) and revenue-weighted output quantity indexes (Y).

$$Trend\ R = Trend\ P + Trend\ Y \tag{2}$$

The growth rate in the cost incurred by an industry is the sum of the trends in a cost share-weighted input price index (W) and a cost-share weighted input quantity index (X).

$$Trend\ C = Trend\ W + Trend\ X \tag{3}$$

Substituting (2) and (3) into equation (1) and rearranging, we find

$$\begin{aligned} Trend\ P &= (Trend\ W + Trend\ X) - Trend\ Y \\ &= Trend\ W - (Trend\ Y - Trend\ X) \\ &= Trend\ W - Trend\ TFP \end{aligned} \tag{4}$$

This is the basic result of the indexing logic. It shows that the change in an industry output price index can be decomposed into changes in the industry's input price index minus changes in its TFP index. When this result is applied to utility regulation, it implies that allowed changes in utility prices (the left-hand side variable in (4)) can be linked to industry input price inflation minus changes in industry TFP. If the chosen inflation factor (such as the CPI) is a good proxy for long-run trends in industry input prices, then it is appropriate to set the X factor equal to the trend in the regulated industry's TFP.

These results, which show the usefulness of TFP trends for tariff adjustments, are generally understood, but the implications of this same indexing logic for appropriate TFP measurement are less recognised. For example, while equation (1) is only the starting point for the analysis, it has two important implications. First, it focuses only on the rate of change in prices and revenues. The indexing logic applies only to calibrating the terms of tariff adjustment formulas, not setting rate levels at the outset of an indexing regime. The competitive market paradigm therefore focuses on only a narrow issue – how revenues and costs evolve over time in competitive markets – and works from this premise towards deriving implications for the appropriate calibration of changes in tariffs for regulated markets. Equation (1) has no implications for the regulated industries' price levels; for example, it never says that regulated prices should approximate marginal costs, as occurs in perfectly competitive markets. This distinction between what the paradigm implies for appropriate price changes and appropriate price levels is sometimes not appreciated.

Second, equation (1) has implications about the dimensions of efficiency which need to be captured in a TFP measure used to adjust tariffs. Economists often distinguish between productive efficiency and allocative efficiency. Productive efficiency focuses on cost efficiency *e.g.* whether firms use the minimal number of inputs to produce a given level of output. Productive efficiency is focused exclusively on costs, which appear only on the right-hand side of equation (1). If an industry is productively efficient, then the trend rate of change in costs on the right-hand side of (1) will be the lowest possible change in costs that is necessary to satisfy the industry's changing output (given existing technology).

There are a number of components of allocative efficiency, but in a regulatory context one important consideration is whether changes in revenues approximately track changes in its costs. Equation (1) clearly embodies this dimension of allocative efficiency on an industry-wide basis. This is obvious since the change in the variable on the left-hand side of (1) [revenues] is explicitly set equal to the change in the variable on the right-hand side of (1) [costs].

The indexing logic which links TFP trends to changes in tariffs begins with equation (1). Our exposition above indicates that equation (1) necessarily reflects both allocative efficiency (in the relationship between changes in revenues and changes in costs for the industry) and productive efficiency (with respect to the efficient change in costs that appears on the right-hand side of (1)). It follows that the TFP measure that emerges from the further elaboration of this logic – and which appears in equation (4) - must also embody both productive and allocative efficiency. Importantly, the appropriate measure of industry TFP growth that is used in TFP-based regulation must be one that would tend to promote changes in industry revenues that approximate changes in industry costs. It should be emphasised that this relationship applies to the *industry* and not an individual utility; any individual utility would still have incentives to keep its cost growth below what is reflected in the industry-wide norms, as is the case in competitive markets.

The ESC believes that this important point has not been appreciated in the TFP debates that have taken place to date in Australia. For example, much of the criticism of PEG's TFP research in Victoria has implicitly been motivated by the concern that it does not adequately measure productive efficiency, but these critiques do not consider the (at least) equally important issue of allocative efficiency. For example, in arguing for its output specification (including the addition of a network capacity variable and the use of cost elasticities rather than revenue shares as weights), Meyrick and Associates has written that "the objective is to measure TFP which is output produced per unit of input (or total real cost)."[17] Meyrick has also written that "the objective of the X factor is to calculate achievable TFP gains going forward. As such, the use of cost elasticity shares to aggregate outputs in calculating TFP is unambiguously preferable to revenue shares which may bear little resemblance to relative costs."[18]

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[17] Meyrick and Associates, *Response to Pacific Economics Group 'Evaluation of Meyrick and Associates Review of PEG TFP Report*, Report prepared for AGLE, CitiPower, Powercor, TXU Networks and United Energy, 29 March 2005, p. 3.

[18] Meyrick and Associates, *op cit*, p. 4.

Both of these statements focus exclusively on the linkage between TFP and cost – or productive – efficiency. This focus is often warranted in academic research where the objective *is* to obtain the best possible measures of productive efficiency. But equation (1) makes it clear that this focus is not sufficient for TFP measures that are used to regulate utility tariffs, since an exclusive focus on productive efficiency would concentrate only on the right hand side of this equation. The TFP trend measures that appear in equation (4) of this logic, and which are used for utility regulation, must go beyond measuring productive efficiency to include allocative efficiency as well. The latter reflects the relationship between changes in costs and changes in revenues; this is an essential part of the indexing logic that cannot be ignored.

We next consider equation (2). This equation shows that the change in revenue can be decomposed into a change in output prices and output quantities. The change in output quantities in this equation is the same output quantity trend that appears in the TFP trend measure in equation (4). Equation (2) therefore draws a direct link between the outputs that are used to measure TFP and revenues. In other words, the outputs that are used in the TFP measure must have a direct link to the revenues of the regulated industry. If this was not the case, then the index decomposition in (2) – which gives rise to the output quantity index used in the TFP measure – would not be satisfied.[19]

More specifically, equation (2) has two direct implications for the output quantity specification. One is that the specific output quantities that are used to compute the output quantity index must be the billing determinants that are used in the tariffs for the regulated sector. No other output quantity measures can be compatible with equation (2) in the logic above. This can perhaps be clarified by considering a particular TFP controversy that has arisen in Australia. In its original TFP research for Victoria's electricity distribution sector, PEG measured output using the quantities that these utilities actually billed its customers for – customer numbers (via the customer charge), on-peak kWh deliveries, off-peak kWh deliveries and peak demands. Their rationale was that these are the billing determinants and hence the only quantities that are consistent with equation (2). Meyrick criticised this specification, in large part because it ignored what it called the network capacity output. Meyrick compared energy networks to roads, and said that electricity distributors were responsible for providing and maintaining this "road" but not responsible for the traffic (e.g the kWh deliveries) on that road. Meyrick claimed that PEG's TFP specification was deficient since it did not consider this important consideration, which is critical to how distributors actually operate and manage their businesses. Meyrick's critique could have had merit if the only objective of the TFP study was to measure distributors' how effectively managers are running their business i.e. their productive efficiency. But as our exposition of equation (1) indicates, this is not the objective for TFP measures that are used for rate adjustment mechanisms, since these must consider both productive and allocative efficiency. Meyrick's network capacity output is not consistent with the allocative efficiency prerogative, nor is it consistent with equation (2), which links changes in utility outputs to changes in utility revenues.

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[19] More technically, equation (2) says that the revenue, price and output quantity indexes that are used in TFP-based regulation must satisfy what is known as the product test.

Distributors do not charge directly for the network capacity measure that Meyrick recommended, so there is no logical relationship between this output and distribution revenue. Such a linkage is essential for equation (2) to be satisfied. Thus while Meyrick's critique raised interesting points that may be relevant for academic research, they were not material for the specific objective of PEG's TFP study. In TFP-based regulation, there must be a link between the outputs used in a TFP study and utility revenues, and only a utility's billing determinants can satisfy this criterion.

The second implication of equation (2) is that each billing determinant should be weighted by its revenue share when computing the output quantity index. Again, this is necessary for the changes in revenues to be decomposable into changes in output prices and output quantities. If output quantities were weighted by anything other than each output's share of revenues, equation (2) would not be satisfied (except by chance).

We turn now to the implications of equation (3). This equation shows that there is a direct link between the input quantity measure used in TFP calculations and the costs of the industry. In other words, the trend change in the industry's input quantity (which appears, in turn, in the industry TFP trend term in equation (4)) should be associated with trend changes in industry cost.

The main implication of equation (3) for TFP measurement is that all input quantities must be measured in monetary terms. Clearly, the total cost of the industry is measured in monetary terms, and internal consistency requires this value to be decomposed into two component indices (for input prices and input quantities) that are measured on the same, monetary basis. This is almost invariably the case for opex inputs, which are measured using the monetary values for operating expenditures. These monetary values are "deflated" using an opex input price index, which functionally divides the monetary value of opex changes into a price change component (reflected in the change in the overall input price index, W) and a quantity change component (the change in the overall input quantity index, X). Capital input quantities will be logically consistent with the total cost and opex input quantity measures only if these indices are also calculated using monetary capital values, not "physical" capital measures.

The link between monetary capital values and TFP trends is also consistent with how utility prices are set in practice. When prices under a TFP-based regulation review or arrangement are updated using measures of industry input price and TFP trends, prices at the outset of the review are typically set to recover the company's cost of service in a base year. These initial year costs include the costs associated with capital assets. When a utility sets its rates to recover the depreciation and carrying costs of these capital goods, it does so with reference to the aggregated monetary values of these disparate assets, net of their depreciation. It follows that if monetary costs – including the monetary costs of physical capital assets - are used to set rates at the outset of a review but a "physical method" for measuring capital is used to set the productivity factor, the productivity factor to adjust distribution rates will not be consistent with how those rates were originally set. This internal inconsistency between setting initial rates and adjusting rates over time can only reduce the transparency of the rate adjustment mechanism and perhaps exacerbate rate volatility when prices are

updated, thereby undermining the predictability and effectiveness of the TFP-based regulation regime.

In sum, the ESC recommends the following for the output quantity and input quantity specifications used to measure productivity in a TFP-based regulatory regime. We believe these recommendations are the only output and input choices that can be consistent with the indexing logic that is generally accepted in Australia and elsewhere.

(i) Outputs should be measured using the sector's billing determinants

(ii) Output weights should be revenue shares (for each billing determinant)

(iii) Inputs should be measured using monetary values for capital and opex

(iv) Input quantity weights should be cost shares

It should be noted that this specification also requires input price indexes to be determined for capital and opex. PEG has developed these indexes in its TFP studies for Victoria, and they have generally not been controversial. While these input price indices can perhaps be refined, we believe they can also be easily extended to other States and Territories.

(b) What should be the approach for determining the weightings for inputs and outputs?

This issue is addressed above. We note that some studies have used cost elasticity shares as "second best" output weights when data are not available on the revenues associated with different tariff elements for all companies in a sample. However, the ESC believes revenue share weights will be generally available in Australia, so there would be no need to use second-best, cost elasticity share weights.

It also should also be recognised that TFP-based regulation can encourage energy distributors to price their services efficiently, which over time will lead tariffs to be more cost reflective. This will in turn tend to reduce peak load and energy consumption, particularly if advanced metering enables distributors to measure and thus charge for the peak demands of residential and small commercial customers. We believe distributors will have much stronger incentives to send these price signals under TFP-based regulation, but these incentives will remain negligible under building block regulation.

This point can be clarified through an example. The main cost driver of electricity distribution is local area demand, which over time increases the need for distribution infrastructure. In recent years, demand by residential and small commercial customers has risen more rapidly than overall energy usage primarily because of the greater utilisation of air conditioning (and, to a lesser extent, plasma television sets, etc). Distributors can reduce their expenditures on new infrastructure spending if they charge for peak demand, since doing so will also tend to reduce customers' on-peak consumption and hence the need to build infrastructure. Under the traditional accumulation meter, it has not been possible

to measure peak demand directly, but this is possible with advanced metering technologies.

In this scenario, distributors have different pricing incentives under TFP-based and building block regulation. Under building blocks, distributors have little incentive to reduce customers' peak demands since there is a direct link between their allowed revenues and their capital expenditures. There are also stronger incentives to maximise regulated revenues under the price controls rather than maximise profits through cost containment. Discouraging on-peak consumption over the longer term would reduce distributors' regulated asset base and, under building blocks, distributors' allowed revenues and profits. With TFP-based regulation, however, distributors are essentially competing against industry TFP trends – if they can keep their own (capital) expenditures below the industry trend, they can profit. One way to do this is to send price signals to consumers that reflect the costs of their peak loads on the distribution system. These price signals will tend to reduce customers' on-peak consumption and the costs of building new infrastructure, will in turn boost profits. TFP-based regulation therefore creates stronger incentives for distributors to price their outputs efficiently, in a manner that reflects cost causation. Over time this is also likely to lead the revenue shares generated under a TFP-based regime to more closely reflect the cost elasticity shares of different distribution services.

5. What are the variables that would be needed to compute a TFP growth estimate for the gas and electricity transmission and distribution sectors?

Given our analysis above, the ESC believes that only a limited number of variables are needed to compute TFP growth estimates that can be used in indexing plans for energy networks. These TFP estimates require annual observations for the following variables:

(i) Company billing determinants (e.g. for electricity distribution, these billing determinants will be customer numbers, kWh and, where billed, kW demand, by tariff class)

(ii) Revenues collected from each billing determinant, and total revenue

(iii) The value of the regulatory asset base (RAB), and the components used to calculate changes in the regulatory asset base between years (e.g. the previous year's RAB, capital expenditures, depreciation, capital retirements, and inflation adjustments if applicable)

(iv) Operating expenditures (opex)

(v) An opex input price deflator; this has been constructed for Victoria as part of PEG's research for the ESC, and it has been generally accepted by the businesses. This index can be updated and/or extended to other Australian States and Territories.

(vi) A capital asset price deflator; this has been constructed for Victoria as part of PEG's research for the ESC, and it has been generally

accepted by the businesses. This index can be updated and/or extended to other Australian States and Territories.

6. What is the current availability of TFP-relevant data and its quality and consistency?

All data necessary to develop appropriate TFP measures currently exist. The ESC knows that this is true for Victoria and believes it is likely to be the case for other States and territories as well. However, under the ESC's recommended TFP-based regulatory model, the X factor would initially be developed using data and existing TFP trend estimates that have been developed for Victoria, and data from new companies in the electricity distribution and gas distribution sectors would be rolled into these calculations as they become available. We therefore believe that sufficient, TFP-relevant data already exist and can be the basis for the initial TFP studies that are used for TFP-based regulation.

Clearly, data quality and consistency will be important for expanding the number of companies that are included in the TFP computations. We do not believe that these issues will be difficult to resolve on the output side, since reliable information on billing determinants and associated revenues are maintained as a matter of course for utility billing purposes. These tariff and billing data can be accessed and used to develop TFP estimates for new companies.

There will be more challenges associated with developing high-quality and consistent cost data. The ESC recommends that these challenges be confronted on a case-by-case basis as part of the building block reviews that will still be conducted for individual service providers. These reviews provide an opportunity to examine each company's costs carefully and attempt to establish uniform and consistent standards for accounting and reporting.

While the ESC acknowledges that there will be challenges associated with developing high quality cost data, we believe these challenges will exist – and indeed will loom larger – under building block regulation. Cost misallocations will be more material under building blocks since those costs determine price adjustments directly under building block methods, while under the TFP-based approach price adjustments depend on changes in industry TFP aggregates. Companies therefore have less incentive to profit from cost misallocations under TFP-based regulation. The ESC has detailed the mathematics behind this important result in a document that can be downloaded from our website.[20] It is also likely to be easier to identify gaming and cost re-allocations during the historical, single-year cost reviews under TFP-based regulation than under building blocks, since the former deal with a single year's worth of observable, past data, while the latter involve a multi-year series of cost projections. Compared with the counterfactual of ongoing and exclusive reliance on the building block approach, the ESC therefore believes that the current lack of data consistency is something

[20] Essential Services Commission, *Cost Reporting and Cost Allocation – Implications for Regulation*, April 2006 Information Paper

that supports adding TFP-based regulation as an option to the existing regulatory framework rather than a deficiency that negates its value.

7. What would be the appropriate balance between precision and availability of data for the calculation of TFP?

The ESC believes this balance needs to be assessed on a case by case basis for each service provider. We believe this balance will generally not be an issue for the required output data, since companies will have the necessary data (billing determinants and associated revenues) as part of their customer billing records. Tradeoffs between precision and availability are likely to be more of an issue for the operating and capital cost data which are needed to estimate inputs. However, the ESC is recommending a flexible and evolutionary approach that allows companies to be rolled into industry TFP applications at different times. This approach means that it is not necessary to resolve all data quality and consistency issues before a TFP-based regulatory option can be considered. In the ESC's TFP-based regulatory model, any company's data would be added to the industry's TFP computations only after the AER is reasonably confident that these (historical) cost data are acceptable.

8. If a TFP based approach is adopted, what sample period would be appropriate for the data and what adjustments, if any, would be needed for it to be extrapolated for future circumstances?

The ESC believes that the appropriate sample period for estimating TFP trends that are used to set X factors would ultimately be ten or 11 years. This is approximately the length of the post-privatisation period (excluding the immediate TFP "boom" in the first three years after privatisation) for Victoria's electricity distribution industry. The ESC therefore believes that this currently measured TFP trend can be a starting point for nationwide TFP measurement and TFP-based regulation, at least for Australia's electricity distribution industry. Not only is the TFP estimate for Victoria's electricity distributors feasible and consistent with the indexing logic discussed above, but it has been estimated for a relatively "mature" post-privatisation industry. This trend may therefore may representative of longer-term trends for the entire electricity distribution industry in Australia.

The ESC does not believe that any adjustments are needed to extrapolate the measured past TFP trend for future circumstances. In practice, this is almost never done in TFP-based regulation and, in general, we do not believe it would be necessary or appropriate to do so in Australia. However, if there is a discrete, short-term change in an industry's TFP trends that is linked to an identifiable event – such as privatisation – it may be appropriate to exclude these data from the computation of past TFP trends that are used in TFP-based regulation. This anomalous, one-time TFP experience would not be representative of the future and hence should not be used to adjust tariffs. The ESC believes that these one-time events can be dealt with on a case-by-case basis and will often be straightforward to identify. This has proven to be the case in the TFP research that has been undertaken for Victoria's electricity distribution industry.

In addition, as discussed, our approach to TFP-based regulation would contain an optional capital investment module which could allow service providers to recover the incremental costs of their future capital expenditures which are not otherwise reflected in the industry's historical TFP trend. It should be emphasised, however, that this module is only an option, and it is specifically designed to eliminate any potential "double counting" of investment costs and will therefore only allow recovery of costs which are not otherwise reflected in the indexing formula.

9. If a TFP based approach is used, should any Australian data be supplemented with overseas data? Under what conditions would this be appropriate?

Given the extensive TFP research that has already been done in Australia, the ESC does not believe it is necessary or desirable to supplement this work with overseas data. However, as a "sanity check," it could still be reasonable to examine TFP trends from other jurisdictions, such as New Zealand or Ontario, which are implementing TFP-based regulation. We believe TFP trends for energy networks are unlikely to diverge substantially given the similarities in the underlying technology.

10. What characteristics of the dataset would need to be met for a TFP calculation to be robust and credible? Should the regulator be permitted to 'clean up' data?

The ESC believes that the data for Victoria's electricity distribution and gas distribution sectors already satisfy the criteria of being robust and credible. We believe these data can be used immediately as the basis for TFP trend estimates for these sectors throughout Australia. Data for other companies can be evaluated on a case by case basis, after the AER completes a building block review of that company's historical costs. We also believe regulators should be allowed to "clean up" a company's data, if necessary, to prevent gaming and to ensure consistent definitions and accounting to the greatest extent possible across the industry, although under TFP the need to do this is likely to be substantially mitigated and have little impact on the TFP trends calculated.

11. What should be the pre-conditions relating to industry characteristics required for the implementation of a TFP based approach?

The ESC believes these pre-conditions will be satisfied after one more year's worth of data (*i.e.* 2008 data) is added to the most recent TFP calculations for Victoria's gas and electric distribution industries. These TFP trends can then be used as the basis for preliminary X factors for TFP-based regulation for any distributor that elects to use this option. More data will be rolled into the TFP calculations after review and approval of the underlying data integrity of these companies by the regulator.

We do not believe that concerns over investment profiles is a sufficient reason for delaying the implementation of TFP-based regulation, at least for gas and electric

distribution providers. Investment spending tends to be fairly smooth in these industries and the "bow wave" somewhat exaggerated. The ESC's experience with building block reviews is that distributors' actual spend patterns have rarely matched the step change forecasts that these companies consistently submit.

We also note that our preferred TFP-based regulatory approach includes at least two features that will mitigate concerns with investment profiles. The first is the use of a rolling X factor. As discussed, a rolling X factor will reflect recent and changing capital spending patterns (eg upward trending capex spending) for the companies that are used to compute the X factor.

The second feature is the optional investment "module." This module can accommodate any surges in investment spending that would not otherwise be reflected in the indexing formula. This module would be an option available to all utilities, but it would lead to rate adjustments only on incremental capital spending that companies have (generally) already invested and the regulator has determined to be prudent (such as the roll-out of automatic interval meters). There are straightforward means of ensuring that this capital module does not lead to "double-counting" of allowed capital spending, and these formulas will be embedded directly in the module. A similar capital investment module has been included in the TFP-based regulatory plan that was recently approved for electricity distributors in Ontario, Canada.

12. If implementing a TFP based approach, should adjustments to an industry wide X be allowed to account for specific business characteristics?

The ESC believes that it would not be appropriate to adjust the industry-wide X for specific business characteristics, for the reasons discussed in our response to Issue Three. However, we do believe it would be appropriate for TFP-based regulation to include a capital investment module.

13. If a TFP based methodology was to be introduced, should fixed or rolling X factors be used? Alternatively, should the regulator have the option to choose between these in applying the TFP based methodology?

The ESC believes a rolling X factor should be used. There are a number of advantages with a rolling X factor, including:

(i) A rolling X factor greatly reduces concerns with the recovery of industry-wide cost changes, such as any upward movement in capital replacement expenditures, since those costs are reflected immediately in the X factor and price trends.

(ii) A rolling X factor makes it easier to roll new companies into a TFP-based regime. With a rolling X factor, the value of X is updated each year to reflect new TFP information. It is therefore possible, at each annual X factor update, to expand the definition of the relevant "industry" to include data that have become available on additional regulated companies. Companies could become subject

to the index-based price adjustments under TFP-based as their data are added to the computation of industry-wide TFP and input price trends. With a fixed value of X, any updates of TFP trend measures, and hence potential expansion of the PBR regime to new companies, would logically only take place at five-year intervals when the overall plan is reviewed. This would delay the expansion of the industry aggregate to include new companies.

(iii) Annual updates of TFP information are likely to lead to relatively smooth adjustments in the TFP trend. In contrast, X factors could change more substantially if prices were only reviewed at five year intervals, thereby increasing price volatility. If computations of TFP trends at five year intervals also include expansions in coverage of the regulated industry, the volatility of TFP trends and hence X factor adjustments that occur at those reviews may also be exacerbated.

(iv) Any changes in the regulated industry's long-term unit cost are flowed through to prices more quickly. These price adjustments would be symmetric. For example, if TFP accelerates due to the realisation of greater productive efficiencies, then the benefits of these gains would be flowed through to customers more quickly. On the other hand, if greater capital replacement expenditures put upward pressure on the industry's unit costs, a rolling X factor would allow these costs to be recovered more quickly. As mentioned above, adjusting prices relatively rapidly in response to long-term changes in unit costs should lead to less price volatility than if the X factor is updated every five years. It will also lead to much less price volatility than the price ratcheting that often occurs under building block reviews. Price volatility under the building block model creates uncertainty for utility business financing and cash flows.

(v) Relatedly, any "step changes" in industry unit costs will be tracked more closely under a rolling X factor than under a fixed X factor.

(vi) Although a rolling X factor will track industry unit costs relatively closely in "real time," it will not undermine company performance incentives. The reason is that the annual updates of TFP and input price trends apply to the regulated industry and not the company itself. Every company therefore has ongoing incentives to out-perform the industry in each year of the plan.

(vii) Annual updates of the TFP trend should reduce the weight that is placed on the review that takes place at the end of the price controls. This should reduce the regulatory costs associated with the review, diminish the potential for gaming at the review, and generally promote a more light-handed regulatory regime. It will also diminish the price volatility that is often associated with price changes that take place when price controls are updated.

(viii) Annual updates of the X factor will focus attention on data quality and comparability across companies on an annual basis, rather than at the time of price reviews.

There are arguably some disadvantages with a rolling X factor approach. The most important such disadvantage, compared with a fixed X factor, is that rolling X factors will certainly increase the frequency of regulatory computations of the X factors. Some may regard these additional computations as an increased regulatory burden. Whether a rolling X factor will prove more administratively burdensome is ultimately an empirical issue, but the ESC does not believe that annual X factor computations will impose additional burdens. On the contrary, after an initial learning period, the ESC would expect annual X factor updates to become relatively perfunctory and, by reducing the emphasis placed on the reviews that take place every five years, would actually reduce regulatory burdens compared with building block regulation. We provide more information on the costs of TFP updates in response to Issue Number 32.

The ESC does not believe the regulator should have the option of choosing whether a fixed or rolling X factor as it applies in TFP-based regulation. We believe the option for selecting the regulatory regime should fall entirely to the company. All businesses would have the option of choosing either a building block review, or a TFP-based methodology. The X factor that would apply under the latter option would be the most recent value of the rolling X factor that prevails at the time the new price controls for the service provider take effect.

14. If a full application of a TFP based approach were to be introduced:

(a) Should periodic assessments of efficient costs and the resetting of the X factor be undertaken?

Even though the X factor is updated annually in the ESC's preferred approach to TFP-based regulation, we believe it will still be necessary to review a company's costs when their price controls expire. Most price controls in Australia are currently reviewed every five years. The Commission recommends that this five-year period between price control reviews be maintained.

However, the ESC believes that the nature and purpose of these cost reviews will be very different under TFP-based regulation than building blocks. Under building block regulation, price reviews evaluate the operation of the expiring controls and, more importantly, set allowed revenues for the term of the upcoming control period. In TFP-based regulation, reviews will focus only on the first of these objectives – reviewing the operation of the expired controls – but not the latter.

This represents a substantial change from building block regulation. Under the building block model, allowed prices are set using a forward-looking assessment of each company's projected costs and outputs over the term of the controls. Reviews under TFP-based regulation will not consider each company's cost and demand projections but, rather, will examine the companies' own historical performance. A review will examine the company's costs and output for a single, historical "test year," which would be given by the most recently available, full year at the time the review commences.

This test year examination will be more light-handed than in the building block model. This is possible because a rolling X factor is designed to generate prices that track changes in unit costs more or less automatically. Reviews of expiring controls can therefore be more in the spirit of a "sanity check" that considers whether these controls, broadly considered, have operated reasonably.

One implication of a more light-handed review process is that prices established at the review should *not* attempt to take away all economic rent from utilities. This, again, is an important change in regulatory philosophy, but the Commission believes it is warranted. Practically speaking, we also believe information asymmetries make it impossible for regulators to eliminate monopoly rent entirely under any regulatory model.

Several methods for updating prices that do not focus on rent extraction were investigated in PEG's incentive power report. PEG considered several price control updates where the P_0 is set as a weighted average of the company's own costs and continued application of the current application of the current price controls. For example, 80% weight can be placed on the company's own costs in the last year of the controls and 20% weight can be placed on the prices that would result if the controls continued to go forward without a price review. PEG's simulation results showed that these types of P_0 updates dramatically improved incentives to undertake longer-term cost reduction initiatives. Both company shareholders and customers gain under these arrangements, but the lion's share of gains go to customers even though some rent is intentionally left "on the table." Although the Commission does not necessarily endorse this specific formula for updating company prices, we believe these results generally support the view that regulators should not focus excessively on rent extraction at price reviews but, instead, should establish a regulatory model that has desirable long-term incentive properties. The Commission therefore believes it is appropriate to allow companies to retain some economic rent at price reviews as a component of a TFP-based regulatory option.

(b) Would it be appropriate for the building block approach be applied to an assessment of single year of costs?

Yes. The ESC believes that any cost reviews under TFP-based regulation should focus on only a single, historic test year. This is consistent with the manner in which TFP-based regulation has been implemented in other jurisdictions. It is also sufficient for ensuring that there is a reasonable relationship between observed prices and costs. This objective is not necessarily furthered under building block reviews which rely on speculative, future cost projections. One of the main benefits of the TFP-based approach is that such cost projections – which have been the impetus for many of the costs and problems with the building block model – become superfluous. It is necessary only to determine a reasonable start point, where observed prices correspond to observed costs, adjust prices based on external TFP and inflation data, and then review observed costs and prices again at the end of the period.

The ESC also disagrees with the statements in the *Framework and Issues Paper* that "it is questionable whether the term used for the calculation of the rate of

return would need to be a single year – consistent with the other costs – or whether it should still be required to be consistent with the term of the forthcoming regulatory period." In cases where TFP-based regulation has been applied, the same techniques used to estimate cost of capital in standard cost of service regulation (*e.g.* the CAPM, discounted cash flow) have also been used to determine the cost of capital for prices established at the outset of an indexing period. The latter application does not raise any new logical or methodological issues.

The ESC also does not agree that "to assess the efficiency of proposed costs in that single year, the regulator would need to also assess the proposed profile of expenditure over the period." This simply is not the case. Again, there are examples of cost reviews under TFP-based regulation for energy networks, and these reviews have not examined "proposed profiles of expenditure" for future periods.

(c) Does the building block approach need amending to allow it to work within a TFP framework (particularly in relation to the asset base, depreciation, new capital expenditure and the rate of return)?

There is no need to amend the building block approach for it to work with a TFP framework. Any past measures of the regulatory asset base, depreciation, capital expenditure and (implicitly) rate of return would be reflected in the past data that would be part of the historical industry data used to measure the industry's past TFP trends. These same data would be used to compute historical costs for the test year used to set rates before TFP-based regulation takes effect (with one exception – the cost of capital could be updated – but this would lead to a discrete adjustment in starting rates only, not impact past, observed costs). There is accordingly no disconnect or inconsistency in these data which would require amendments to the building block regulatory framework.

15. Under a full application TFP approach, what should be the length of the regulatory period?

The ESC believes the length of the regulatory period should be five years. This has been the standard period under previous building block applications in Australia and is also consistent with many plan terms under TFP-based regulation. A five-year term strikes an appropriate balance between being long enough to create meaningful incentives for service providers, and short enough to ensure that a reasonable correspondence between companies' costs and prices can be established at rate reviews.

16. If a TFP based methodology was introduced, could earnings based re-openers or cost pass through mechanisms be used? What features of these mechanisms would be desirable (or not desirable)?

There are potential advantages and disadvantages with using earnings sharing mechanisms (ESMs) or earnings-based reopeners in TFP-based regulation. One clear disadvantage is that ESMs typically weaken incentives to control unit costs. Under an ESM, the benefits of each company's cost reduction efforts are likely to be shared immediately with customers via the ESM. Utility managers clearly have less incentive to undertake cost reduction initiatives if doing so leads in part to price reductions. Ongoing monitoring of earnings also maintains the potency of inherently controversial issues like cost allocations and transfer pricing. Regulatory attention to these issues can impose ongoing administrative burdens.

At the same time, ESMs can have some attractive features. One is that they are relatively simple and easy to understand. They also clearly align the interests of shareholders and customers, and their benefits appear to be transparent and easily computed (i.e. the amount of additional utility earnings distributed to customers or retained by shareholders). ESMs will also, by design, keep utility earnings within politically acceptable bounds and hence may build consensus among parties. For all of these reasons, ESMs may be viewed favorably in terms of fairness.

Notwithstanding these potential benefits, the ESC's view is that ESMs are not warranted at this time. A rolling X factor should keep prices from broadly diverging from costs and maintain earnings within acceptable bounds. The cost review when price controls are updated will provide another opportunity to ensure that TFP-based regulation is operating reasonably and effectively. Therefore, the Commission believes that ESMs will add to the complexity and cost of the regulatory system without generating considerable additional benefits that can be shared with customers.

Another important implementation issue is whether a TFP-based regime should have provisions to ensure the financial viability of companies and/or allow price controls to be reopened in the event that they lead to unexpectedly bad financial outcomes. Such protections have historically existed in Victoria. For example, Clause 3.2 of the Essential Services Commission Act allowed a price determination to be reopened at any time if:

> *a distributor to which the Price Determination applies is materially adversely affected by the Price Determination as a result of an event beyond the Distributor's control and which was not contemplated at the time the Price Determination was made and, on balance, the benefits of revoking the Price Determination outweigh the detriment to participants in the Victorian electricity supply industry resulting from revoking the Price Determination, then the ESC may revoke the Price Determination, but only with the prior written consent of all those Distributors to which the Price Determination applies.*

The Commission believes it might be appropriate to have a similar type of provision in a TFP-based regime. We also believe that such a provision would provide

sufficient protection against the impact of certain unexpected events on firm viability under any regulatory system.

17. If a TFP based methodology was introduced, what would be the appropriate index for measuring input prices?

The ESC believes that it is appropriate to use the national CPI as the inflation measure. At the same time, annual updates of the TFP index should compare trends in industry input prices with inflation in the CPI. Industry input price measures will be a natural, and automatic, by-product of an updated TFP study, so ongoing examination of the relationship between input price trends and the inflation index used to adjust tariffs will not impose any new regulatory burdens. If these trends diverge substantially, it could be worthwhile for the indexing formula to include an industry input price differential. Based on its experience and the TFP research it has sponsored, the ESC does not believe that this will prove to be necessary, but it is an issue that can be examined during the actual operation of a TFP-based regulatory approach.

18. Is a TFP based methodology consistent with a revenue cap form of control?

Yes, although the indexing logic that relates changes in TFP to changes in tariffs can be somewhat different under a revenue cap form of control. This logic shows that the specific outputs that are used to measure TFP can be different under revenue cap regulation than under price cap regulation. Intuitively this is sensible, because if revenue caps are designed so that allowed revenues depend on changes in customer numbers but are completely independent of volumes distributed, then output should be measured entirely by customer numbers.

This can be seen by considering the indexing logic for a revenue per customer indexing plan. This logic begins by noting that the trend in revenues for an industry will be equal to the trend in revenues per customer plus the trend growth in customer numbers.

$$trend\ Revenues^{Industry} = trend(\mathrm{Re}venues / Customer)^{Industry} + trend\ Customers^{Industry} \quad [1]$$

In a competitive industry, in the long run, the trend in industry revenues will equal the industry's trend in total cost.

$$trend\ Revenues^{Industry} = trendCosts^{Industry} \quad [2]$$

The trend in industry costs will, in turn, be equal to the trend growth rates in industry input prices and industry input quantities.

$$trend\ Costs^{Industry} = trend\ Input\ Prices^{Industry} + trend\ Input\ Quantities^{Industry}$$

[3]

If we substitute equations [1] and [3] into equation [2] and re-arrange terms, we have

$$trend\ (Revenues/Customer)^{Industry} = trend\ Input\ Prices^{Industry} - \begin{pmatrix} trend\ Customers^{Industry} \\ -trend\ Input\ Quantities^{Industry} \end{pmatrix}$$

[4]

We recommend that the indexing plans in Australia use CPI as an inflation factor. If the trend growth in CPI is both added and subtracted from the right hand side of equation [4] above, this equation is unchanged. Doing so yields the following formula

$$\text{trend (Revenues/Customer)}^{\text{Industry}} = trend\ \text{CPI} - \left[\begin{pmatrix} \text{trend Customers}^{\text{Industry}} \\ -trend\ \text{Input Quantities}^{\text{Industry}} \end{pmatrix} + (\text{trend CPI} - \text{trend Input Prices}) \right]$$

[5]

Equation [5] is a variant of the typical indexing logic, although it applies to the growth in revenues per customer rather than prices. It can be seen that the growth in revenues per customer decomposes into the growth in CPI inflation minus the expression that appears in brackets, which collectively will comprise the X factor. There are two components of this X factor: the trend growth in customer numbers minus the growth in input quantities; and the trend growth in CPI minus the growth in industry input prices. The latter terms is equivalent to the inflation differential;

the first term is in fact equal to TFP growth, where output growth is measured entirely by the growth in customer numbers.[21]

This result makes sense intuitively. The fundamental rationale for a revenue cap per customer plan is to make utility revenues insensitive to the volumes delivered. If revenues are designed to be insensitive to delivery volumes, it would not be appropriate for the indexing formula to adjust allowed revenues for changes in volumes. But this would in fact take place if the industry TFP trend used in the adjustment formula includes delivery volumes in the computation of industry TFP. Eliminating volumes from the computation of industry TFP trends is therefore consistent with, and ultimately a consequence of, the underlying motivation for a revenue per customer application.

19. If a TFP based methodology was introduced, should it be a requirement for service providers to consent to an application of TFP to determine allowed revenue/prices?

Yes, the ESC believes that any use of a TFP-based regulatory application must be voluntary and take effect entirely through the choice of the service provider. We also believe that giving companies this degree of discretion is broadly consistent with economic theory. Theory shows that overall economic welfare can generally be improved by allowing utilities to select from a menu of well-designed regulatory options.[22]

20. Would a TFP based approach be suitable to determine the revenue path for electricity transmission service providers?

The ESC believes that a TFP-based approach to regulation is suitable for electricity transmission providers, although the benefits (compared with the building block methodology) may be less pronounced than for electricity or gas distribution. In this regard, the ESC believes there are at least three important institutional and technological differences between energy transmission and distribution networks. These differences can be accommodated within the basic TFP-based model that the ESC is recommending, but they may lead the capital investment module to be more important for energy transmission providers.

One difference between distribution and transmission networks is that a key objective for energy transmission infrastructure is to enhance the performance of energy markets. Most of the costs of delivered gas and electricity are associated with the energy commodity that is supplied and traded in competitive markets. Relatively small changes in these commodity prices can therefore have more impact on customer welfare than much larger changes in use of network charges

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[21] In other words, the typical TFP growth formula is trend TFP = trend Output Quantities minus trend Input Quantities. If output quantity is measured entirely by customer numbers, then trend Output Quantities = trend Customers. If this substitution is made into the typical TFP growth formula, it yields equation [5] above.

[22] For example, see Laffont, J. and J. Tirole (1993), *A Theory of Incentives in Procurement and Regulation*, pp. 224-25.

(which account for a smaller share of overall energy costs). Gas and electricity transmission networks integrate diverse energy supply sources and hence play a critical role in facilitating effective energy market competition. In contrast, energy distribution networks primarily deliver services to end-users and have much less impact on the operation of upstream wholesale markets. The broader, integrating role of transmission infrastructure means that transmission investments may lead to higher cost transmission services yet still produce customer benefits by promoting market-wide efficiencies through the more effective operation of wholesale markets. This is less likely to be the case with distribution services, where there is a more direct link between the efficiency of the services provided and the prices paid by end-users. Regulatory frameworks should therefore recognise the unique linkage between transmission networks and energy markets and adopt regulatory methods that encourage efficiency in upstream commodity markets and the provision of transmission services.

Relatedly, the patterns of capital investment typically differ between the transmission and distribution sectors. Electricity and gas transmission investments provide for bulk energy transfers from supply sources to large energy users and distribution points. Such large investments tend to be "lumpier" than energy distribution infrastructure, which is more often added in smaller increments in response to customer and demand growth. Output and investment growth is therefore more stable over time in energy distribution than in energy transmission.

It should also be recognised that there is more diversity in institutional arrangements for Australia's energy transmission networks. Some electricity interconnectors had previously been built on an unregulated, "merchant" basis. Some states (like Victoria) separate power transmission ownership from transmission planning while others do not. In some jurisdictions, any major expansion of transmission facilities must be subject to competitive tenders, while in other States this is not mandatory. Given this diversity in institutional arrangements and differences in the scope of contestability, a one-size-fits-all regulatory approach may not be warranted for gas and electricity transmission.[23]

All of these factors argue in favour of a more cost-based regulatory approach for energy transmission than energy distribution. In particular, more cost-based approaches can accommodate lumpier, more uncertain transmission investments more easily than a TFP-based methodology. All else equal, a period when large, lumpy investments are made will be one where input quantity growth expands rapidly and TFP growth (equal to the difference between output and input quantity growth) accordingly declines. By the same token, a period where investments are either not necessary or are not undertaken is more likely to register relatively rapid TFP growth. The lumpiness of investment is therefore likely to make TFP trends in

[23] Recent experience on electricity transmission in the US lends support to this view. In the last several years, the FERC and federal policymakers have struggled with alternative structural models for US transmission services, including several attempts (eventually abandoned entirely) at imposing a "standard market design." The FERC has also been interested in performance-based regulation for electricity transmission, but regulatory reform proposals have been stymied by more fundamental structural uncertainties regarding transmission services.

the electricity and gas transmission industries less stable than for either power or gas distribution. This could limit the appeal of such an approach in these industries compared with regulatory alternatives that are more tied to the costs of the enterprises themselves.

But while a more generally cost-based option may be appropriate for transmission services, the ESC believes that alternatives to the forward-looking building block model may be appropriate and deserve consideration. For example, prices could be adjusted only after investments have been put in place. This is equivalent to setting prices using observed, backward looking historical cost information rather than speculative, forward-looking projected costs as in the building block approach. Relying on observed costs would minimise the gaming incentives that are inherent in the forward-looking approach, which may lead to more stable prices and thus greater long-term benefit for customers.

Basing price changes only on observed capital investment can be accommodated through a TFP-based approach with a capital investment module. This is, in fact, the model for TFP-based regulation that the ESC is recommending for all energy networks in Australia. We therefore believe this basic framework is valid for transmission service providers, and it will create many of the same incentives and benefits that are detailed elsewhere in this submission. However, given the differences in investment patterns, it may be expected that transmission service providers will need to avail themselves of the capital investment module (e.g. for major transmission augmentations) more frequently than distribution service providers.

21. If a TFP based methodology was to be introduced, should it be applied in electricity distribution determinations? Are there such significant differences in the DNSPs across the jurisdictions that classifying the sector as a single industry would be difficult or inappropriate?

Yes. The ESC believes that a TFP-based methodology can potentially lead to significant benefits in electricity distribution determinations. As discussed, we believe that investment patterns for electricity distributors tend to be fairly smooth over time, in contrast to transmission networks. However, in the rare cases where distributors may experience a "bow wave" of investment spending, our TFP-based methodology includes a capital investment module to accommodate a surge in such expenditures. We also do not believe differences in business conditions among distribution service providers would make classifying the sector as a single industry either difficult or inappropriate. As discussed, empirical evidence suggests that these differences do not lead to substantial differences in TFP growth rates as opposed to TFP levels. Any "levels" differences are logically dealt with when setting, and updating, the prices that prevail at the outset of a TFP-based regime.

22. Would a TFP based approach be suitable for determining the price path for gas transmission pipeline service providers?

The analysis for gas transmission pipeline service providers is largely parallel to that for electricity transmission networks. In both cases, the ESC believes that a TFP-based approach to regulation is suitable, although the benefits (compared with the building block methodology) may be less pronounced than for electricity or gas distribution. There are at least three important institutional and technological differences between energy transmission and distribution networks. These differences can be accommodated within the basic TFP-based model that the ESC is recommending, but they may lead the capital investment module to be more important for gas transmission providers than for distribution providers.

23. Can a TFP based methodology be applied to the gas distribution sector? Are there such significant differences in the gas distribution systems across the jurisdictions to make classifying the sector as a single industry inappropriate?

Yes. The ESC believes that a TFP-based methodology can potentially lead to significant benefits in gas distribution determinations. We believe that investment patterns for gas distributors tend to be fairly smooth over time, in contrast to transmission networks. However, in the rare cases where distributors may experience a rapid surge in investment spending *(e.g.* bushfire reconstruction); the ESC's TFP-based methodology includes a capital investment module to accommodate a surge in such expenditures. We also do not believe differences in business conditions among distribution service providers would make classifying the sector as a single industry either difficult or inappropriate. As discussed, empirical evidence suggests that these differences do not lead to substantial differences in TFP growth rates as opposed to TFP levels. Any "levels" differences are logically dealt with when setting, and updating, the prices that prevail at the outset of a TFP-based regime.

24. What would be the ability of a TFP based methodology to address any perceived problems with the current applications of the building block approach?

Before addressing the relative merits of the TFP-based option, the ESC would note that building block methods have yielded some benefits in Victoria and elsewhere in Australia. Some incentive mechanisms incorporated into the approach have reduced regulators' informational disadvantages. Regulators have also been able to strike an appropriate balance between the legitimate commercial interests of infrastructure operators (in maintaining financially viable operations and having the capacity and incentive to undertake long-term investment) and the legitimate interests of users of infrastructure services in receiving reliable service at efficient prices.

The building block approach has also increased regulators' understanding of the underlying cost and demand conditions of the businesses they regulate. This understanding has emerged from the detailed and systematic analyses of company information inherent in building block methods. In Victoria, the ESC has also developed confidence that past applications of building blocks have yielded prices that are an appropriate start point for TFP-based regulation. Building block regulation has therefore been an important precursor to the Rule Change application since it led to generally cost-based prices that can now serve as an appropriate "cast off" point for a TFP-based alternative.

A related benefit of building block regulation is that it has been instrumental in enhancing the institutional capabilities of Australia's regulatory agencies. Human capital is inevitably developed as regulatory staff assimilate the detailed cost and company information that are provided and processed in building block reviews. Building block regulation has therefore played an important role in developing informed and capable regulators throughout Australia.

However, while building block regulation has been generally effective in the past, the ESC believes this approach also has significant deficiencies, and many of these flaws are at least partly mitigated under a TFP-based regulatory approach. One important issue is that information asymmetries remain pronounced under the building blocks methodology. Even if the efficiency of past expenditures is "revealed," the method still requires forecasts of efficient capital and operating expenditures during the price control period. Projecting future costs is an information-intensive and inherently uncertain process that is fraught with risk. On the one hand, there is the risk of overcompensating regulated businesses, thereby leading to excessive prices and profits, distorted infrastructure investment and misallocated resources in upstream and downstream markets. On the other hand, there is a risk of providing inadequate prices and revenues for regulated businesses, undermining their financial viability and incentive and capacity to invest. The potential risk of overcompensation is exacerbated by the fact that firms clearly have incentives to "game" the cost forecasts that are used to determine their forward-looking revenues. The information asymmetry between regulators and regulated firms may make it especially difficult for regulators to detect such gaming.

The ESC's views about the future viability of the building block model have been influenced significantly by the electricity distribution price review (EDPR) it conducted in 2004-05 and the gas access arrangement review (GAAR) conducted in 2007-08. We believe the EDPR in particular was a watershed event that exposed many of the fundamental challenges that regulators will face with continued applications of building block regulation. Because many of the issues the ESC encountered in the EDPR are likely to be a harbinger of regulatory trends throughout Australia, it is worth reviewing some of these challenges in some detail.

Information Availability and Accuracy

One basis problem is that the ESC experienced difficulties simply in obtaining the information needed to assess the costs of providing distribution services. In some instances companies responded to information requests with delays, while in other cases information was withheld entirely. In one instance, a distributor refused to

provide information voluntarily on the costs of a service provider, and the ESC was forced to issue notices under Section 37 of the *Essential Services Act 2001*. Before the Determination was even finalised, these notices were appealed on the grounds that they were unreasonable and not made in accordance with the law. The Appeal Panel upheld the appeal in part, on the grounds that the service provider did not have a sufficiently long period of time to comply with the requests. This was in spite of the fact that the ESC had sought the information for months before resorting to its Section 37 authority.[24]

Even when information was provided, the ESC found that it was necessary to undertake an extensive process of adjusting distributors' reported costs so that they were consistent with the "regulated by price cap" (RBPC) services that were subject to CPI-X controls. Simply identifying what was in RBPC cost base therefore proved to be a challenge that required line by line scrutiny of distributor cost estimates, since many of these were found to overstate actual costs by a significant amount. Adjustments were also necessary to control for "step changes," or changes in distributor functions that were expected to take place over the term of the next controls. The magnitude of some of these step changes to costs were controversial and subsequently appealed.

In the most recent GAAR, initial attempts to seek costs incurred by business affiliates through regulatory reporting guidelines were challenged in the Supreme Court by both the licensee and business affiliate. Subsequent efforts to seek cost information directly from the business affiliate were time consuming and litigious and, when the information was finally provided, it did not comply with the regulatory reporting guidelines.

Changes in Corporate and Business Relationships

There has been a considerable amount of mergers and acquisition activity among Australia's network industries including substantial financial restructuring and outsourcing. Some corporate parents now own multiple energy utilities in Australia. Other mergers have led to re-integration among previously unbundled firms. Energy networks are also increasingly involved in other network industries such as telecoms. In addition, some utility-affiliated service vendors are providing "back office" and support services to multiple clients in different regulatory jurisdictions.

All of these trends exacerbate the basic cost identification problem described above. Vertical and horizontal mergers potentially allow companies to obfuscate and/or distort the reported costs of their regulated services through transfer pricing and cost allocation policies. Companies can also engage in "jurisdiction-shopping" in an effort to allocate costs differently across States or regulated services, depending on the timing of price reviews. Companies serving multiple jurisdictions can also "double count" some of their common costs, so that the same costs

[24] Although the Appeal highlighted aspects of the law which require clarifications, and some procedural improvements which must be made in relation to the issue of section 37 notices, the Appeal Panel clearly accepted that the Commission could serve such a notice on parties other than regulated distributors and that the Commission did have the power to obtain the details of industry costs from subcontractors.

recovered in a price determination in one jurisdiction are also recovered in another jurisdiction.

These challenges can be perhaps be clarified through two examples that arose in the 2004-05 EDPR. One issue was "management fees" paid for executive management services provided by corporate parents. It is difficult for any regulator to determine whether such payments reflect profit transfers or legitimate costs or, more generally, the percentage of such payments that represent legitimate costs and the fraction that is an implicit transfer of profits.

Some distributors have also entered into outsourcing arrangements with related corporate parties without simultaneously considering bids from other service vendors. These outsourcing contracts are not necessarily "arms length" arrangements. Companies serving both regulated and competitive markets have inherent incentive to shift reported costs towards regulated networks and away from competitive operations (or alternatively, to shift reported revenues to competitive operations and away from networks), and the terms of contracts between related corporate parties gives companies greater opportunity to act on those incentives.

These corporate and restructuring arrangements create serious regulatory challenges. One difficulty is that the incentives to shift costs undercut the presumption that the costs that result under a high-powered regulatory regime are "revealed" to be efficient. Since the earliest applications of building block regulation in the UK, one of the tenets of this approach was that CPI-X regulation creates strong cost-cutting incentives, and firms benefit financially by pursuing cost reductions earlier rather than later. Accordingly, it was expected that at the end of a CPI-X plan, firms' profit-maximising behaviour would lead to costs that reflected the sum of their cost reduction efforts and were therefore efficient. These efficient costs would form the starting point for the next price controls, thereby passing achieved efficiencies onto customers in the form of price reductions. However, this expectation will be frustrated if cost allocation and transfer pricing policies distort the amount of cost reductions that utilities report and hence pass on as price reductions. Firms' ability to manipulate their reported costs therefore tends to undermine a fundamental premise of how the building block model is supposed to operate and generate customer benefit. The ability to distort reported costs is easy to do with the complex financial structures that are permitted within the Australian regulatory laws. Stronger powers to obtain "actual costs" or issue guidelines cannot overcome this fundamental weakness.

Concern with the accuracy of firms' reported cost can also compel regulators to rely on alternative cost measures. In fact, the ESC was forced to develop such cost proxies in place of the non-market tested outsourcing costs discussed above. The ESC relied on the distributors' cost out-turns as the basis for determining relevant costs over the period covered by the outsourcing contract. This approach was controversial and eventually appealed by the business. While the Appeal Panel agreed that the ESC's approach was reasonable given the lack of direct cost data from the company, the ESC acknowledges that any use of proxy data in a building block application is necessarily a substitute for the data that are theoretically required *i.e.* the company's costs themselves. However, the necessity for such proxies will arise in building block models and, indeed, all forms of

monopoly regulation that link prices to business-specific costs, because of the incentives for firms entering into such arrangements to inflate their reported costs. Firms' ability to engage in such manipulations is enhanced by the merger, acquisition and corporate restructuring trends that are taking place among Australia's energy networks.

Regulator Judgments on Forecasts and Efficiency

The heart of a building block price review is assessing the reasonableness of companies' cost and demand forecasts over the term of the price control period. Companies clearly have incentives to game these projections by overstating expected cost increases while understating the expected growth in output. The regulator must accordingly "de-game" firms' unit cost projections and determine the "truth" about the level of efficient costs and how they are likely to change. This process raises a host of challenges, beyond the initial difficulty of determining whether costs reported at the outset of the controls are reasonable.

Evaluating the efficiency of a firm's operating expenditures (opex) and capital expenditures (capex) is an inherently difficult and uncertain exercise, especially on a projected basis. Regulators know much less than company managers about a utility's expected changes in costs and demand. Evaluating opex and capex forecasts therefore necessarily exposes regulators to the information asymmetry problem. This is a fundamental deficiency of the building block model, because incentive regulation is designed to overcome the information asymmetries that exist under cost of service regulation and encourage firms to use their superior information in socially beneficial manner. The importance of cost forecasts in building block regulation can create ways for firms to circumvent this objective and exploit their information asymmetries in other ways.

One straightforward way to avoid the difficulties of evaluating opex and (particularly) capex projections is essentially to accept companies' cost forecasts. However, because companies have incentives to inflate these forecasts, doing so is likely to lead to price changes that exceed the actual change in companies' unit costs over the term of the price controls. Simply accepting forecasts will therefore reduce expected customer welfare. It will also effectively reward companies' gaming, thereby encouraging such inefficient behaviour in the future.

Some of the research sponsored by the ESC on alternative forms of regulation sheds light on these important issues. As previously discussed, PEG developed an "incentive power" model which investigated the outcome of regulatory scenarios where firms are in a position to game their cost forecasts. PEG's model shows that, under a building block model that is specifically designed to replicate the outcome of Victoria's EDPR in 1999-2000, "customer benefits are *lower* than they would be under "pure" cost of service regulation....Customer benefits are lower under Victoria's building block model because company projections of cost increases exceed actual company costs by a wide margin. If a sufficiently large share of this difference between projected and actual costs is allowed in distribution prices, customers can become worse off than under (pure) cost of service regulation where prices are based on, and cannot exceed, observed past

costs."[25] This is a sobering conclusion, since Building Block regulation is clearly designed to improve on the outcomes that would be expected under traditional cost of service regulation.

In principle, regulators can rely on benchmarking studies to overcome information asymmetries and determine efficient opex and capex. However, any benchmarking study involves serious challenges that often reduce the reliability of the results and the extent to which benchmarking models can be used to determine the efficient costs of regulated services. At the most general level, even though benchmarking has been increasingly employed in utility regulation internationally, there is still no consensus among economists or engineers on the best benchmarking methods, or even the proper choices for inputs and outputs to use in benchmarking models. Benchmarking exercises are therefore often contentious and do not lead to clear-cut results that regulators can employ with confidence.[26]

It is also difficult for benchmarking studies to separate cost efficiency from service quality performance. These issues are inextricably linked, yet it has proven very difficult to benchmark cost and quality simultaneously and obtain reliable inferences on a firm's relative cost and quality performance. Because of this limitation, companies can always argue that relatively poor cost performance results from programs they have implemented to improve service reliability and quality. It is difficult for regulators either to verify or reject such claims, since such programs take time to bear fruit and measured quality will fluctuate in any case because of weather and other random factors that are difficult to control for.

In Victoria, the companies have also provided evidence which acknowledges that some benchmarking models significantly overstate their costs. For example, the price-service proposal from SPI Networks in the 2005 EDPR discussed its capex replacement projections relative to those based on a capex engineering model developed by PB Associates. SPI wrote:

> *SPI Networks has determined its future asset replacement forecasts based on the model provided by PB Associates, validated against a zero-based bottom up analysis for selected asset classes derived from condition analysis and historical failure rate data (where available).*
>
> *In undertaking planning for the 2006-2010 submission, SPI Networks has increased the effective economic lives of many of its asset classes to more accurately reflect the knowledge gained by new condition assessment data and a better understanding of failure rates.*

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[25] L. Kaufmann, *Incentive Power and Regulatory Options in Victoria*, May 2005, p. 6.

[26] In the Commission's opinion, this contrasts with the estimation of total factor productivity trends, for which there exists widespread (although not universal) agreement on appropriate measurement methods. Moreover, as we have indicated elsewhere in this submission, we believe many of the debated issues regarding TFP measurement can be resolved by carefully considering the implications of the underlying indexing logic.

Even after these adjustments are considered, detailed comparisons of the bottom up analysis and the PB Associates model show that actual replacement expenditure requirements are less than those forecast by the model by almost 40% across categories where sound historic failure rate data is available. Therefore, SPI Networks has adjusted the PB Associates model forecast down by 40% across all categories to reflect the insights gained from the more detailed bottom up analysis.[27]

Thus by failing to reflect asset condition and service lives accurately, SPI Networks concluded that the PB Power capex projection model overstated its capex requirements by 40%. This is a very significant over-statement that, if left uncorrected, would have resulted in substantially greater price increases for SP AusNet customers. Because ESC staff do not have the same detailed, bottom-up understanding of the SPI network that company employees possess, it would have been difficult for the ESC to arrive at the same forecast as SPAusNet's assessment of its real capital needs if it had only been presented with the results of the PB Associates model. This example demonstrates the limitations of such a benchmarking model, including the fact that it relies on assumptions about asset lives and conditions that may not accurately reflect the manner in which distribution personnel have actually managed their network assets.

For all of the reasons discussed above, it is perhaps not surprising that Australian regulators which, like the ESC, have undertaken two building block reviews have generally placed less emphasis on benchmarking methods in the second review than in the first.

Interaction Between Service Quality Incentive Mechanisms and Building Block Forecasts

In addition to the problems it poses in benchmarking, service quality regulation in the context of a building block model can lead to other regulatory challenges. For example, there may be double counting of quality expenditures that are devoted towards improving reliability and quality: once directly in the calculation of building block revenues; a second time in the rewards a company earns under a service quality incentive (SQI) plan when quality actually improves. In the 2005 EDPR, the Commission has attempted to avoid this problem by not allowing expenditures designed to improve reliability and quality to be included in the determination of building block revenues. However, after controls are set, companies have an incentive to report quality-related capital expenditures as motivated by purposes other than reliability improvement. Doing so will tend to support high capex growth forecasts in the future. It may be difficult for the Commission to monitor each distributor's capex and accurately segregate expenditures related to reliability improvement from other types of capex.

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[27] SPI Networks, *Electricity Distribution Price Review 2006 Price-Service Proposals for the Period 2006-2010*, 21 October 2004, pp. 78-79.

Integrating service quality incentives with building block regulation can also impose administrative burdens. For example, regulation in Victoria includes a detailed mathematical formula for determining service quality rewards or penalties and integrating these adjustments with the price control formula. Complications stem from the need to eliminate double-counting of rewards and/or penalties and to modify rewards and penalties when quality-related capex have depreciated and are no longer reflected in the adjustment formula. The complicated nature of SQIs under building blocks may create confusing incentives for managers and potentially lead to unintended outcomes.

Regulatory Depreciation and Over-recovery of Capital Costs

Another issue in building block regulation is the relationship between regulatory depreciation and the recovery of capital costs. Historically regulators in Victoria and other Australian States have taken a "hands off" approach to this issue. Their rationale was that regulatory depreciation did not affect the net present value (NPV) of a firm's forward looking costs but only its timing *i.e.* while a firm could increase revenues now by increasing regulatory depreciation, doing so would also reduce the company's rate base and therefore its rates in the future. In theory, the NPV of increasing current revenues through higher depreciation rates is exactly offset by the NPV decline in future revenues due to "cannibalising" the company's rate base.

However, successive applications of this approach are now raising concerns about its impact on future prices. A hands off policy may accentuate a company's incentives to exaggerate its depreciation rates *and* its future capex requirements in an effort to prevent rate base "cannibalisation." Greater regulatory depreciation does tend to reduce companies' future rate base, but under the building block model firms are able to offset this cannibalisation by forecasting capex growth and rolling these projected expenditures into current rates. Such gaming behaviour leads directly to price increases. It also puts regulators in the difficult position of having to second guess company capex forecasts and, as cannibalisation occurs, potentially allowing the value of the regulatory asset base (RAB) to consistently decline below its market value.

There is evidence that, in practice, regulators in fact find it difficult to allow the value of a company's RAB to decline too far below market valuations. This was evident in Ofgem's most recent view of distribution prices in the UK. The UK distributors' initial "vesting" assets were assumed to have asset lives of fifteen years. Vesting took place in 1990, so these vesting assets were to be fully depreciated by 2005. The most recent price controls for the UK distribution network operators (DNOs) took effect in 2005, and Ofgem applied some essentially arbitrary price adjustments to prevent the DNOs' RABs from declining. This is demonstrated in the following quotes, which appeared in a section of Ofgem's Final Price Proposals entitled "Depreciation, Asset Lives and Capitalisation."[28]

[28] Office of Gas and Electricity Markets, *Electricity Distribution Price Control Review: Final Proposals*, November 2004, p. 94.

8.10. At the last price control review, some companies would have seen a large reduction in their depreciation allowance as Vesting assets became fully depreciated (the so called depreciation "cliff-face"). An adjustment was made to smooth the depreciation allowance and a similar approach is proposed for this review.

8.11. This adjustment involves switching to a shorter asset life for post-Vesting assets (from 33 to 20 years) once Vesting assets are fully depreciated. In order to ensure companies are neutral to this switch in NPV terms it is also necessary to make an adjustment for the different values implied by the different lives. The difference between asset values using 33 and 20 years is calculated and added to depreciation spread over 15 years in equal instalments. Over the next price control period, most of the DNOs will see Vesting assets fully depreciated, and as this occurs, the smoothing adjustment has been applied….

8.13. In the longer term, it would be reasonable to expect the price control treatment of long-lived assets to more closely approximate to their useful technical or economic lives, for example so that the customers that pay for an asset are those that derive benefit from it. Were it not for the peculiarities of pre-vesting asset lives and the need to maintain broadly stable financial profiles, it seems unlikely that 20 year lives would be optimal. Ofgem will want to review this issue at the next review in the light of these considerations.

While Victoria did not inherit the same "depreciation cliff face," the hands off policy that it has allowed towards regulatory depreciation may be contributing to a similar scenario. Victorian distributors have chosen depreciation rates that are consistent with asset lives of between 15 and 18 years, on average. This rate of depreciation almost certainly understates the economic lives of distribution assets even allowing for the shorter lives of IT assets. Accordingly, these rates of asset regulatory depreciation could lead eventually to either a declining RAB or regulatory price adjustments, similar to those agreed by Ofgem, because of "the need to maintain broadly stable financial profiles."

Efficiency Carry-Over Mechanism Flaws

In the 2000 EDPR, the ESC added an "efficiency carry over mechanism" (ECM) to its price controls. The ECM was designed to create consistent incentives for companies to pursue cost reduction initiatives in all years of the price controls. In the absence of an ECM, companies would have an incentive to forgo cost reductions, and perhaps even raise costs, in the final year of a price control, since costs in the last year of the plan are the base to which CPI-X adjustments are applied. Cost padding at the end of the expiring controls would therefore lead to a greater increase in the dollar of revenue adjustments over the succeeding controls. The ECM theoretically eliminated cost padding incentives by phasing out the difference between allowed (i.e. forecast) and actual costs over a five year period, regardless of the year in which those "efficiency" gains were achieved. Separate ECM calculations applied to opex and capex during the term of the 2001-2005 controls.

In practice, implementing an effective ECM in Victoria has proved to be challenging. One issue is that the carry-over amounts are inherently sensitive to how opex and capex are defined. The Victorian businesses employed different approaches towards capitalising and expensing costs and different cost allocation policies, and this inevitably affected the magnitudes for the carry-overs. Several distributors objected to the ECM calculations developed in the 2000 EDPR and appealed the calculation. An amended version of the ECM was included in an updated Price Determination following the appeal.

The ESC has also concluded that ECMs further accentuate companies' incentives to game their cost forecasts. The calculation of "efficiency" carry overs depends directly on the amount of allowed capex and opex. Companies therefore gain by increasing their cost forecasts and hoping these inflated projections are built into the ECM. The calculation of efficiencies under the ECM also potentially conflates gaming (which raises forecast and allowed costs) with true realised efficiencies (reflected in actual costs).[29] In practice, the ESC found that it was particularly difficult to distinguish the impact of gaming from true realised efficiencies in the capex mechanism.[30] The 2005 EDPR therefore eliminated the ECM for capex, so in the current price controls the ECM applies only to opex.

Given these and related challenges, and notwithstanding its value to date, the ESC has serious reservations about the relying exclusively on the building block model for energy regulation in Australia. One fundamental concern is that building blocks expose regulators to the information asymmetry problem that incentive regulation is designed to overcome. Modifications of the building block approach that are designed to address its deficiencies (like the ECM) can also exacerbate the gaming and information asymmetry problems inherent in the model. Consolidation, restructuring and other developments on the horizon for Australia's network industries will also make it increasingly difficult for regulators to obtain accurate information on company costs which are, literally, the "building blocks" of the approach. The ESC does not believe that all these challenges can be overcome by allowing a TFP-based regulatory option. Nevertheless, we believe that many of these challenges become less problematic under TFP-based regulation.

Compared with building block regulation, there are a number of potential advantages with using a TFP-based methodology for setting X factors. One is that the X factor is calibrated on the basis of industry TFP trends and not a company's own expected costs. Industry performance measures are distinct from and "external" to the performance of any individual firm. Setting the terms of indexing plans on the basis of industry TFP measures is therefore a more high-powered form of regulation that creates stronger performance incentives since it creates less of a link between a regulated firm's own costs and its allowed prices. The economic literature clearly indicates that the strength of incentives, and associated

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[29] This assumes, of course, that "actual" costs can in fact be accurately determined using reported data. For all the reasons previously discussed, this assumption cannot be taken for granted, and regulators face real challenges in identifying and measuring actual costs.

[30] One reason is that operating expenditures tend to be more consistent from year to year, while there is more variability in capital projects that are pursued in a given year.

"power" of a regulatory regime, depends on the extent to which prices and costs are de-linked.[31]

TFP-based regulation can simultaneously enhance performance incentives and reduce regulatory cost. Because TFP-based prices are set using external data, unit cost reductions do not decrease allowed rate escalation but go straight to the bottom line. This creates optimal incentives to control costs.

TFP-based regulation may further enhance performance by allowing many operating restrictions to be relaxed. When utility revenues are based on external indexes rather the company's own costs, prices of monopoly services can be insulated from the company's involvement in competitive markets. This reduces concerns about cross subsidies and the impact of uncertain competitive market initiatives on core customer tariffs.

TFP-based regulation also reduces, but does not eliminate, regulatory concerns with other cost reporting issues and outsourcing initiatives that may take place between utilities and related parties. The ESC believes that regulatory concerns with utility's cost allocation policies can never be eliminated entirely. Nevertheless, utilities clearly have more ability and stronger incentives to manipulate costs and thereby raise prices under a building block (level approach) than a TFP-based (trend approach) to regulation. Under building blocks, there is a direct link between the utility's allocated costs and its prices. The utility therefore has a very strong incentive to allocate more costs to its regulated operations. A TFP-based approach breaks this direct link, so a company can at most affect its own prices indirectly i.e. cost allocations will affect the company's own prices only to the extent that these higher costs reduce the industry TFP trend.

It can be argued that the companies can still reduce the industry TFP trend by colluding to raise cost via cost allocation and transfer pricing policies. While this may be true in theory, such a strategy would be costly. Companies would incur coordination costs such as agreeing on a cost allocation policy and policing the companies to make sure everyone that follows that policy. These costs would naturally increase as the definition of the industry was expanded and more companies' costs were used to calculate industry TFP trends. Companies would also be penalised if their collusive behavior was discovered. This is, in effect, a price fixing agreement and would be illegal. These are likely to be strong deterrents that would diminish the attractiveness of cost collusion strategies.

Cost collusion would also be less effective under TFP-based regulation than a building blocks approach. The reason is that building blocks link cost levels to price levels, while under TFP-based regulation (after initial prices are set) price updates are based on industry TFP trends. Firms could therefore affect the industry TFP trend only by ongoing changes in industry-wide cost allocations; the impact of a single cost re-allocation will have a muted impact on the measured TFP trend unless it is repeated continually. The ESC has provided a simple mathematical demonstration of the different impact that cost reallocations have on

[31] For example, see J. Laffont and J. Tirole (1998), *A Theory of Incentives and Procurement*, MIT Press, Cambridge, MA.

price under cost-based (i.e. building block) regulation and TFP-based regulation which is available at our website.[32] Continual changes in cost allocations and transfer prices during the regulatory period would also be harder to maintain, and would be easier for regulators to detect, than the one-time mass of such reallocations that a regulator may be required to unravel in a building block review.

TFP-based regulation can also have a beneficial effect on regulatory cost. The cost and contentiousness of regulatory reviews under a TFP-based approach are likely to be lower than under a building block approach. Unlike the building block method, X factor updates can focus on industry TFP and input price trends rather than detailed examinations of company costs (past and forecast). Focusing on a smaller set of empirical parameters in X factor updates may reduce the potential for regulatory "error" that can unfairly disadvantage either customers or companies. This sharpened focus can reduce the costs of price determinations themselves, as well as diminish the prospect of costly appeals of determinations to Panels established to decide whether regulators have made material errors of fact.

TFP-based regulation is also likely to be easier to administer for Australia's rapidly changing networks than building block approaches. As discussed, because of the ongoing consolidation and restructuring of network industries, one of the greatest challenges facing regulators will simply be to identify and obtain accurate measures of each firm's costs of providing regulated services. Some of these difficulties will be reduced by the TFP-based alternative's focus on industry as opposed to company-specific measures. For example, consolidation among companies will not affect industry-wide cost measures but can distort the reported costs of the individual, transacting firms.

TFP-based regulation may also reduce the potential for firms to benefit from their superior information. Detailed cost reviews expose regulators to the same information asymmetries that are the heart of problems with traditional, US cost of service regulation.[33] These information asymmetries may be especially pronounced under the building block approach since prices are set using information on a company's past cost performance and, more importantly, its expected growth in costs. As discussed, evaluating cost forecasts, particularly for capex, is an inherently difficult and uncertain exercise. Regulators' challenge in evaluating whether future cost projections are inflated is exacerbated by the fact that they know much less than company managers about the underlying utility business and its outlook for demand, cost and technological growth.

These concerns are mitigated under TFP-based regulation. Unlike the building block method, utilities have little ability to "game" their prices under a pure productivity-based approach. The reason is the X factor is based on industry data that are entirely outside of the utility itself and therefore not under its control.

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[32] Essential Services Commission, *Cost Reporting and Cost Allocation – Implications for Regulation*, April 2006 Information Paper.

[33] These information asymmetries may be even greater in Australia than in the US because there is no equivalent of the Public Utilities Holding Company Act (PUHCA) in Australia, which gives US state regulators greater access to data at the Holding Company level.

TFP-based regulation can also be more effective than building blocks in encouraging companies to pursue dynamic and allocative efficiencies. Unlike cost-based approaches, utilities under a TFP-based regime are not effectively rewarded for building rate base but, rather, will generally benefit by reducing their capital expenditures. This should create more balanced incentives and encourage cost effective methods of reducing capex. It should also reduce the disincentives that distributors have to pursue initiatives related to demand management and distributed generation.

In general, the ESC believes policymakers should place more emphasis on the goals of dynamic and allocative efficiency and less on the aim of productive efficiency. The ESC believes that most available gains in productive efficiency have already been realised in Victoria (*i.e.* most of the accumulated inefficiencies prior to privatisation or corporatisation have been eliminated) and arguably reflected in regulated service prices. However, distributors have devoted far less attention either to pricing their services efficiently or towards more innovative investment behaviour. The ESC believes that distributors can play a greater role in these and related areas, thereby enhancing the dynamism of the energy sector and providing greater benefits to energy service consumers. Our view is consistent with the original motivations of the Hilmer report, subsequently echoed by Parer in his review of Australia's energy markets. Because it is potentially more light handed and creates stronger performance incentives, the ESC believes that the objectives of dynamic and allocative efficiency will be promoted more effectively by TFP-based regulation than the building block approach. Indeed, one of the reasons the ESC supports a TFP-based option is that it believes this approach is more compatible with the regulatory objectives that should receive greater priority throughout Australia.

In theory, there are also some disadvantages with productivity-based regulation. One is that delinking prices and costs creates greater business risk. Companies are more at risk for changes in supply or demand conditions that affect their unit costs, since these changes will only be reflected in their allowed prices to the extent that they are reflected in industry-wide input price or TFP measures. One example of a company-specific risk that may not be reflected in productivity-based price trends is a capital replacement profile that differs substantially from capital replacement trends throughout the industry. If a given company actually faces the long argued "bow wave" of capital replacement in coming years but the industry as a whole does not, that company may be at risk for not recovering its capital replacement costs under a "pure" TFP-based regime.

In the ESC's opinion, however, these risks are not likely to be significant. Differences in capital requirements and other business conditions across companies is almost entirely a "start point" issue that can be dealt with when setting initial prices before index-based price changes are applied. In our experience, distribution networks exhibit more stability in cost out-turns than is sometimes imagined. Relatedly, we believe that any approaching "bow wave" of replacement capex is likely to be an industry-wide phenomenon rather than something that affects only a small number of individual companies. An industry-wide bow wave would be reflected in a slower, industry TFP trend, which would automatically compensate companies for this investment. In any event, the ESC's

preferred TFP-based model also includes an optional capital investment module for the rare distributor that does face significant capital investment pressures.

25. Under a TFP based approach, what would be the impact on the incentives to make efficiency improvements and make efficient investments?

As the previous response indicates, the ESC believes that utility incentives to make efficiency improvements and efficient investments are very strong under TFP-based regulation, and generally stronger than under than the alternative building block model. We also believe that encouraging efficient investments is especially important in the current environment, which is responding to the imperatives of climate change. Addressing these challenges requires an industry structure that is flexible and able to respond quickly to new and uncertain developments. One of our concerns with exclusive reliance on a building block model is that it may not encourage energy networks to make their full potential contribution in addressing broader energy market objectives.

In this regard, it should be recognised that energy policy in Australia has shifted somewhat from the supply side of the energy services marketplace (*i.e.* maximising the efficiency with which energy is produced, traded and delivered) to enhancing efficiency on the energy *demand* side. More emphasis is now being placed on promoting efficient energy consumption and making energy usage more responsive to price signals. These efforts are prompted in large part by concerns over greenhouse gas emissions (GHG), which have also led to a new generation of "supply side" initiatives designed to develop less carbon-intensive fuel sources and applications.

Many such policy initiatives are currently underway. In Victoria, prominent examples include the proposed Victorian Energy Efficiency Target (VEET), a certificate-based approach for stimulating investment in a broad range of energy efficiency technologies that will reduce GHG, and various Renewable Energy Target schemes which mandate that renewables account for a proportion of electricity. New South Wales has also taken a leadership role on these issues, with efforts including a Greenhouse Gas Reduction Scheme in place since 2003 and a Climate Change Fund providing subsidies to consumers to retrofit and/or replace old appliances and to develop renewable energy pilot demonstration projects for solar, geothermal and other new technologies.

Many of these initiatives have significant merit, but it is notable that less attention has been paid to the role that energy networks can play in contributing to energy market solutions.[34] Policy efforts across Australia overwhelmingly focus on either energy producers or consumers, with subsidies or higher mandated standards as the preferred policy instruments. This approach to policy implicitly (and no doubt unintentionally) views energy delivery systems as inert links in the energy supply

[34] To the extent that policy makers have considered this issue it has been in the context of identifying potential barriers. This was examined by NERA in its report commissioned by the MCE on network incentives for distributed generation and demand side response.

chain. Policymakers appear to assume that networks should provide the infrastructure necessary to connect energy producers with consumers but otherwise have little role to play in achieving broader energy market objectives.

This view fails to appreciate networks' potential contribution to policy objectives in both upstream and downstream markets. If they are properly motivated, networks can help the entire energy value chain respond to new policy demands. Moreover, energy networks can make these contributions without receiving either direct or indirect subsidies from the public. We believe that TFP-based regulation can promote broader public-policy goals by encouraging behaviour that rewards networks for taking risks, investing in non-network solutions and thereby promoting broader energy market goals.

Like traditional cost of service regulation, the ESC believes that building block regulation does not create strong incentives for dynamic or longer-run cost efficiency. One important reason is that both regulatory systems link returns directly to the RAB, or the value of capital assets used to provide regulated services. Particularly as cost-based regulatory systems become more mature, networks therefore have little incentive to reduce capital expenditures and, indeed, are rewarded when RAB increases. In such an environment, networks have little to gain and much to lose from any actions that reduce RAB, such as effective demand response, appropriate DG investments, or other actions that defer or reduce the need for network capital expenditures.

The need to determine "regulated" asset bases and operating costs can also raise cost allocation issues, particularly if networks are providing both regulated and non-regulated services. Costs of inputs that are used to provide regulated and non-regulated services must be allocated in some way. Such allocations are inherently arbitrary and usually controversial, since network managers have incentives to allocate the largest possible share to the regulated business. New and competitive market opportunities can also be pursued through unregulated affiliates, but this can create new controversies surrounding the pricing of utility-affiliate transactions.

Regulators are also likely to face more difficulties in evaluating the appropriateness of network capital investments as wind and micro renewable generation investments proliferate. Advanced metering infrastructure (AMI) can be critical for helping networks manage their operations under these circumstances, but there is considerable uncertainty about technologies and what types of investments are most appropriate in a given instance. Under building block regulation, the burden ultimately falls on regulators for determining efficient investment levels, and this task will become more complex as renewable and distributed generation becomes more common. The information asymmetry problem and associated potential for gaming may become even more pronounced in the future under cost-based regulation.

In the present context, one particularly negative consequence of building block regulation is that it can prevent networks from integrating efficiently or, more generally, offering the full range of services that can benefit both shareholders and customers. Consider the case of a distributor owning and operating a distributed generation (DG) unit. DG can be used to enhance the stability of network

operations, reduce the need for network investments and, of course, generate and sell energy to end users. However, networks have financial incentives to forgo DG investments whenever they reduce the network's overall regulated asset base. A DG investment would in fact reduce the RAB whenever the incremental cost of the DG investment was less than the incremental cost of network expansions – yet this is exactly the condition that needs to be satisfied for DG to be a more cost effective and efficient solution for meeting infrastructure needs. In addition, under building block regulation, cost allocation issues will arise when the DG unit is used to support regulated operations and sell energy in non-regulated markets. The network is also unlikely to capture all the benefits of DG energy sales in related markets; especially since a "regulated" asset was used to provide competitive services, the network may have to pass some of DG sales revenues through to regulated customers in the form of lower network charges. For all these reasons, building block regulation creates inherent incentives for networks to forgo DG investments when these investments are more economical than network expansions. A failure to invest efficiently in DG would also lead to the loss of the auxiliary energy efficiency and conservation benefits that potentially result from DG technologies.

These perverse incentives can be further "locked in" as utility financial structures and corporate cultures adapt to the incentives created by the building block model. Since building blocks tend to discourage dynamic efficiency and prudent risk taking (*e.g.* through sensible vertical integration), capital markets will over time inevitably establish highly geared (*i.e.* leveraged through debt), risk-averse business models and management styles. An example might be a privatised enterprise where retail is separated from distribution operations, with the remaining network financed largely through bonds and the residual equity marketed as a low risk stock to retail "mum and dad" investors. By having little equity, the network business is relatively capital constrained and thereby lacks the resources and flexibility to pursue somewhat riskier investments, such as distributed generation, which can have important spill over benefits for the broader marketplace.

This can be contrasted with the experience immediately after privatisation in Victoria where various networks (at that time integrated with retailing operations) pursued a variety of ventures that leveraged company expertise and assets into competitive market applications. Examples included advising customers on efficient lighting applications, providing HVAC maintenance and installation, energy service company operations, developing private networks, and participating in cogeneration, geothermal heating and cooling projects. These efforts required equity and were generally successful, but they were largely abandoned after the regime increasingly took on cost-based characteristics. Capital markets concluded that returns would be driven more directly by the regulatory asset values and WACCs approved by regulators. A different regulatory approach may have encouraged the businesses to remain more integrated and active across a range of businesses in the broader energy marketplace, which in turn could contribute to enhanced energy efficiency across the entire value chain on both the supply and demand sides of the marketplace.

TFP-based regulation can promote these goals by allowing some operating restrictions to be relaxed. This is especially true of marketing flexibility and operations in competitive markets. When utility revenues are based on external

indexes rather the company's own costs, prices of monopoly services can be insulated from the company's involvement in competitive markets. This reduces, but doesn't eliminate, concerns about cross subsidies and the impact of uncertain competitive market initiatives on core customer tariffs. Networks will always try to find ways to mask their efficient cost levels in order to reduce the extent to which their own costs are reflected in lower prices or lead to more efficiency gains transferred to customers. But while this incentive never goes away entirely, it is greatly diminished under TFP-based regulation. The reason is that under building blocks regulation, there is a direct link between a company's costs and its prices. This link is broken under the TFP-based alternative, and the way a company reports its costs (e.g. through changes in the allocation of overhead costs or transfer pricing arrangements) will affect the company's own prices only to the extent that its own costs affect the industry TFP trend. Under TFP-based regulation, networks cannot affect their prices to the same extent as under building block regulation unless the cost reallocations take place repeatedly, which would make them easier for regulators to detect. Thus while the regulator must still be vigilant about how networks use their assets in competitive markets, their job should become easier under TFP-based regulation because it reduces networks' ability to profit from cost misallocations.

The combination of stronger performance incentives and reduced regulatory costs can have a salutary effect on utility management and corporate cultures. Managers are likely to be more effective as attention shifts towards the marketplace from the regulatory process. Stronger incentives to perform may also develop skills that can facilitate expansion of the utility business via mergers and acquisitions and successful involvement in other markets.

All of these features become more important when competitive pressures increase. Competitive environments require companies to react quickly and nimbly to unexpected developments. In energy markets, these developments include commercial opportunities and public demands for networks to promote conservation and energy efficiency. By mitigating concerns with cost allocations and reducing regulatory cost, TFP-based regulation can allow energy networks to be more active – and successful - in a broader array of energy markets.

Networks will also be far more motivated to pursue competitive market ventures under TFP-based regulation than building block regulation. Because allowed prices do not depend directly on allocated cost or revenues, networks have strong incentives to use their assets and expertise to generate revenues in related markets. Accordingly, TFP-based regulation can be instrumental for facilitating efficient diversification and integration of activities across the energy value chain.

Returning to the DG example considered earlier, networks under TFP-based regulation will evaluate DG versus network investments on the basis of relative incremental costs and revenues (including the extra revenues the network can earn from selling DG energy in related markets) rather than their impact on RAB. Networks would select DG investments when they are more cost effective in meeting investment needs and providing new sources of revenues, as would a firm operating in a competitive market. Efficient DG investments would also be likely to have a range of positive spillover benefits for the broader energy marketplace.

The ESC therefore believes that energy networks can make a significant contribution towards achieving broader public policy goals to increase demand-side efficiency and reduce GHG emissions. Efficient investments in AMI will impact the effectiveness of demand response and customer willingness to invest in demand side management programs. AMI can be important for optimising distribution assets and reducing the amount of energy that is produced but lost during transmission and distribution to consumers. Networks can also be important players in the DG marketplace, since DG offers a range of potential benefits to network operations as well as broader energy policy goals. Efficient investment in AMI, demand response and DG are all critical for reducing peak demands and deferring investments in power generation, transmission and distribution infrastructure which, in turn, increases the probability that cleaner technologies will become available to satisfy infrastructure needs. Efficient investments in AMI and similar areas are more likely if these result from market-related incentives where agents (including energy networks) bear the risks but also reap the benefits from their actions. Australia's regulatory regime has inadvertently discouraged this behaviour, which has compelled governments to intervene and mandate investments (such as large scale AMI rollouts) that create widespread benefits but also increasingly shift the risks of bad decisions to customers.

Energy networks can play an important role in promoting energy policy objectives, but this is unlikely to be the case under an exclusive reliance on current regulatory methods. Building block regulation implicitly encourages companies to build regulatory assets and blunts incentives to manage demand and utilise existing infrastructure more efficiently. These incentives are becoming increasingly "hard wired" into the financial structures and business models driven by capital markets. TFP-based regulation offers a more promising approach for encouraging networks to pursue demand efficiency goals, efficient network pricing and new technologies. Companies under TFP-based regulation will have incentives to pursue efficient integration, will benefit rather than be harmed by more efficient use of network infrastructure, and will evaluate investment options on the basis of relative incremental costs and revenues rather than their impact on RAB. While TFP-based regulation is not a "silver bullet," it is more compatible with encouraging a wide range of efforts to enhance both supply- and demand-side energy efficiency than the building block methods current used in Australia.

26. If a TFP based methodology was to be introduced, would the existing incentives schemes be needed? And if so, do they require any amendment?

Existing service quality incentive schemes would still be needed, because any type of incentive regulation designed to encourage cost efficiencies could unintentionally lead to a diminution of service quality. Service quality incentives are an appropriate form of "countervailing" regulation to ensure that greater cost efficiency does not take place at the expense of service quality.

If demand management schemes are in place, a case could also be made for retaining them under price cap regulation. Most distributors' profits increase when energy consumption expands. This is because the volumetric components of distribution tariffs (*e.g.* per kWh charges for electricity distributors) are typically

greater than the incremental cost of service resulting from energy consumption. Under this type of tariff structure, all else equal, price cap regulation, in theory, creates some incentives to expand energy consumption, which runs counter to demand management/energy conservation goals. In reality, the ability of a distributor to increase volumetric kWh sales is limited with consumption being a direct reflection of increasing end use demand (*e.g.* air conditioning, etc). The incentive to manage consumption at the network level can therefore be substantially achieved through more cost-reflective demand style distribution tariffs. This would be more efficient than retaining demand management schemes.

Efficiency carry over mechanisms would no longer be needed under TFP-based regulation. These mechanisms are based directly on the comparison between forecast and actual expenditures. They are therefore incompatible with TFP-based regulation, which relies entirely on historical and not forecast data. Other mechanisms – such as those described in our response to Issue 14 - can be used to ensure that distributors pursue cost efficiencies in all years of an incentive plan. PEG's incentive power research shows that these alternative methods tend to create much stronger incentives for cost control than efficiency carry over mechanisms.[35]

Existing service quality schemes would not need to be amended under TFP-based regulation. If demand management incentives are retained, they also would not need to be amended to be consistent with TFP-based regulation.

27. If a TFP based methodology was to be introduced, how should service quality be regulated?

The ESC believes that it has developed an effective service quality incentive scheme for electricity distributors in Victoria. We believe this mechanism can serve as a template for appropriate service quality regulation for other network industries and for other States. Further information on the details of this service quality incentive plan is available on the ESC's website.

The ESC also believes that service quality regulation should be kept entirely separate from the X factor that is used to adjust tariffs. This implies that service reliability and quality performance should not be reflected in the TFP measure used in TFP-based regulation. There are several practical reasons why this is desirable. First, there are many reliability and quality measures that could theoretically be included in TFP measures (*e.g.* for electricity distribution, just SAIDI, or SAIDI and SAIFI, or SAIDI, SAIFI, and MAIFI), but it is not clear how many should be included. Second, there is a lack of audited, historical time series of reliability data that are calculated comparably across the DBs. It is also not clear what weight or weights should be applied to reliability measures. The last issue becomes particularly problematic as more reliability measures are added to the index. PEG has also undertaken analysis which shows that including service

[35] L. Kaufmann, *Incentive Power and Regulatory Options in Victoria*, Report to the Essential Services Commission, May 2005

quality in TFP studies could create conflicting and perhaps perverse incentives if the regulatory plan also includes a service quality incentive.[36]

For these reasons, the ESC believes that service quality should be regulated by a combination of separate, service quality incentive mechanism that is entirely independent of the information used to compute the X factor (and direct mandatory planning standards where appropriate). This implies that the revenues and revenue shares that are used to compute the output index should exclude any revenues that result from the operation of the service quality incentive scheme. This should not be problematic, since the revenues resulting from service quality penalties or rewards can be easily identified.

28. What would be the benefits and costs from having two forms of control in the regulatory framework?

The ESC believes there is significant option value in having two forms of control for companies and that in the long term this is also in the interests of consumers. Compared with existing regulatory arrangements, nothing is lost if TFP-based regulation is added as an option, since service providers could always elect a building blocks form of control. Companies choosing TFP-based regulation would also do so only if they believed *ex ante* that they could keep their unit cost growth below the industry's historical trend, which would be reflected in the X factor. A share of these efficiency gains (relative to industry norms) would ultimately be passed through to customers.

The regulator is also likely to benefit. The ESC believes the cost of approving and monitoring a TFP-based plan will be far below those associated with a building block review. If some firms choose the TFP-based option, there would accordingly be regulatory savings. This would potentially free up regulatory resources to focus more closely on the companies that do choose building block regulation.

Implementing both TFP-based and building block review plans side by side could also prove to be a valuable learning opportunity for the regulator. It could gain

[36] In its response to the Meyrick report on PEG's TFP study, PEG addresses this issue by considering two examples. First, assume a DB has bad reliability performance and is subject to consistent penalties under the S factor mechanism. If that company's declining reliability is added as an output to the comprehensive output index, it is measured as a decline in outputs. All else equal, declining outputs lead to a lower X factor and higher revenues. Adding reliability to the X factor therefore gives back at least some of the revenues the company was penalised for under the S factor and blunts the incentive to maintain the quality of service. By the same token, suppose a company was improving its reliability and rewarded under the S factor. If improved reliability is added to the output quantity index, TFP growth and the X factor increase. Revenues therefore decline and the company is giving back some of the revenues it earned under the S factor. This clearly reduces the DB's incentives to improve reliability. Adding reliability to the TFP measure may thereby undermine the objectives for the S factor and create perverse or conflicting incentives. Given the current structure of regulation in Victoria, it may therefore not be appropriate to include reliability measures in the TFP trend computation even if this becomes feasible.

more information, in real time, on which regulatory approach appears to be more effective and less costly. This is a type of comparative "benchmarking" of regulatory methods that could help policymakers refine regulatory arrangements in the future.

The ESC believes the costs of establishing and administering a TFP-based regime would be quite modest. One important reason is that we have already undertaken significant research on these topics. PEG's TFP studies could provide the foundation for immediate TFP-based regulation of electricity and gas distributors. We believe the costs of updating these studies are likely to be small, since PEG's annual TFP updates for Victoria's DBs have cost about $40,000 per update. PEG has also done some preliminary analysis of electricity distribution TFP in other States and Territories. While the costs of rolling new companies into TFP calculations may be somewhat greater than $40,000, we believe they would not be substantially greater. These costs are also far less than the millions of dollars that are spent on typical building block reviews, including appeals and reviews.

29. Would giving service providers the option between either a TFP based methodology and a building block methodology be appropriate? Would the option create any perverse incentives?

Yes, the ESC believes it would be appropriate to allow service provides to choose between building blocks and TFP-based regulation. The TFP-based approach has a strong analytical and empirical foundation and represents a just and reasonable alternative to building block regulation. We also believe that giving companies this degree of discretion is broadly consistent with economic theory. Theory shows that overall economic welfare can generally be improved by allowing utilities to select from a menu of well-designed regulatory options.[37]

The ESC does not believe that that allowing companies to choose between these options will create perverse incentives, when compared with ongoing and exclusive reliance of a building block methodology. It could be argued that service providers will conserve on their capital and operating expenditures under TFP-based regulation, then apply for a building block review to recover these costs. The ESC believes these concerns are exaggerated for two reasons. First, the very same gaming incentives already exist under building block regulation. Companies always have incentives to forecast high expenditures going into a building block review, then "underspend" while the plan is in effect. The worst that could be said if service providers switch from TFP-based to building block regulation is that this change re-introduces the perverse incentives of the latter approach, and these perverse incentives would be ubiquitous if the building block method was the only approach that was allowed.

Second, the ESC's TFP-based regulatory model includes an optional capital module. For those service providers with legitimate investment needs that cannot

[37] For example, see Laffont, J. and J. Tirole (1993), *A Theory of Incentives in Procurement and Regulation*, pp. 224-25.

be entirely funded through industry-based inflation and TFP measures, this module can provide companies with a considerable degree of certainty about recovering their investments in "real time," shortly after they are incurred. This could ultimately prove very attractive to utility managers and undercut the desire to switch to building block regulation and its related gaming incentives. The optional capital module is based on the module that was recently approved for electricity distributors in Ontario Canada, and further details of this module are provided in the Appendix.

For these reasons, the ESC does not believe allowing companies to select TFP-based regulation will create perverse incentives. Indeed, one of the reasons we believe this option should be offered is that it substantially mitigates some of the perverse incentives that are known to exist in the current arrangements. The ESC has refined its preferred TFP-based regulatory model so that it may serve to reduce these incentives further.

30. What would be the likely participation by service providers under a TFP based methodology?

The ESC believes that interest in the TFP-based regulatory option is likely to increase over time. One factor limiting current interest is simply a lack of familiarity with the approach. Utility managers and stakeholders more generally tend to be risk averse and therefore more comfortable with the "devil they know" than the one they don't. However, we believe these same managers will examine the TFP-based regulation more closely when it ceases to be a theoretical/academic exercise and is instead a live option that they can use to regulate their business. If and when this occurs, we believe managers will evaluate the TFP-based and building block methodologies on their merits, and this comparison will lead at least some companies to select the TFP-based approach.

It is also noteworthy that the government-owned providers seem to be less attracted to TFP-based regulation than privately-owned firms. This may indicate that the publicly-owned utilities operate under generally weaker incentives. We also believe these firms have much less understanding of the TFP-based approach, since it has not been discussed as extensively in these jurisdictions as in Victoria.

It is also important to recognise that the Commission is effectively making a once-and-for all decision about whether to add an option to the existing regulatory framework. Although the level of current company interest in the option should be considered when making this decision, the Commission should not lose sight of the enormous opportunity cost associated with foreclosing the TFP-based option indefinitely. This decision would lock in existing regulatory arrangements and eliminate the chance for service providers to pursue what the ESC believes is a low-cost and effective regulatory alternative. Especially because establishing and administering a TFP-based regime is unlikely to be costly, the ESC believes that barring some companies to pursue this approach would be a significant lost opportunity.

31. If a TFP based methodology was to be introduced, what should be the procedures for collecting the TFP dataset? Should confidential data which have previously been provided to the regulator for regulatory determinations now be allowed to be used for calculating TFP growth estimates?

As discussed in our response to Issue Five, the ESC believes the dataset required to estimate TFP is minimal. All the data needed to calculate the output quantity index (billing determinants and associated revenues, net of any revenues associated with service quality or supplemental regulatory mechanisms) will be provided through utilities' annual tariff submissions. Data on operating expenditures and changes in the RAB also needs to be provided. We believe data on these variables may be sufficiently accurate to be included at the present time in TFP calculations. All companies for which this is determined to be the case should be immediately added to TFP computations. The data quality for all other companies should be evaluated on a case by case basis.

Procedures also need to be put in place to ensure that these data are accurate and defined comparably across companies. We recommend that a process be put in place to improve data quality and consistency. However, we believe this process can run parallel to what is needed to compute industry TFP trends, and TFP measurement should not wait until this process is finalised, especially since there is a significant probability that costs can never be defined completely comparably across companies. It should also be recognised that the quality of company-specific data is even more important in building block regulation, yet building block reviews will not be delayed until data imperfections have been eliminated.

32. What are the costs of implementation a TFP based methodology?

The ESC believes these costs will be modest, in large part because we have already funded this work for some years. The ESC-sponsored research can provide a solid foundation on which to build TFP-based regulation for Australia's electricity and gas distributors, although similar foundation studies have not been sponsored for electricity or gas transmission. PEG has now undertaken four updates of its original TFP research for Victoria's electricity distributors. Each of these updates has cost about $40,000 and, once the company data are provided, completed in no more than two months' time. It should be noted that these updates include the evaluation and processing of data for five separate distributors. Although the costs of processing a time series of data may be greater, the ESC does not believe that the costs associated with rolling a single, new company into rolling TFP calculations will be substantially greater than the observed A$40,000 cost of this undertaking this work for five companies for a single year. In any event, these costs are small in comparison to the millions of dollars, and years of time, that are spent on a building block reviews. While there are some implementation costs, the ESC believes a TFP-based methodology can lead to substantial regulatory savings for companies and regulators.

33. What is the required level of specification on a TFP based methodology that needs to be included in the Rules?

The ESC believes that a TFP-based methodology can be specified relatively simply and straightforwardly in the NEG and NGR. First, the rules should outline the method that will be used to calculate TFP. The ESC's recommendations for this issue are discussed in Issues Four and Five.

The rules should also define how the industry used to calculate TFP for the sector should be defined. For gas and electric distribution, we recommend that the industries initially be defined to be the service providers in Victoria, and the current TFP trends for these industries will be the preliminary TFP trends for the industries nationwide.

Next, the rules should define how new companies are added to the industry aggregates. We recommend that new companies be added after the regulators have undertaken a building block review and/or determined that the data for the companies is available and of sufficient quality.

Next, the rules should define how the X factor is calculated. We recommend that the X factor be computed as the average change in the TFP index over the period that ends with the most recently added data and begins with the data of ten years earlier. We recognise that not all companies included in the industry definition may have 10 years worth of data in the aggregate. If they do not, then all data that are available and deemed to be reasonable for the selected companies should be included in the TFP computation.

The next issue is the procedure for selecting a building block or TFP-based regulatory approach. If a company elects the latter, a historical cost review will commence as soon as practicable. The cost review will establish initial rates under the review and will focus on observed costs from the most recently observed year for which a full year of historical data are available. The service provider will also decide whether it wishes to utilise the capital module while the access arrangement is in effect. Once the historical cost review is completed, the X factor will be set at the value of the rolling value of X that prevails at that time. The service quality incentive and demand management incentives would also be updated, using the same provisions that currently exist in the rules.

While the plan is in effect, the distributor would submit tariff compliance reports that are identical to those currently reflected in existing Victorian guidelines. If a company has invoked the capital investment module, it would also report on how much capital it invested in the previous year and which it chooses to recover through the module. The module would have tariff adjustment formulas written directly into the module which would allow recovery for whatever portion of the service provider's observed historical capital spending was deemed to be prudently incurred by the regulator.

In the fourth year of the five year access arrangement, the service provider again decides whether it wishes to adopt the TFP-based regulatory option or a five year, forward-looking building block review. If it elects the TFP-based alternative, a historical cost review is again undertaken for the most recently observed year for

the purposes of setting initial rates. The X factor will be set at the value of the rolling value of X which prevails after this review is completed.

34. What are the criteria for assessing whether a TFP based methodology should be applied?

The ESC believes the criteria detailed in Section Two of the *Issues and Framework Paper* should be used to evaluate whether TFP-based regulation would be an appropriate option for energy networks, compared with exclusive reliance on a building block methodology. These criteria are comprehensive and focus on the relevant regulatory objectives. The use of a counterfactual assessment is also particularly germane for the Review. As is evident in this submission, the ESC believes that an objective evaluation of TFP-based regulation relative to the counterfactual of exclusive and universal use of the building block approach indicates that it would be an appropriate addition to Australia's regulatory framework and should be considered as an option.

We would also emphasise that the "dynamic" efficiency criterion mentioned in Section Two goes beyond the narrow energy delivery function, since energy networks can and should play a larger role in achieving Australia's broader energy market objectives. The extent to which this occurs will depend greatly on networks' investment behaviour. Networks' incentives to be innovative, and undertake investments that have broader energy market implications, will also be greatly influenced by the regulatory environment and the strength and type of incentives it creates.

In addition to the criteria outlined in Section Two, the ESC believes it is particularly important for this Review to be guided by a long-run perspective. The Commission will make a one-off decision that either allows a TFP-based regulatory option or, essentially, forecloses this alternative indefinitely. We appreciate that there are some issues that need to be addressed to implement a workable, TFP-based regime. However, we believe that the merits of allowing a TFP-based regulatory option should not hinge on whether the Commission believes it can reach a definitive and unambiguous resolution of every implementation issue in this Review before the TFP-based alternative can be made available. The ESC strongly believes that there is a need for regulatory regimes to evolve, and in this submission we have advocated a flexible, TFP-based regulatory model. In our view, this model strikes an appropriate balance between incorporating certain, well-specified rules (*e.g.* for calculating the rolling X factor) and allowing for flexibility to reflect the diverse and changing circumstances of energy networks throughout Australia (*e.g.* for incorporating data from new companies into TFP calculations). This model has built-in evolutionary properties, and over time more energy networks are likely to find it an attractive regulatory approach compared with the building block option. We believe there is a risk that, if this Review focuses excessively on reaching a definitive resolution of all implementation issues, it may lose sight of the long-term and bigger picture, which we strongly believe can only be enhanced if some firms are allowed to select a TFP-based regulatory option.

35. If a TFP based methodology was to be introduced, what would be the appropriate timing for its introduction? Should implementation process include a trial period?

The ESC believes that a TFP-based methodology can be introduced almost immediately after this Review is concluded, at least for electricity distribution. The Victorian TFP research can be the foundation for computing TFP trends for both of these industries, with data on additional companies rolled in after the AER deems that this is appropriate. Because the ESC favours a flexible application, and TFP-based regulation is only an option in any case, we do not believe there is any merit in delaying its implementation. In our opinion, the substantial research that has already be done on these topics implies that little new can be learned from a "trial period," which is tantamount to expecting businesses to respond to trial "incentives."

36. How could the balances under the existing incentive schemes be carried over from a building block methodology to a TFP based methodology?

The ESC believes that the best method for carrying over balances from previous regulatory mechanisms is the approach that was outlined in the Victorian Government's rule change application. We believe this method is simplest and most compatible with a TFP-based methodology. It is also administratively simper for these balances to be reflected in the starting prices rather than amortised during the term of the controls.

3 CONCLUSIONS

The ESC believes that TFP-based regulation is a viable, low-cost option that can create real benefits in Australia. While there have been significant debates regarding TFP measurement, we believe that many of the disagreements have been more academic than practical or material in nature. The ESC believes that consensus can be reached on the appropriate method of estimating TFP to be used specifically for tariff adjustment mechanisms if careful attention is paid to the implications of the indexing logic which underpins the TFP-based regulatory approach. It should also be recognised that future efforts to measure TFP can build on the extensive research in Victoria on TFP growth for electricity and gas distributors in the State. The ESC has recommended a flexible TFP-based regulatory model which allows data from new companies to be rolled into the industry's TFP calculations and includes an optional investment module to accommodate the capital investment needs of some utilities.

For all the reasons discussed in this submission, the ESC believes that there can be considerable benefits associated with amending the current regulatory arrangements to allow TFP-based regulation as an option. The incremental costs of establishing and administering a TFP-based regime would be quite modest, in part because of the considerable amount of work that the ESC has already sponsored on this topic. TFP-based regulation would ameliorate some of the known defects in current regulatory arrangements. We also believe that flexibility in regulation can be a beneficial to companies, customers and regulators. Regarding the latter, TFP-based regulation can potentially conserve available regulatory resources and provide valuable, real-world experience on how alternative regulatory approaches work in practice. The ESC also believes that TFP-based regulation can play a critical role in facilitating innovation and institutional responses that help Australia's energy sector make its maximum potential contribution to achieving climate change and broader energy market objectives.

The ESC therefore strongly encourages the AEMC to recommend that TFP-based regulation be added as a regulatory option. We further recommend that the TFP-based option be introduced in a gradual, evolutionary manner along the lines detailed in this submission. The next steps towards practical implementation of this approach would be to undertake the necessary data collection and extend Victoria's TFP studies to other States and Territories.

APPENDIX | INTERNATIONAL EXPERIENCE WITH PRODUCTIVITY-BASED REGULATION

As part of this Review, the Commission received input from economic consultants on the international experience with TFP-based regulation. This work was summarised in two documents: 1) an October 2008 report entitled *Use of Total Factor Productivity Analyses in Network Regulation: Case Studies of Regulatory Practice* from the Brattle Group (the Brattle Report); and 2) a November 18, 2008 presentation to the Commission entitled *Experience with TFP methods in regulation of North American electric utilities* from London Economics International (the LEI presentation). The ESC does not wish to make the consultants' work a focus of its submission; in part because it is not clear to what role (if any) these documents have had in framing or directing the current Review. However, we have been informed that the experience presented in both the Brattle Report and the LEI presentation is in certain respects inaccurate and, on the whole, does not present an objective or balanced overview of the overseas experience with TFP-based regulation. The ESC believes a Review of this nature should establish an accurate record of the available evidence, even if the ultimate conclusions do not depend directly on the Commission's assessment of how TFP-based regulation has operated in practice.

The ESC has therefore asked Dr. Larry Kaufmann of PEG and Navigant Consulting to prepare this Appendix, which briefly reviews the Brattle Report and LEI presentation and presents additional information on the regulatory experience in the UK, the Netherlands, Ontario Canada and the United States (with respect to TFP-based regulation, not cost of service regulation).[38] We do not address Brattle's discussion of the New Zealand experience, which is factually accurate although a number of Brattle's interpretations are difficult to support.[39] We also

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[38] PEG has been extensively involved in the TFP-based regulatory proceedings in California, Maine, Massachusetts, and Ontario, all of which are referenced and analysed in the Brattle Report and LEI presentation. PEG and Dr. Kaufmann are therefore in a unique position to provide perspective on these proceedings. On behalf of other clients, PEG has also written extensively on the experience with index-based regulation in the UK and Netherlands.

[39] For example, in describing the calibration of the CPI-X "thresholds" for New Zealand's electricity distributors, the Brattle Report says "given the 'two-level' approach to controlling prices in New Zealand, the regulator considers that it does not matter too much if the comparative approach results in a threshold that is too low for a given firm" (page 16). Not a single written statement regulator from the New Zealand Commerce Commission can support this view. It is also difficult to reconcile this conclusion with the very extensive review of the alternative threshold values that were proposed by the Commission's consultant and the companies; the Commission would have never countenanced such a time-consuming (well over a year) and costly review of the thresholds regime if it was so

note that the Brattle Report acknowledges that it is limited in scope and not comprehensive. To obtain a more comprehensive and balanced survey of the same experience, Dr. Kaufmann and the ESC would direct the Commission's attention to other reports that are in the public domain. We believe the most relevant such document for this Review is the report that PEG wrote for the Ontario Energy Board (OEB) in February 2008, as part of its role advising OEB Staff on the development of a comprehensive, index-based incentive regulation plan for Ontario's electricity distributors.[40] This was known as "third generation incentive regulation" (IRM3) in Ontario, and the main details of the approved IRM3 plan were released in September 2008. PEG's report clearly cannot discuss the outcome of IRM3, but it does present a wealth of timely information on nearly all of the jurisdictions referenced in this Review, including Ontario, California, Massachusetts, the United Kingdom, and New Zealand, as well as British Columbia and Victoria. A copy of the PEG report can be obtained from the OEB website or can be provided upon request by the ESC.

United Kingdom

One of the case studies in the Brattle Report is the United Kingdom. Brattle says "this case study describes how Ofgem, the energy regulator in Great Britain, has used TFP analyses in setting network price controls." If that was its intention, Brattle could have concluded this chapter with a single sentence, saying "Ofgem has not used TFP analyses in setting network price controls." Indeed, the UK is the classic example of building block regulation, and it is fundamentally misleading to include it in a survey of TFP-based regulation. If the UK was to be included in the Brattle Report, it should have been to draw a distinction between building blocks and TFP-based regulation. There are, in fact, important lessons to be learned from the UK experience that bear on the issues in this Review, but the Brattle Report does not address these implications.

It is true that Ofgem has sponsored research on TFP (from CEPA) in electricity distribution price reviews. But this research project ran in parallel to the building block review Ofgem was conducting and ultimately played no discernible or explicit role in the RPI-X controls that Ofgem established in that proceeding. This is very similar to the TFP project that PEG undertook on behalf of the ESC, which at the outset ran in parallel to the second EDPR.

It is also true that productivity analysis played a more significant role for setting allowed operating expenditures (opex) in Ofgem's first (and only) review of price controls for gas distributors. But allowed opex was set using estimates of opex partial factor productivity (PFP) growth, not TFP growth. In fairness, Brattle

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nonchalant about the final result. It would also be instructive to query the members of the New Zealand Commerce Commission and see if they agree with this conclusion.

[40] Kaufmann, L. *et al*, *Calibrating Rate Indexing Mechanisms for Third Generation Incentive Regulation in Ontario: Report to the Ontario Energy Board*, February 2008.

sometimes says that Ofgem used PFP estimates in the gas distribution controls. Far more frequently, however, Brattle refers to this work as "TFP analysis."

This is an important and material error. TFP and PFP are different concepts and quite often very different measures. In order to avoid confusion and provide the most transparent guidance to policymakers, expert reports must clarify and communicate these differences, not conflate them. Again, the ESC has direct experience with this issue. The ESC used estimates of PFP growth for setting the allowed "rate of change" of opex in building block reviews for both electricity distributors and gas distributors in Victoria. This experience shows that PFP growth can be used as an input into building block methods, but TFP-based regulation is a fundamentally distinct approach to regulation. The fact that opex PFP growth can be useful to building blocks has no relevance to the relative merits of TFP-based regulation, and referencing PFP research from other building block reviews can only obfuscate rather than clarify the relevant issues.

It is also important to recognise that, while UK energy regulation has retained the building block model, it has also evolved into a very benchmarking-intensive regime. Ofgem is now using separate benchmarking analyses to set allowed opex and capital expenditures (capex) for electricity distributors. The latter also include "self-revelation" schemes that are designed to mitigate gaming and elicit truthful forecasts by distributors. This experience may have significant implications for continued applications of building blocks in Australia, for it suggests that regulators over time may increasingly rely on benchmarking as a means of overcoming the gaming properties inherent in the building block approach. Below we briefly describe how benchmarking has been integrated into the building block reviews for electricity distribution in the UK, but more detailed discussions can be found in PEG's 2008 report to the OEB.

Ofgem has primarily relied on econometric benchmarking for setting allowed opex. Its econometric benchmarking approach is a variant of corrected ordinary least squares (COLS). For price controls taking effect in both 2000 and 2005, Ofgem regressed a "normalised" measure of opex on what it called a "comprehensive scale variable" (CSV). The CSV was based on each distributor's number of customers served, kWh distributed, and network length. The weights applied to these variables in developing each DNO's CSV were 25%, 25%, and 50%, respectively. These weights differed from those used in the 1999 COLS study, which were 50% for customers served, 25% for kWh and 25% for network length. These weights were considered roughly proportional to the impact of each scale measure as a "driver" of distribution opex.[41]

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[41] In two dimensional space, COLS is normally applied by running an OLS regression and shifting the intercept of that regression until the line passes through the minimum observation. Any gap between a DNO's opex and this COLS line would therefore reflect that DNO's inefficiency, or the excess of its opex costs over the observed minimum regression line. For the 2000 review, however, Ofgem's COLS benchmarking was done by shifting the *slope* of the estimated function and not the intercept. The slope was shifted until the line passed through the *second* lowest observation. This approach was taken because Ofgem believed a conventional COLS application would have led to implausible results. For the 2005

In the 2000 review, Ofgem set opex targets by assuming that companies would catch-up to the opex target determined by the COLS procedure by closing 75% of the gap between their "normalised" operating cost and the normalised opex of the second most efficient firm in the UK by the second year of the price review.[42] In the 2005 review, each distributor's allowed opex is based on an upper quartile benchmark within the UK. Ofgem's rationale for this decision is that an "upper quartile benchmark...provides a more robust and sustainable benchmark than a frontier based on one company."[43] The 2005 review also undertook some data envelope analysis (DEA) as a "cross check" on the econometric results. However, Ofgem concluded that the DEA results "are not plausible so it (DEA) has not been incorporated directly."[44]

The regulation of capex has also increasingly relied on benchmarking, although this has been implemented differently. In the 2005 price review, Ofgem applied what was called a sliding scale mechanism to the UK distribution companies' capital expenditures. A similar type of mechanism was applied in the most recent energy price control review for the gas distributors but was called an "information quality incentive." These mechanisms were motivated by Ofgem's view that the distributors have incentives to inflate their forecast capex during the next price control period but then "underspend" once an allowed capex is used to set the value of X. Ofgem believes some utilities have actually behaved in this way, although others have not. The aims of the sliding scale mechanism are to:

- retain incentives for efficient capital spending during all years of the control
- reduce the emphasis on Ofgem's or its consultant's view of the appropriate level of capex
- reduce the perceived risk that the price control causes under-investment
- allow but not encourage expenditure in excess of the allowance
- reduce the possibility that companies submitting high capex projections will make very high returns from underspending
- reward companies making "low" capex forecasts

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review, Ofgem did shift the intercept in its COLS application as is typically the case. However, the intercept was shifted so that the line passed through the upper quartile opex performance rather than minimum performance. Upper quartile performance was effectively determined as the midpoint between the third and fourth lowest opex cost observation of the 14 distributors.

[42] Office of Gas and Electricity Markets, *Electricity Distribution Price Control Review: Initial Proposals*, June 2004, p. 66. "Normalised" cost here refers to costs that are adjusted for scale of output and other factors that are quantified through econometric benchmarking.

[43] Ofgem, *op cit*, p.67.

[44] Office of Gas and Electricity Markets, *Electricity Distribution Price Control Review: Final Proposals*, November 2004, p. 70.

- avoid incentives to underspend in ways that reduce service quality or create service quality problems in subsequent years

The sliding scale mechanism essentially gives companies a choice between:

- a lower allowance for capex reflected in the controls, but with a higher- powered incentive that allows them to retain a greater share of "underspend" relative to the allowance and collect a greater share of "overspend"; or
- a higher allowance for capex in the controls, but with a lower-powered incentive that lets companies keep a lower share of "underspend" and collect a lower share of "overspend."

Companies also get an additional reward if they do choose the lower allowed capex option, but do not receive this reward if they select higher allowed capex. If the sliding scale mechanism is designed correctly, it is "incentive compatible" and removes incentives for the company to inflate its projected capex. The mechanics of Ofgem's proposed sliding scale mechanism are as follows:

- Ofgem determines a benchmark level of projected capex over the price control period for each distributor; in the 2005 distribution price review, these benchmarks were determined by the engineering consulting firm PB Power
- Each distributor presents its actual capex projections over the price control period
- Ofgem determines a capex allowance rate, additional income and a capex incentive rate depending on the relationship between benchmark and forecast capex. The allowance rate is the total amount of capex that will be allowed in the controls; this number is specified as a multiple over the benchmark level. The additional income term is an addition to the distributor's allowed revenue. The incentive rate is equal to the portion of capital "underspend" the company is allowed to retain. The allowance rate, additional income and incentive rate each increase as the company's forecast gets closer to the benchmark level, and vice versa. This approach therefore rewards companies for keeping their capex forecasts low.

The entire sliding scale/information quality scheme is captured in a matrix, which details how allowance rates, additional income, and incentive rates vary with the relationship between a distributor's forecast capex and the benchmark capex that was determined by the engineering consulting firm.

The UK approach to building blocks is even more complex and costly than how this method has been applied in Australia. It also relies more explicitly on benchmarking to set company-specific opex and capex targets, which in itself only addresses the incentive for static, as distinct from dynamic, efficiency. This experience is sobering, because the UK adopted these complexities to address the inherent deficiencies of the building block model. These same deficiencies are evident in Australia as well. The UK experience may therefore represent a vision of where Australian regulation is heading if it relies exclusively on building block methods.

Netherlands

The Brattle Report also presents a very confused and misleading discussion of Netherlands' regulatory experience. It discusses three applications of CPI-X regulation for Dutch electricity distributors and the "TFP methodology" or "TFP approach" that was used to set the X factor in each. But the first two applications of CPI-X regulation in the Netherlands did not rely on index-based TFP information at all; these reviews used frontier benchmarking techniques (DEA) to set overall cost targets, not TFP estimation methods to calculate productivity trends. The third application did use a more conventional, TFP-based approach. In contrast with the first two CPI-X controls, however, this most recent review did not lead to chaos or contentious Court challenges. It is misleading to ascribe the legal challenges in the Netherlands, even in part, to "the formulaic way in which the results of the TFP analysis were used directly to set X" (p. 36) when those challenges occurred only when TFP was not used to set X and disappeared when TFP-based regulation was in fact applied. It is critical to understand the differences among the Dutch electricity distribution reviews, but the Brattle Report smears these reviews together and leaves the erroneous impression that they represent repeated applications of a similar (or even identical) approach for estimating TFP-based X factors.

The first price control review for the Dutch electricity distributors and TenneT (the national transmission utility) set the terms of the CPI-X indexing formula for three years (from 2001 through 2003). There were two components of the X factor. The first was a general component, which was termed "frontier shift." The value of the frontier shift was estimated to be 2% in the first review. The second component was a "catch up" factor, which varied by company depending on their estimated initial cost inefficiencies.

Benchmarking played a critical role in setting the catch-up or company specific factor in the first price review. The regulator believed that prices initially differed significantly among distributors due to differences in management efficiency. Benchmarking for the first price control was designed to set tighter price controls for companies that were either less efficient or had historically set higher tariffs in order to generate higher returns.

The benchmarking method used by the regulator in the first price review was data envelope analysis (DEA). The regulator used DEA to set X factors in a manner that proved to be highly mechanistic. A 'raw' X factor was computed that would essentially move companies from their initial (2000) "controllable" revenues to "efficient" revenues over the three year term of the plan. "Controllable" revenues were determined by taking initial revenues and subtracting what the regulator deemed to be excess returns. "Efficient" revenues were essentially determined by the company's DEA score on the preferred DEA model. For example, if a given company had a DEA score of 0.60, this would imply that its costs were 40% above the efficient frontier, and X would be set to reduce revenues by a cumulative 40% (excluding adjustments for inflation) over the three year plan. However, X factors were capped at 8% maximum per year, regardless of the company's DEA score. Moreover, several companies pointed out material errors in the data used to compute their initially proposed X factors, and this led to revisions of several utilities' X factors.

This contrasts sharply with the most recent regulatory review, which covers the 2007-09 period. All Dutch distributors are subject to a common, baseline X factor, which the regulator terms a "generic" X factor. This X factor reflects the industry's computed TFP trend over a recent, historical period. However, the regulator has also allowed modest tariff adjustments to reflect "regional differences" in costs for two business conditions (water crossings and taxes).[45] This represents a slight departure from the classic TFP-based regulatory model, but it is a far more significant departure from the methods used in the earlier reviews, which set company-specific X factors using benchmarking methods. Only the most recent application of CPI-X regulation in the Netherlands can be accurately described as an example of TFP-based regulation.

Ontario

The Brattle Report also presents a misleading picture of the experience with TFP-based regulation in Ontario, for three main reasons. First, the Report focuses only on gas distribution and ignores the well-publicised, more widely applied and more recent incentive regulation proceeding for Ontario's electricity distributors. The main Determination in the IRM3 proceeding for electricity distributors was released in September 2008 and hence available to be included in Brattle's survey. Second, the Brattle Report cherry picks the evidence from the gas distribution review in a manner that exaggerates the controversies. Third, the Report provides no context for the gas distributors' settlement agreements, which are common in Canadian regulation and not a sign that the regulatory process has 'failed' in some sense.

On the first point, the most recent and relevant experience with TFP-based regulation in Ontario is IRM3 for the electricity distributors. This process was overwhelmingly viewed as a success by companies, customer groups, regulatory staff, and the Commissioners themselves. It included a "working group" process comprised of six customer representatives, six company representatives, and the Power Workers Union. This process was organised and led by OEB Staff, working closely with its advisor PEG.

The working group considered a wide range of regulatory options and approaches, and in the end reached helped the Staff develop a basic framework which included a "core" model that applied to all distributors as well as some "modules" that distributors could access if they satisfied certain conditions. This core-modular framework was designed to be rigorous and founded in economic reason, yet flexible enough to accommodate the differences in Ontario's 80+ electricity distributors. The core model included a baseline X factor set at the estimated growth in industry TFP, as well as three productivity "stretch factors" applied to three groups of distributors that were differentiated on the basis of their estimated cost efficiency. The most important module was the capital investment module, which could allow distributors to recover the costs of incremental capital investment that was not otherwise reflected in the tariff adjustment formula. The approved

[45] Further research was also authorized on whether adjustments should be allowed in the future for customer density. Eleven different business conditions were explored for potential regional adjustments.

capital module included a threshold which varied by company and was explicitly designed to eliminate these "double counting" concerns.

Although there was general agreement on the TFP-based regulatory approach, companies and customer groups naturally had differing opinions on the specific values to be included in the tariff adjustment formula. These differences were explored and debated in a collegial atmosphere before stakeholders, OEB Staff and two Board members. The most substantive differences related to the estimate of TFP growth, but even here the differences were relatively minor. Dr. Kaufmann proposed a TFP growth estimate of 0.88%, which was supported by all customer groups and Board Staff. The Companies proposed a TFP growth estimate of 0.55%. The difference between these proposals compares favourably with building block reviews and the experience with TFP-based regulation in New Zealand, where the consultant for the Commission originally proposed an X factor of 2.6% and some companies countered with negative X factors.[46]

The OEB accepted Dr. Kaufmann's proposed TFP methodology, although they found that the period for estimating TFP trends should use all available information rather than the subset of information that Dr. Kaufmann proposed.[47] This TFP methodology is very similar to what PEG has used in its TFP research for the ESC. The OEB explicitly rejected an alternative TFP methodology proposed by Julia Frayer of LEI. The Board wrote that this methodology

> *"was not based on a series of consistent principles. Of greatest concern with Ms. Frayer's approach is the (physical, rather than monetary) approach to the measurement of capital, which is inconsistent with prior Ontario TFP studies and does not appear to have been adopted in any jurisdiction other than New Zealand. While the Board recognises Ms. Frayer's efforts to construct an Ontario-specific TFP trend, the Board does not believe that the methodology advocated by Ms. Frayer is appropriate."*[48]

A final noteworthy point on IRM3 is the rationale for the capital module. While the Brattle Report did not address this (or any other aspect of IRM3), the LEI presentation claimed that the "need for incremental capital funding (was) generally recognised because the rate base has been growing faster than rates under the price cap." This is not accurate; it is true that the Companies argued that the capital module should be available as a matter of course because rate base is growing more rapidly than prices, but the Board came to a very different conclusion in its September Determination:

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[46] The final X approved X factor in the New Zealand electricity distribution thresholds regime was 1.0%. Dr. Kaufmann advised Powerco in this proceeding and proposed a value for X equal to 0.7%.

[47] Using the entire TFP sample (1988-2006) led to a final approved TFP trend of 0.72%, compared with Dr. Kaufmann's recommended TFP trend of 0.88% over the 1995-2006 period.

[48] Ontario Energy Board, *Supplemental Report of the Board on 3rd Generation Incentive Regulation for Ontario's Electricity Distributors*, September 17, 2008, p. 12.

The Board notes that there are clearly differences in perception as to the purpose of the incremental capital module. Ratepayer groups perceive the capital module as a mechanism aimed solely at addressing extraordinary or special capex needs by distributors. The distributors, on the other hand, perceive the module as a special feature of the 3rd Generation IR architecture which would enable them to adjust rates on an on-going, as-needed basis to accommodate increases in rate base.

In the Board's view, the distributors' view is not aligned with the comprehensive price cap form of IR which has been espoused by the Board in its July 14, 2008 Report. The...intent is not to have an IR regime under which distributors would habitually have their capex reviewed to determine whether their rates are adequate to support the required funding. Rather, the capital module is intended to be reserved for unusual circumstances that are not captured as a Z-factor and where the distributor has no other options for meeting its capital requirements within the context of its financial capacities underpinned by existing rates.[49]

The capital module is therefore a mechanism that is appropriate to reflect extraordinary capital spending needs, which would not otherwise be reflected in the industry's historical TFP trends, but it is not something which is necessary to reflect the capital spending that distributors undertake when subject to TFP-based regulation.[50]

Regarding the gas distribution plans, the Brattle Report does not present a complete or balanced account of the outcome of that proceeding. This is perhaps most evident in its statement that "it is noteworthy that the Board was not able to accept the findings of its advisors (PEG) – criticism of the advisors' report from the companies resulted in a settlement agreement that was significantly different from the recommendation of the Board's advisors" (p. 39). This sentence then references a footnote that says the average value of X in the Enbridge settlement (assuming an inflation rate of 2.04%) will be 0.96%, or about midway between PEG's recommended value of 2.04% and Enbridge's recommended -0.14%. But this passage is deceptive because (as the Brattle report notes) the gas proceeding set the terms of incentive regulation plans for two gas distributors, yet the Brattle report documents the outcome for only one of those companies. An assessment of the "noteworthiness" of the proceeding can only be evaluated when looking at how this proceeding was resolved for all companies involved, not just a single company. As it turns out, there were two settlement agreements in the proceeding, and the terms of the agreement that Brattle chooses not to report (for Union Gas) were very different than Enbridge's. The X factor in Union's settlement was 1.82%, which was virtually identical to PEG's recommended value. This implies that, on balance, the approved X factors in the Ontario settlements were not radically dissimilar to what PEG recommended.

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[49] Ontario Energy Board, *op cit.* p. 31.

[50] LEI makes another inaccurate claim in its September 2008 presentation. It says it's "argument that 125% threshold (relative to depreciation) correlated with greater than 2% growth in rate base accepted by Board." In fact, the Board adopted a very different threshold than what was advocated by LEI and the Coalition for Large Distributors; the final threshold was more similar to the thresholds of two customer groups.

Moreover, it is misleading to suggest that the terms of a settlement agreement somehow imply that the evidence presented by any given party is unreliable. Settlements may be relatively unfamiliar to the Australian regulatory community, but they are common in North American regulation. They often emerge at the conclusion of litigated, adversarial regulatory cases, such as the Ontario gas proceeding. The terms of settlement agreements are determined entirely through negotiation, with give and take on a large number of issues. Companies or customer groups can trade off one item in a settlement (such as the X factor) in exchange for receiving more favourable treatment on something else. It can therefore be misleading to focus on a single item of a settlement without understanding the settlement as a whole. Settlements are also not considered a "failure" of the regulatory process or a rebuke of any given party's evidence. Indeed, in some cases, they are viewed as leading to more favourable outcomes that ultimately benefit all parties. The Brattle Report is silent on this institutional context and the nature of settlement negotiations, which substantially undermines their conclusions and is critical for understanding the outcome of the gas IR proceeding.

United States

The Brattle Report and the LEI presentation both discuss the US experience with TFP-based regulation in less detail than in the other case studies, yet much of what is reported in these documents for the US is not accurate. For example, the Brattle report says the X factor in the originally Boston Gas plan was 2%. This is not correct; this approved X factor was 0.5%. Brattle also claims that the TFP studies in the Boston Gas were similar to the econometric studies that were used to estimate TFP in the Ontario gas proceeding. This is also not correct; TFP in the original Boston Gas plan was estimated using indexing methods. The Brattle Report also presents a confused discussion of whether a regional or national standard was used for estimating the industry TFP trend, implying that a national standard was used in the original (1996) plan and a regional standard in the updated (2003) plan. This is not correct: the regulator adopted a regional, North-eastern standard in both plans.

The LEI presentation also includes some misleading statements about the experience with TFP-based regulation in Massachusetts. There is no basis for its claims that "TFP (was) used to inform rate design as part of Nstar settlement agreement" or that there was "no independent analysis conducted on X factor, being determined by 'black box approach.'" It is true that the NStar plan emerged from a settlement, but PEG estimated an industry TFP trend on behalf of NStar and provided this study to the company during its settlement negotiations. While it is in the nature of settlements never to know precisely how the parties arrived at a final agreement, it is not true that no independent analysis was conducted on the X factor in that proceeding.

The Brattle and LEI documents also discuss TFP-based regulation in California. While Brattle's discussion is far from comprehensive or definitive, it concludes that "in these cases, unlike the others discussed above, the TFP analysis received relatively little criticism during the proceedings, and the results of the studies were as adopted in the final decisions." It is true that TFP estimates presented by PEG have been accepted by the regulator in the California, but this was also the case in

the "other cases," especially Massachusetts, where PEG's TFP estimates have been used in approved plans for Boston Gas (both original and updated), Berkshire Gas, and Bay State Gas.

It should also be noted that Brattle's discussion of Californian, TFP-based regulation are not consistent with what LEI reports in its presentation. LEI claims that in San Diego Gas and Electric's electricity distribution case, the California Public Utilities' Commission (CPUC) 'took (a) middle ground' between the productivity factor proposed by PEG (0.92%) and that proposed by the California Office of Ratepayers (sic). This is not true; the approved productivity factor in SDG&E's gas distribution plan was 0.92%. The CPUC approved an indexing plan SDG&E's gas distribution in the same proceeding, and the productivity factor it approved was also identical to what PEG recommended (0.68%). Other errors in the LEI presentation about the California experience include the statement that the 2000-01 retail market crisis "forced a return to cost of service regulation" and that the SDG&E TFP study was based on a 20 year sample period. Moreover, the LEI presentation leaves the impression that California utilities no longer use index-based regulation. This is not true; while California regulation has always been eclectic, and relied on a number of different methods, there have been recent proceedings where utilities filed evidence on industry TFP trends, and index-based plans were approved.

There are many other inaccurate or misleading statements in the Brattle and LEI documents about the US experience with TFP-based regulation. A failure to address any given point in this Appendix does not indicate that it its valid. However, given the general nature of their discussions and the deficiencies of what is presented, there is little if any value in these documents on US TFP-based regulation, and the Commission can obtain a far more accurate, complete, timely and balanced assessment of this experience in PEG's 2008 report to the OEB.