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**Transitional and Implementation Issues
in Total Factor Productivity Regulation**

**Submission to the Expert Panel on
Energy Access Pricing**

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1 INTRODUCTION

The Ministerial Council on Energy's Expert Panel on Energy Access Pricing has released its Draft Report on Revenue and Network Pricing across the Energy Market.¹ The draft report responds to the Productivity Commission's Review of the National Gas Access Regime and advises on a model to achieve a common approach to transmission and distribution revenue and network pricing across electricity and gas.

Notably, the report sets out guidance on the application of price controls and, in particular, assesses the potential for the adoption of Total Factor Productivity-based (TFP-based) price setting methods. Reviewing potential alternatives to the building blocks methodology was a key matter for review contained in the terms of reference provided to the Panel.

The Essential Services Commission of Victoria (the Commission) notes the Panel's broad acceptance of TFP-based approaches as "likely to be a worthwhile development for electricity and gas distribution businesses ...".² The Commission supports the Panel's recommendation for the National Electricity and Gas Laws to direct the Australian Energy Market Commission to review and develop Rules that permit the economic regulation of distribution and transmission services through the application of a TFP-based approach.

The Panel raises some critical issues that it believes need to be resolved before TFP-based regulation can be accepted as a preferable alternative to the building blocks.³ These relate to:

- The need to develop industry-wide TFP estimates, which involves issues in both data collection and the appropriate methodology for measuring TFP.
- Assessing whether industry-wide TFP estimates need to be adjusted for company-specific characteristics that affect their long-term TFP growth.
- The need to develop rules regarding a productivity-based regulatory regime, such as:
 - the duration of price controls;
 - whether there are "triggers" for updating initial prices or X factors and what form they take;
 - under what circumstances prices are adjusted to bring prices in line with costs; and
 - incorporating service incentive mechanisms into the design of TFP-based approaches.

The Commission also views these as critical issues that must be considered before TFP-based regulation can be implemented as an alternative to the building blocks approach.

The Commission, with the assistance of Pacific Economics Group (PEG), has been considering the issues associated with implementing and transitioning to a TFP-based approach. This work has addressed the Panel's other key concerns with the TFP-based regulation approach. It has considered the practical design of a TFP-based regulation

¹ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March.

² Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 95.

³ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 93-94.

approach and whether and how the features of the building blocks framework, such as the service incentive and efficiency carryover arrangements, are rolled into a TFP-based regulation approach. This submission sets out the results of this work.

The Commission also draws the Panel's attention to previous work that PEG has completed on the Commission's behalf.

In 2004, the Commission engaged PEG to estimate a TFP trend for the five Victorian electricity distribution businesses and consider the best estimate of the future TFP trend over the 2006 to 2010 period.⁴ The trend was calculated using both Tornqvist and Malmquist productivity indices over the 1995 to 2003 period. The output index measured the trend in the number of customers served, volumes delivered on-peak and off-peak and (non-coincident) peak demand. The input index measured trends in the amounts of capital and operating and maintenance inputs that the distributors used.

This work demonstrated that robust industry TFP and input price trends could be estimated from the data available to the Commission. The data used relied on information reported by the distributors under their regulatory reporting requirements and on data obtained from the Australian Bureau of Statistics. The results also demonstrated that there was little evidence that different X-factors were needed to account for any variations in the exogenous factors that exist between distributors.

PEG is currently updating the Victorian trend for 2004 data, the results of which will be released in April 2006 and will in coming months be further updating the trend for 2005 data.

In 2005, PEG also then developed an economic simulation model that demonstrated the impact of different regulatory regimes on prices, profits and incentives, assessing adjustments to a range of parameters, 'true-ups' and timeframes.⁵ This work concluded that TFP-based approaches produce stronger incentives and greater customer benefits than building block approaches.

The papers released on these two pieces of work are available on the Commission's website: www.esc.vic.gov.au.

1.1 Purpose of this paper

The purpose of this paper is respond to the comments and views made by the Expert Panel on TFP-based approaches. In particular, it addresses issues the Panel has with the practical implementation of TFP-based approaches and addresses presumptions the Panel made about what features a TFP-based approach must have.

In Chapter 2, the Commission reviews the evolution of the building blocks approach and the challenges confronting the continued use of that approach. Chapter 3 then sets out the design, implementation and transitional issues that arise in implementing a TFP-based approach. In particular, the chapter considers:

- the regulation of service reliability and quality;

⁴ Kaufman et al 2004 TFP Research for Victoria's Power Distribution Industry, Pacific Economics Group, December.

⁵ The results of this work are available in Kaufman, L. 2005 Incentive Power and Regulatory Options in Victoria, May.

- whether different X-factors should apply to different companies;
- whether a fixed or rolling X-factor should be used;
- the role and frequency of price reviews;
- the sharing of efficiency gains;
- the scope for allowing for a re-opening of the price controls;
- the treatment of the efficiency carryover mechanism;
- the incorporation of service incentive regulation; and
- the treatment of depreciation.

Finally, in Chapter 4, the application of TFP-based approaches to transmission services is considered.

The Commission is of the view that the model set out in this paper effectively addresses the implementation issues raised by the Expert Panel report and therefore provides further reinforcement of the Panel's recommendation in relation to the AEMC's development role and changes in law to facilitate productivity regulation.

The paper focuses exclusively on electricity distribution and draws on the experience of regulating electricity distribution services in Victoria.

2 INCENTIVE-BASED REGULATION AND BUILDING BLOCKS

Electricity distribution services possess certain characteristics that mean it is more efficient to have only one supplier of these services. Generally, these characteristics include high sunk costs arising from the specificity of the assets and increasing returns to scale.⁶

However, where there is only one supplier of a service, the supplier will possess a substantial degree of market power because it is isolated from the disciplines created by a competitive market. Such a firm will have the capacity to elevate prices and supply less of the service that customers would demand if prices were more cost-reflective. As a result, consumer welfare is reduced.

Regulation aims to replicate the outcomes that might be expected where the disciplines of a competitive market are present by ensuring that prices tend toward cost-reflectivity and electricity distributors provide the quantity and quality of services required by customers.

However, regulation can also impose costs that may offset some of the societal gains of limiting or preventing monopoly behaviour.

Whilst regulation can, in principle, improve on problems of excessive pricing and under-supply (allocative inefficiency), it comes at the expense of some regulatory costs. In other words, regulation cannot flawlessly mimic the competitive process — it can only improve what would otherwise be, and then not necessarily so. In some circumstances, the regulatory costs incurred in pursuing a competitive outcome may outweigh the benefits to be achieved. Thus there are intrinsic limits on the extent which regulation can improve upon market outcomes.⁷

The greatest limitation to the effectiveness of regulation is the existence of information asymmetry between the regulator and the distributor. Only the distributor knows the actual costs incurred in efficiently providing regulated distribution services. As such, it is in a strong position to mask the efficient cost level in order to build in additional returns to its shareholders through a more generous price path from the regulator.

In Australia, the regulation of distribution services has been incentive-based. Incentive-based regulation aims to decouple prices from costs (at least for a period) so that the distributor can increase or decrease profits depending on how well it manages its costs. The benefits of efficiency gains are then passed on to customers in the form of lower prices.

However, there is trade-off between bringing prices into line with efficient costs and allowing distributors to retain enough of the benefit of efficiency gains to preserve the incentive for cost reductions going forward.⁸ The more that regulators attempt to bring prices in line with efficient costs, the less is the incentive on distributors to achieve improvements in efficiency.

⁶ Specificity means that the assets are specific to service that they provide and have little or no value in any other use.

⁷ National Economic Research Associates 2004 Alternative Approaches to 'Light Handed' Regulation: A Report for the Essential Services Commission, Sydney.

⁸ National Economic Research Associates 2004 Alternative Approaches to 'Light Handed' Regulation: A Report for the Essential Services Commission, Sydney.

If efficiencies achieved are given back in full to customers after only a short period of time, there is less of an incentive for distributors to find those efficiency gains because there is only a small benefit to them of doing so.

This trade-off is materialised in the choice that regulators have between ‘high-powered’ and ‘low-powered’ incentive approaches:

... there is a basic trade-off between incentives, which call for a high-powered incentive scheme, and rent extraction, which requires ... low-powered incentives. ... High powered incentive schemes ... indeed deliver a good cost performance, [however] they are also likely to leave substantial profits to the firms’ owners. ... Those who support or just accept the use of high-powered incentive schemes should be ready to refrain from forcing contract renegotiation when they observe large profits.⁹

In work undertaken for the Commission, PEG highlighted the divergent outcomes arising from high-powered and low-powered regulatory arrangements:

... a utility’s cost containment effort and the allocation of benefits between shareholders and customers depend greatly on the design of the regulatory system. Effort is generally stimulated by ‘external’ mechanisms that de-link prices from costs. Indeed, we find that it is optimal for regulated utilities to expend no effort to reduce costs under ‘pure’ cost of service regulation. Maximum efforts are expended under ‘pure’ external regulation where prices are completely de-linked from costs.

...

Incentives are weakened if prices are ‘trued up’ entirely to observed past costs when plans are updated. ... However, incentives are strengthened greatly if prices are only partially trued up to observed costs at the end of the plan. ... Moreover, customers receive the lion’s share of the incremental benefits generated by a partial true-up of prices to observed costs. Incentive power and customer benefits continue to increase as less weight is placed on observed costs at the end of the expired plan.¹⁰

The two most common forms of high-powered incentive frameworks are the CPI-X forward-looking building blocks framework and TFP-based approaches.

Under the CPI-X building blocks framework, a forward-looking profile of the revenue that a regulated entity will require to provide an efficient level of service is calculated. This revenue profile is built up from an assessment of key cost component forecasts comprising operating and maintenance expenditure, cost of capital financing requirements (return on and of capital)¹¹ and a forecast tax liability.¹² The X-factor is then determined by adjusting current prices or revenues to match the forward-looking revenue profile.

⁹ Laffont and Tirole 2000 ‘Competition in Telecommunications, MIT Press, Cambridge, Massachusetts.

¹⁰ Kaufman, L. 2005 Incentive Power and Regulatory Options in Victoria, May.

¹¹ The return on capital is typically determined by rolling forward the value of the regulatory asset base taking into account, among other things, capital expenditure requirements and then applying a weighted average cost of capital to the rolled forward asset value.

¹² A fuller description of the building blocks approach can be found in Essential Services Commission 2005 Electricity Distribution Price Review 2006-10, Final Decision, Volume 1 — Statement of Purpose and Reasons, p. 19-21.

It is the ability of the regulated business to keep the difference between the forecasts of the cost components and the actual costs incurred that provides the incentives for efficiency.

TFP-based approaches use information on industry trends in TFP and input prices to estimate changes in costs over time — that is, the X to apply to future price movements. However, the approach places more emphasis on industry performance information, such as industry TFP trends, rather than company-specific costs as in the building blocks approach.

Both forms of regulation de-link prices from costs by estimating costs ex-ante rather than adjusting ex-post. Thus they create high powered incentives for distributors to achieve efficiency gains, although they differ in the way that the benefits are transferred to customers.

In assessing the use of TFP in incentive-based regulation it is useful to consider the strength of the incentives they place on distributors, the degree to which information asymmetry is addressed and any additional regulatory administrative costs they impose.

It is important to note that there may be a limit to extent to which TFP can be used to set initial starting prices. In this respect, the adoption of a TFP-based approach to estimating changes to costs over time relies on a view being formed over how initial prices might be established. One likely option would be to transition to such an approach through a hybrid approach of building blocks to establish start prices and TFP to estimate changes. Once established decisions over how and when any subsequent re-alignment of price and costs will also need to be addressed and the approach to this will impact the incentive power of the approach considerably.

The reliance on estimates of industry trends in productivity and cost changes to estimate change in costs can assist in addressing asymmetric information issues as it reduces the reliance on business specific information. Further, such an approach could be said to better reflect the pressures of competition because the rewards and penalties realised by the businesses depend on how it performs against industry rather than specific estimates of its own costs.

Therefore, the debate is not so much about whether TFP should be used instead of building blocks, but recognising that the adoption of TFP to estimate changes in costs over time is an inevitable evolution in the pursuit of more efficient and effective regulatory approaches.

Critical to the future application of TFP is the approach to future re-sets and the implications for other features of existing approaches, such as the service incentive and efficiency carryover mechanisms. It is the issues associated with the transition and implementation that are discussed later in this paper.

2.1 Evolution of the CPI-X building blocks framework

The CPI-X building blocks framework has evolved over time as regulators have sought to increase the power of the incentives under the framework and thus improve the effectiveness of the regulatory approach.

The pure form of the approach creates incentives for cost efficiency by de-linking a company's cost performance from the prices that it charges its customers. Distributors can increase their profits by outperforming the expenditure forecasts used to determine their allowed price path.

However, the power of these incentives dissipates in the latter years of the regulatory period because distributors only retain the benefits of efficiency gains made for the length of the regulatory period. Any efficiency gains achieved by the distributor in the latter years are returned almost immediately to customers through the next price reset. Hence, there is little incentive for distributors to realise these efficiencies when they are identified. Instead, an incentive is created for distributors to postpone efficiency improvements until the early years of the next regulatory period when the benefits of those improvements can be retained for a longer period.

To maintain the strength of the incentives throughout the regulatory period, regulators have introduced efficiency carryover mechanisms. These mechanisms allow distributors to retain the benefits of efficiency gains for longer by adding an increment to the building blocks revenue requirement in the next regulatory period to reflect the efficiency gains made in the previous period.

Efficiency carryover mechanisms aim to achieve certain outcomes. First, allowing distributors to retain the profits from efficiency gains for longer increased the power of the incentives under the framework. Distributors had stronger incentives to realise efficiency improvements as it could improve their profitability. Second, the incentive for efficiency gains was sustained throughout the regulatory period thus creating an incentive to improve efficiencies in every year. Third, provide an incentive for distributors to reveal their efficient cost levels in order to claim the carryover amount for the next regulatory period, thus reducing the information asymmetry between the distributor and the regulator.

Regulators have also recognised that the incentive for cost efficiencies should not come at the expense of service standards. As a result, some regulators introduced service incentive arrangements that financially reward or penalise distributors for their performance against a set of service standard targets.

A common example of a service incentive arrangement is the S-factor scheme adopted in Victoria which adjusts the regulated price path for the degree to which the distributor outperforms or fails to meet its service standard targets. Where a distributor outperforms (underperforms) the service target, the S-factor is positive (negative) reducing (increasing) the size of the X-factor and thus allowing higher (lower) prices.

Together, the efficiency carryover mechanism and the service incentive arrangements increase the incentive for efficiency gains while also maintaining or delivering improvements in service levels.

In Victoria, the CPI-X building blocks approach combined with an efficiency carryover mechanism and service incentive arrangements has been highly successful in achieving the aims of incentive regulation — encouraging distributors to improve service and lower costs.

The service delivery and out-turn expenditure performance of the distributors during the 2001-05 regulatory period can be characterised as having achieved more in terms of service delivery, but with significantly less expenditure than the distributors considered necessary in their proposals to the last price review. On readily available

*measures of industry performance, this combination of outcomes can only be described as virtuous — more has been delivered, for a cost less than expected.*¹³

However, this framework may also have led to some unintended outcomes that have precipitated some modifications to its features. For example, the application of the efficiency carryover mechanism to capital expenditure during the 2001-05 regulatory period in Victoria may have created an incentive for electricity distributors to inefficiently defer required capital expenditure. Over the 2001-05 period, the Victorian electricity distributors' reported capital expenditure was 22 per cent below that forecast at the time of the price review. However, the distributors then proposed a level of capital expenditure for the 2006-10 period that was 54 per cent higher than reported capital expenditure. As a result of this experience, the Commission removed the efficiency carryover mechanism from capital expenditure in the 2006-10 regulatory period because customers may have been at risk of funding efficiency carryover rewards on efficiencies that were not sustainable and which would not result in sustained lower prices to customers.

A further evolution of the building blocks approach has been implemented in Victoria through the use of the 'inferential approach' to forecasting expenditure and the 'rate of change' approach to forecasting likely changes in operating and maintenance expenditure over time.

Much of the cost and complexity of building blocks price reviews results from the need to develop forecasts of capital and operating expenditure in order to determine the revenue requirement.

Traditionally, forecasting expenditure has required regulators to undertake detailed cost build ups of a distributor's expenditure profile. Detailed cost build ups entail a line by line assessment of a distributor's proposed expenditure. Such an assessment is complex, time-consuming, susceptible to gaming and ultimately requires the regulator to exercise a degree of discretion when determining the expenditure profile it will allow.

To assist in making decisions on expenditure forecasts, regulators have made frequent use of benchmarking studies and engineering cost models. 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.

The use of engineering cost models can result in over-estimation of the costs likely to be incurred. For example, in its price-service proposal for the 2006-10 price review, SP AusNet noted that by failing to reflect asset condition and service lives accurately, the PB Power capital expenditure projection model overstated its capital expenditure requirements by 40 per cent:

¹³ Essential Services Commission 2005 Electricity Distribution Price Review 2006-10, Final Decision, Volume 1 — Statement of Purpose and Reasons, p. 5.

[SP AusNet]¹⁴ 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, [SP AusNet] 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.

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 per cent across categories where sound historic failure rate data is available. Therefore, [SP AusNet] has adjusted the PB Associates model forecast down by 40 per cent across all categories to reflect the insights gained from the more detailed bottom up analysis.¹⁵

It is also noted that the actual expenditure undertaken by the Victorian distributors during 2001 to 2005 was 22 per cent lower than the regulator's estimates in the 2001-05 price review. These estimates relied heavily on engineering cost models.

The inferential approach was adopted by the Commission in the 2006-10 price review to determine the distributors' future expenditure requirements relied on the strength of the incentives inherent in the approach as enhanced by the efficiency carryover mechanism to infer that a distributor's revealed cost information was representative of efficient costs. Where the scope of activities is unchanged, the inferential approach narrows the scope of review to changes in costs driven by changes in the scope of the activities undertaken by the distributor.¹⁶

For operating expenditure, once the base level of expenditure was established under this approach, changes in operating expenditure over the period were estimated using the 'rate of change'. The 'rate of change' is defined as the year to year change in operating and maintenance expenditure for a number of factors such as expected productivity improvements, changes in the price of distributors' inputs and an allowance for the cost of growth.

The 'rate of change' relies on industry performance on historic movements in productivity and the cost of growth rather than forecasts of business-specific cost movements, reducing administrative costs. The index utilised for the rate of change in the 2006-10 price review was based upon the TFP trend calculated by PEG for the five Victorian electricity distributors.¹⁷

The rate of change approach results in the businesses 'competing' with industry efficiencies to realise rewards rather than specific business forecasts. This is similar to a workably competitive market where prices will tend to move based on industry-wide productivity improvements. Firms that outperform the industry-wide trend (or rate of change) will

¹⁴ SP AusNet submitted its price-service proposal under its parent company name of SPI Networks.

¹⁵ SPI Networks 2004 *Electricity Distribution Price Review 2006 Price-Service Proposals for the Period 2006-2010*, 21 October, pp. 78-79.

¹⁶ In the 2006-10 price review, changes in the scope of activities undertaken by distributors were termed 'step changes' and were confined to changes in function or legislative obligations.

¹⁷ Kaufman et al 2004 TFP Research for Victoria's Power Distribution Industry 2004.

generally receive higher returns than the other firms and retain those benefits for five years under the efficiency carryover mechanism.

2.2 Continuing challenges

Although the various modifications made to the building blocks model have strengthened the incentives of the framework and simplified the process, the framework still possesses a number of deficiencies — becoming more evident with repeated applications of the building blocks framework.

First, despite the evolution of the building blocks framework, price reviews remain resource intensive.

Second, issues associated with information asymmetry between the regulator and distributors remain. Even if the efficiency of past expenditures is revealed, the method still requires forecasts of efficient capital expenditure and estimates of step changes in operating expenditures.

Third, as long as the objective of regulatory approaches is to share the benefits of efficiencies with customers, regulated businesses will always seek ways to reduce the level of sharing. Where a distributor can find the means to retain the benefits in perpetuity, they will pursue those means.

In Victoria, nearly all of the distributors have entered into contracts for the provision of distribution services with related parties. Commonly, the price established in these contracts was set equal to the expenditure benchmarks set in the 2001-05 price review. It was these prices that were reported as costs in the distributors' regulatory accounting statements. As a result, any benefits of efficiency gains achieved in the provision of distribution services would be retained within the related party rather than revealed and returned to customers.

The breadth of corporate activity exacerbates the basic cost identification problem. 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.

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 and (perhaps) differences in regulatory methods employed. Companies serving multiple jurisdictions can also “double count” some of their common costs, so that the same costs recovered in a price determination in one jurisdiction are also recovered in another jurisdiction.

These corporate and restructuring arrangements create serious regulatory challenges and undercut the presumption that the costs that result under a high-powered regulatory regime are revealed to be efficient.

3 DESIGN, IMPLEMENTATION AND TRANSITION ISSUES

Introducing TFP-based approaches raises issues about what design features it should have, how it should be implemented and how regulators transition from the current CPI-X building blocks framework to a TFP-based approach.

Implementing TFP-based approaches requires more than simply estimating industry TFP and input price trends. It also requires that regulators address and balance a number of competing, and sometimes conflicting, objectives. These objectives include maintaining service quality, sharing benefits with customers and mitigating risk so that investment is attracted to the industry.

As noted in Chapter 1, the Expert Panel has raised a number of implementation issues associated with TFP-based approaches. The Panel noted the following critical issues:

- Deriving an estimate of industry-wide TFP is itself controversial.
- Development of robust TFP estimates depends crucially on the availability of long-term, reliable information on outturn costs as well as a range of physical input and output parameters.
- Assessing whether industry-wide TFP estimates need to be adjusted for company-specific characteristics that affect their long-term TFP growth.
- The need to develop rules regarding a productivity-based regulatory regime, such as:
 - the duration of price controls;
 - whether there are “triggers” for updating initial prices or X-factors and what form they take;
 - under what circumstances prices are adjusted to bring prices in line with costs; and
 - incorporating service incentive mechanisms into the design of TFP-based approaches.

Transition issues arise from the fact that distributors are currently regulated under the building blocks approach. In moving to a TFP-based approach, consideration needs to be given to how some of the features of a building blocks model, such as the service incentive and efficiency carryover arrangements, are addressed under a TFP-based framework.

In this Chapter, the Commission gives consideration to the practical design of a TFP-based approach and the issues associated with implementing such an approach. The Chapter also outlines the most important transitional issues involved and the Commission’s views for addressing each of these issues.

3.1 Design considerations

Determining the practical design of a TFP-based approach involves considering:

- whether one X-factor should be established for all businesses or company-specific X-factors developed;

- whether the X-factor should be fixed for the length of the regulatory period or updated on an ongoing basis during the regulatory term;
- the role of earning sharing mechanisms;
- the role of and arrangements for price control reviews; and
- the use of viability constraints and re-openers.

3.1.1 Number of X-factors

A TFP-based approach can be designed so that either a single X-factor applies to all firms within an industry or separate X-factors are established for each firm.

Whether more than one X-factor is required has been highlighted by the Expert Panel as an issue that would need to be resolved before a TFP-based approach was introduced:

... one question that may need to be addressed is whether or not it was appropriate to differentiate the long-term TFP estimate to be applied, by reference to the environmental characteristics of different energy networks. ... there may be a case for differentiating the TFP estimate to be applied to different categories of energy network service providers. Addressing such issues is likely to be contentious — as it has been in the United States — and may be hampered in Australia by the absence of long-term robust data on which to draw any such conclusions.¹⁸

The Commission is of the view that a single X-factor is preferable to company-specific X-factors because of its relative advantages. Most importantly, it ensures that the issues associated with company-specific estimates that exist currently are not incorporated in a regime designed to address these issues. However, more specifically:

- a single X factor is easier to implement and administer;
- it is easier to roll new companies into a productivity-based regime as data become available if there is a single X factor;
- a single X mitigates the incentives that could otherwise exist for companies to game their value of X by arguing that they face different exogenous conditions than the industry as a whole; and
- 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.

It is not necessarily the case that differences between firms' operating conditions will dictate the use of company-specific X-factors. Analysis undertaken by PEG suggests that company-specific exogenous factors may not dramatically impact on measured TFP gains.¹⁹ By decomposing the Victorian distributors' TFP trend, PEG quantified the impact of exogenous factors — scale and density effects — on each company's TFP growth compared to the industry as a whole. The difference between the impact of scale and density effects on a company's TFP trend and that on the industry's TFP trend ranged between 0.02 percentage

¹⁸ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 93.

¹⁹ Kaufman et al 2004 TFP Research for Victoria's Power Distribution Industry' December, p. 79-80.

points and 0.17 percentage points.²⁰ This compares with the overall industry TFP trend of 2.95 per cent.

It should also be noted that it is not necessarily correct that the approach taken to varying environmental characteristics has been controversial in the United States as the Expert Panel implies. PEG indicated to the Commission that differentiating X-factors to reflect differences in environmental characteristics has not been raised as an issue in any United States or Canadian energy TFP study or regulatory proceeding that it is aware of.²¹

In the United States, each company proposes its own TFP trend (and X-factor) but relates this trend back to evidence on the industry TFP trend as the basis for the X-factor proposed. The industry TFP trend is not tailored to the conditions of any specific company, although the value of the industry trend can vary depending on when the industry TFP trend is estimated. For example, Boston Gas and Bay State Gas in Massachusetts both used the same industry TFP trend to support their proposed X-factors even though there are differences between the companies' environmental characteristics.²²

Where X-factors do vary between companies, this is usually due to differences in 'consumer dividends' that share the expected benefits of additional TFP growth with customers. However, even these differences are small. For example, the difference between the X-factors for Boston Gas and Bay State Gas was 0.1 per cent.²³

In PEG's view, there is likely to be even less need for differing X-factors to reflect environmental characteristics in Australia than in the United States. Australia is not as economically diverse and does not contain as many distinct regions as the United States.²⁴

It is also unlikely that the relative efficiency between firms would warrant company-specific X-factors. In Victoria at least, most available gains in productive efficiency have likely been already realised by the privatised energy utilities. Variations between prices and costs should be addressed through the review of the start point rather than impact expectations in ongoing trends. Further, two building blocks price reviews have been undertaken and it is likely that these have taken account of these variations. This reduces the need for different X-factors to reflect differing expectations for incremental TFP gains and also reduces (even removes) the need for different levels of 'stretch factors'.

Even where relative efficiencies differ, it is possible to introduce differential productivity 'stretch factors' or 'consumer dividends' (as in the United States) which could be added to the industry TFP trend to reflect companies' differing levels of efficiency and their relative ability to realise future cost savings and thus avoiding the use of company-specific X-factors.

²⁰ For example, density effects contributed 0.06 percentage points to AGLE's TFP trend compared a 0.08 percentage point contribution at the industry level. Scale effects contributed 0.42 percentage points to AGLE TFP trend compared to 0.59 percentage points at the industry level (Kaufman et al 'TFP Research for Victoria's Power Distribution Industry' December 2004, p. 80).

²¹ Email Larry Kaufman (PEG) to Paul Fearon (ESC) 24 March 2006.

²² Email Larry Kaufman (PEG) to Dianne Shields (ESC) 29 March 2006.

²³ Email Larry Kaufman (PEG) to Dianne Shields (ESC) 29 March 2006.

²⁴ Email Larry Kaufman (PEG) to Dianne Shields (ESC) 29 March 2006.

3.1.2 Fixed or rolling X-factors

The difference between a fixed and rolling X-factor is the frequency with which the X-factor is updated during the term of the price controls.

A fixed X-factor would only be updated when the term of the price controls expired. Under this approach, the benefits of greater than anticipated industry-wide efficiency gains are only passed through to customers at the start of the next price control period, although distributors bear the risk of any unexpected increases in costs.

A rolling X-factor automatically updates the X-factor during the price control term according to formulas established at the outset. For example, the X-factor could be updated annually on the basis of new industry TFP data so that if productivity growth increases during the plan, the X-factor also increases. Conversely, if the industry faces large increases in costs, the X-factor decreases. As a result, the benefits of industry-wide efficiency gains are passed through to customers quickly as are any increases in costs — in this case, annually.

While fixed X-factors are more common, the Commission is of the view that rolling X-factors are more appropriate. The advantages of a rolling X-factor over a fixed X-factor are that:

- a rolling X-factor reduces the risk to distributors of any unexpected increase or ‘step changes’ in industry costs because these costs are reflected sooner in the X-factor and price trends;
- new companies or other jurisdictions can be rolled into the TFP trend annually than under a fixed X-factor regime where the inclusion of new companies would only occur at each price reset;
- updating prices annually may result in lower price volatility than under a fixed X-factor arrangement because prices should be more in line with industry cost levels;
- rolling X-factors should reduce the extent of the review undertaken at price resets, thereby reducing regulatory costs and diminishing the potential for gaming;

Other Australian observers have also pointed to a rolling TFP regime as a kind of ‘ideal’ that Australian regulation should strive for.

In many ways, the ‘rolling average’ X factor applied to US railroads represents an ideal to strive for in incentive regulation. This process involves an agreed and long established process for collecting the necessary data and calculating TFP growth. As information for the latest year becomes available, that for the sixth last year is dropped out and the rolling average is updated. However, it needs to be recognised that this is a much more mature regulatory process with a long history of data collection. Approaching this ideal will take time and, importantly, require ongoing effort on data collection and the specification of outputs and inputs.²⁵

One disadvantage that is often cited of a rolling X-factor is that it will increase the frequency of regulatory computations of the X-factors and thus impose higher regulatory costs than a

²⁵ E. Diewert and D. Lawrence 2004 Measurement Problems in Regulation, Presentation to the Australian Competition and Consumer Commission, July 22, p. 12.

fixed X-factor. However, this concern is perhaps overstated as updating the X-factor would be a largely mechanical calculation.

The Commission's preferred approach to implementing a rolling X-factor would have the following specific attributes.

- A formula for measuring TFP and input prices would be established at the outset of a TFP-based regime. Unless these formulas were demonstrated to have led to grossly inappropriate price adjustments, they would not be adjusted when the price controls were reviewed. Consistent measurement of industry TFP and input prices over time would enhance overall regulatory stability, increase investor confidence and reduce the potential for gaming (for example, opportunistic adjustments of the computation of TFP) on the part of both regulators and companies.
- The value of X for the first year of a productivity-based price adjustment would incorporate TFP and input price trends calculated from available data. For example, in Victoria, the trends that would apply in the 2011 regulatory period would be calculated using data available for the years 2000 to 2010. TFP and input price trends for other distributors could also be included if data are available for those distributors over the same period. However, it should be noted that the initial adjustment (P_0) might also require consideration of an appropriate adjustment to reflect a review of the 'start point'.
- The 'trend' in each variable would be measured as the average (arithmetic) rate of change in the metric over the 10 year period.
- The rolling X factor would be 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 the earliest year. For example, if the X-factor in 2012 was calculated using data from 2000 to 2010, the X-factor in 2013 would then be calculated using data from 2001 to 2011. The X factor would then be a 10-year moving average of industry-wide TFP and input price trends.²⁶
- New companies could be rolled into the computation of industry TFP trends following the last building blocks review of costs for those companies (see Section 3.1.4). All available, high quality TFP and input price data would be added for those companies at that time, assuming that the time series for those companies' TFP and input price information did not exceed 10 years. New information will be added for each company until 10 years of TFP and input price data were available, at which time the moving average computation would be implemented.
- Consideration may also be given to relying on a shorter data period where it is considered that broadening the data set by the introduction of new firms (potentially from other jurisdictions) is preferable to requiring a longer data series.

3.1.3 Earnings sharing mechanisms

TFP-based approaches share the benefits of efficiency gains achieved by updating the value of the TFP trend whilst providing distributors with a longer pay off period for efficiency

²⁶ This basic approach was also adopted in the US railroad indexing plan (although that plan eventually settled on a five-year moving average).

initiatives. This is directly translated into an updated value for X, affecting the prices that distributors are allowed to charge.

Typically, an earning sharing mechanism (ESM) adjusts a company's allowed prices when its rate of return has been in a certain range over a recent historical period. The mechanisms are established in advance of their use and typically function for several years. It is common for TFP-based approaches to incorporate ESMs in North America.

The advantages of earning sharing mechanisms are considered to be that they are relatively simple to understand, align the interests of shareholders and customers and benefits (that is, the amount of additional utility earnings distributed to customers or retained by shareholders) are transparent and easily computed. They are also claimed to keep a distributor's earnings within politically acceptable bounds.

However, ESMs reduce the incentives of the TFP-based framework because the benefits of each company's cost reduction efforts are likely to be shared immediately with customers. As discussed earlier, this reduces the benefit to the distributor to achieve efficiencies and the benefits that might otherwise be passed through to customers. The outcomes of such an approach are likely to be more aligned with the outcomes under rate of return regulation than incentive-based frameworks. A continued focus on earnings also maintains the potency of inherently controversial issues like cost allocations, transfer pricing, quality of data and profit measurement.

3.1.4 Price control reviews

Under a TFP-based approach, price control reviews would aim to ensure that outcomes were reasonable and the regime was operating effectively. Reviews would examine a company's historic costs and output for a test year based on information for the most recently available year. This test year examination would be more light-handed than in the building blocks model because a rolling X-factor is designed to generate prices that track changes in industry cost and productivity more or less automatically.

One issue that the Expert Panel has raised is under what circumstances the initial prices would be reviewed. In particular, the Panel noted that a common element of TFP-based approaches used in the United States is:

... the specification of some form of rule or principle under which either initial prices and/or the TFP-based rate of change in prices will be re-determined at a future review — the most common form of such a rule is that a review and/or re-determination will take place when the reported rate of return falls outside a defined band.²⁷

PEG has informed the Commission that such rules are rare in the United States. Almost all plans in the United States have fixed terms, although some plans have re-openers for extreme earnings outcomes.²⁸ In other words, it is more common for a period of time to trigger a review than a previously identified set of circumstances.

²⁷ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 91.

²⁸ Email Larry Kaufman (PEG) to Paul Fearon (ESC) 24 March 2006.

The Commission considers that this is the appropriate design of TFP approaches as the requirement to identify a set of circumstances that trigger a review is resource intensive and potentially undermines the incentives of the regime.

Hence, it is not necessarily correct that:

... the introduction of regulatory determinations that, while of nominally fixed duration, involve the specification of bands within which the out-turn rate of return on assets may fall before a review is triggered.²⁹

Thus, TFP-based approaches do not necessarily limit the extent to which achieved returns may exceed the target within the control period as the Panel suggests. Indeed, the key advantage of TFP-based approaches is that it de-links prices from a regulated firm's own costs and allows a firm to retain a greater share of the benefits of any efficiency gains made that are greater than the industry trend and retain those gains for longer.

The Panel also noted that:

Since virtually all price control setting methods (including the starting price in TFP-based methods) involve the need to determine a target or allowed rate of return, the potential for improving regulatory processes or principles as they relate to this component of re-setting price controls is not material to the merits of TFP-based approaches.³⁰

In the Commission's view, this conclusion is overstated and would only be true if there were a full, cost-based true-up of prices to costs at the end of the price control period. Under a TFP-based approach, prices established at price control reviews may not seek to extract all the economic rent that had been earned by a firm during the period. Instead, where a firm had outperformed the industry trend, the firm would retain the additional gains creating strong incentives for achieving efficiency improvements into the future. Therefore, there is less need to focus on and adjust the rate of return under a TFP-based approach.

It is important to note that there is a distinction between the initial price review that introduced the TFP-based approach and subsequent reviews. The initial price review may look more like a traditional building blocks review than subsequent reviews as it would aim to establish a set of start prices that would provide a foundation for a sustainable, long-term relationship between prices and costs under TFP. The initial review would:

- examine company-specific costs, although the examination would be entirely backward-looking rather than focussed on developing forecasts;
- adjust initial prices for any step changes in distributor functions that occurred over the previous controls and for which companies were not previously compensated; and
- make any adjustments necessary to transition to a TFP-based framework — transitional issues are discussed in Section 3.3.

²⁹ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 91.

³⁰ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 89.

The Expert Panel has also questioned the duration of time that price controls established under a TFP-based framework should remain in place.³¹

There is the potential for regulatory periods under TFP to operate for much longer periods than five years — five years being the common length of current regulatory periods in Australia. However, five-year periods should be considered a ‘default option’ for TFP-based approaches and, in particular, may be the optimal time for the first regulatory period in which TFP is used in order to allow early assessment of how well the framework is operating.

3.1.5 Viability constraints and re-openers

Another design issue raised by the Expert Panel is whether other triggers for updating either initial prices or X-factors might be required and what form they should take.³²

In the Commission’s view, any further triggers considered under TFP-based approaches should be consistent with those that currently exist. For example, in Victoria, clause 3.2 of the Victorian Tariff Order allows 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.

3.2 Implementation issues

The issues associated with implementation include data collection and the methodology used to derive a TFP trend.

3.2.1 Data collection

The Expert Panel notes that the quality of information available in Australia may restrict the adoption of TFP-based approaches:

*... the development of robust TFP estimates depends crucially on the availability of long term, reliable information on outturn costs of supply as well as a range of physical input and output measures, ideally for a large number of firms operating in the relevant industry. ... By contrast, the quality and robustness of regulatory accounting information in the Australian energy sector is poor, and varies from one jurisdiction to another.*³³

³¹ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 94.

³² Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 94.

³³ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 93.

The Commission is also of the view that there needs to be better regulatory cost accounting throughout Australia. Reforms are needed to improve cost reporting, enhance the ability to compare accounts through transparency and disclosure of adjustments, allocations and changes in policy and, if necessary, increase access to the costs of parent companies and related parties.

A proper evaluation of these issues goes beyond the implementation issues pertaining to TFP-based approach and is central to any form of regulation. Determining appropriate reforms also requires further examination of existing data sources in various jurisdictions throughout Australia.

TFP-based approaches cannot eliminate the regulatory concerns over the accuracy of the cost information reported by distributors. In all forms of monopoly regulation that rely on business-specific cost information, there will be an incentive to report or represent costs that are greater than the efficient level. Hence, there will always be a need to carefully review reported expenditure to ensure that it accurately reflects the efficient provision of distribution services.

However, under TFP, distributors have less of an incentive to misrepresent their costs than they have under the building blocks framework because how a company reports its costs will only affect its own prices indirectly. For example, the way that a company allocates its costs will affect the company's own prices only to the extent that these higher costs reduce the industry TFP trend. The same may be true for arrangements designed to achieve transfer pricing — they may distort the reported costs for the individual firm but not necessarily affect the industry-wide trend. Constant review of compliance and changes should allow these issues to be identified and addressed before they are incorporated into TFP trends.

It is also important to note that the data requirements for TFP are not large and fall into four categories:

- Output data — total number of customers delivered, total volume delivered and peak demand;
- Revenue data — for total number of customers, total volume and peak demand to weight them in determining the output index;
- Cost data — total operating and maintenance expenditure; the optimised depreciated replacement cost of distribution plant for the earliest year available; and the dollar value of additions to distribution plant;
- Input prices — input price indexes.³⁴

There are data beyond these basic requirements that could improve the estimation of a TFP trend if it is available, but which are not necessary for the estimation of a trend:

- Output data — measurement of the TFP trend could be improved if the delivery volume was broken down into customer segments and corresponding revenues were available. This breakdown could be as simple as residential, commercial, and industrial. A breakdown by tariff or tariff element is also useful.

³⁴ When estimating the TFP trend for Victoria, PEG constructed input price indexes and capital stock measures using data sourced from the Australian Bureau of Statistics.

- Cost data — measurement could be improved if data were available on the salaries and wages associated with operating and maintenance expenditure and superannuation contributions and other elements charged to operating and maintenance expenditure. The need and usefulness of this information is reducing as regulated businesses undertake high levels of contracting out.
- Input prices and quantities — measurement could be improved if data on labour quantity (number of employees) or the cost of labour (\$ per employee) were available.

In developing an estimate of TFP for the Victorian distributors, PEG has noted that the data available in Victoria was superior in some respects to the information available in the United States where the use of TFP-based approaches is more prevalent.

We believe the DB data are more than adequate for rigorous productivity research. Indeed, the breadth and quality of the Victorian data are superior to analogous US data in several respects. For example, US data on distribution system peak demand tend to be either flawed or unavailable. Information on tariff revenues associated with specific outputs (e.g., customer numbers) are also generally unavailable in the US. The availability of tariff revenue and peak demand data in Victoria leads to more detailed and precise measures of DB output than is typically the case in US power distribution TFP studies.³⁵

3.2.2 Deriving an estimate of TFP

A TFP index is the ratio of an output quantity index divided by an input quantity index. Hence, an industry TFP index would be computed by calculating indexes of total output quantity and total input quantity for a sample of firms in the industry. The growth in such an index over a multi-year period would equal the industry trend in TFP.

The input quantity index is computed by aggregating the quantities of labour, other operating and maintenance expenditure inputs and capital inputs into a comprehensive input quantity measure. The output quantity index is computed by aggregating individual output quantities into a comprehensive output quantity measure.

Two index forms (the Tornqvist index and the Fischer Ideal index) are almost universally employed in productivity research. These indexes aggregate inputs and outputs in specific and well-defined ways.

The Panel stated that:

... the task of deriving an estimate of industry-wide total factor productivity is itself controversial. ... TFP estimation might itself be characterised as involving as much 'art' as hard science and it could not reasonably be expected that regulators and service providers will reach ready agreement on the precise approach and its outcomes.³⁶

Experience with TFP-based approaches tends to suggest that it is possible to derive and then consistently apply a robust industry-wide TFP trend to the regulation of utilities. The earliest

³⁵ Kaufman et al 2004 TFP Research for Victoria's Power Distribution Industry December, p. 6.

³⁶ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 93.

price indexing plans in the United States were introduced in the 1980s and more than 20 TFP-based approaches have been introduced into the North American gas and electric utility industry since the early 1990s. The experience with TFP in the United States demonstrates that it is a robust regulatory approach, with debate on the magnitude of the relevant trend being confined to a relatively small range of estimates, for example 1.5 per cent versus 2 per cent.

Further, even if the methodology used to derive a TFP trend is controversial, it is probably no more controversial than the decisions that are made about methodology under other regulatory approaches. For example, the methodology used for determining the expenditure requirements in the 2006-10 electricity distribution price review (the inferential approach) was strongly criticised by the Victorian distribution businesses.³⁷

It should be recognised that any regulatory approach that reduces the gaming opportunities for the regulated businesses will always be strongly criticised by those businesses.

The Commission also notes the Panel's further points that:

*... the use of a measure of long-term industry-wide [TFP] to set the X-factor which, together with the CPI, determines the allowed rate of change in average prices/revenues for the regulatory period.*³⁸

It should be noted that CPI is almost never used as an inflation measure in US TFP-based plans because it computes upwardly-biased calculations of inflation (see for example Boskin Commission Report 1996). The most common inflation measure used is the gross domestic product price index (GDP-PI) because it is considered a better underlying measure of inflation. In addition, several plans directly use measures of industry input price inflation, not economy-wide measures. Industry-specific input price inflation measures are the rule in California.

3.3 Transitional issues

Although the Expert Panel did not explicitly discuss transitional issues, in this section, the Commission sets out some of the transitional issues that will need addressing if TFP is implemented in Victoria. These include the treatment of any remaining balances from the efficiency carryover mechanism, whether changes are required to the services incentive mechanisms and whether regulatory or economic depreciation should be used under a TFP-based approach.

3.3.1 Efficiency carryover mechanism

As noted in Chapter 2, efficiency carryover mechanisms have been introduced into CPI-X building blocks approaches in order to increase the power of the incentives created by the framework.

³⁷ Essential Services Commission 2005 Electricity Distribution Price Review 2006-10, Final Decision, Volume 1 — Statement of Purpose and Reasons, p. 258.

³⁸ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 91.

TFP-based approaches are an optimal form of efficiency carryover mechanism. Distributors can retain a greater share of any benefits from efficiency gains that are greater than the industry trend in efficiency and retain those benefits for longer. Where a company continues to outperform the industry trend, it can maintain the benefits of the gains made in perpetuity.

Nevertheless, in jurisdictions where efficiency carryover mechanisms are currently operative, distributors may have carryover balances at the start of the first TFP regulatory period.

Consequently, how these balances are treated under TFP needs consideration. The two main options are:

- an amortization of the carry-over amounts over the term of the TFP controls, as if the ECM continued to operate over the succeeding controls as in a building block approach with an ECM; or
- an upfront adjustment (that is, an adjustment in the start price) at the outset of TFP, equal to the NPV of any carry-over balance at the end of the expired controls

In the Commission's view, an upfront adjustment to prices to allow for any carryover balance would be the most effective and efficient way of dealing with carryover balances.

3.3.2 Service incentive arrangements

As noted in Chapter 2, some regulators have introduced service incentive mechanisms that aim to ensure that any reductions in expenditure are due to efficiencies and not a deteriorating level of service. The Expert Panel has highlighted the future of service incentive mechanisms as one issue that needs resolution before a TFP-based approach can be introduced.³⁹

The S-factor scheme that operates in Victoria adjusts the regulated price path for the degree to which a distributor outperforms or fails to meet its service targets. Where a distributor outperforms (underperforms) the service target, the S-factor is positive (negative) reducing (increasing) the size of the X-factor and thus allowing higher (lower) prices.

It is important to note that, under this framework, service performance is regulated externally to the setting of the price controls. That is, the X-factor is calculated using the standard building blocks formula, while the S-factor is then used to adjust the size of the X-factor after the fact.

The S-factor scheme is often complemented by a Guaranteed Service Level (GSL) Payment scheme under which payments are made directly to customers where the performance received by those customers is worse than a specific threshold.⁴⁰

The Commission is of the view that some form of service incentive mechanism will be required to create incentives for distributors to deliver appropriate service outcomes to customers. This is the case regardless of whether building block or TFP methods are used to set the price controls.

³⁹ Expert Panel on Energy Access Pricing 2006 Draft Report to the Ministerial Council on Energy, March, p. 93.

⁴⁰ Further information on the S-factor scheme and GSP Payment scheme can be found in Essential Services Commission 2005 Electricity Distribution Price Review 2006-10, Final Decision, Volume 1 — Statement of Purpose and Reasons.

However, the Commission believes that there need not be any fundamental change to the approach currently in place. In other words, the S-factor would continue to adjust the size of the X-factor with the X-factor determined using TFP and input price trends rather than the building blocks and a GSL Payment scheme could continue to operate in association with the S-factor scheme. This would accommodate the incorporation of S-factors into the design of re-openers and the initial price setting process as these will only impact upon the calculation of the X-factor, after which the S-factor would then be applied.

It has been suggested that the TFP measures used in a TFP regime should include service performance measures as outputs.⁴¹ Were this to occur, then service performance would directly impact upon the calculation of the X-factor — that is, service performance would be internal to the calculation of the X-factor. As a result, the CPI-X price control would be directly regulating service performance as well as prices.

There are fundamental issues with including service performance measures as outputs in the calculation of a TFP trend. These are as follows:

- There are conceptual concerns about whether the X-factor should reflect both industry unit cost trends and service quality performance. In particular, preliminary analysis done by PEG suggests that it could potentially create conflicting and unintended incentives (see Box 3.1).
- There is a lack of audited, historical time series on data on reliability that is calculated comparably across the distributors.
- It is not clear how many reliability and quality measures should be included in TFP measures — SAIDI; SAIDI and SAIFI; or SAIDI, SAIFI, and MAIFI.
- It is not clear what weight or weights should be applied to reliability measures, which is particularly problematic as more reliability measures are added to the index.
- It is not necessary to complicate the approach to achieve the objective.

⁴¹ For example, see Meyrick and Associates, *Review of Pacific Economics Group Report “TFP Research for Victoria’s Power Distribution Industry”* available on the Commission’s website.

Box 3.1: Incentives created by including service performance measures as outputs into the calculation of a TFP trend

Assume that a distributor 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 penalized 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 distributor'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.

Source: PEG 2005 Evaluation of Meyrick and Associates: Review of PEG TFP Report, February.

3.3.3 Regulatory or economic depreciation

Historically, regulators in Australia have taken a 'hands off' approach to depreciation — that is, regulators have accepted the depreciation profiles chosen by distributors. The rationale for this approach is that the rate of depreciation used does not affect the net present value of a firm's forward-looking costs but only affected its timing. For example, while a firm could increase revenues now by increasing the rate at which it depreciated its regulatory asset base, doing so would also reduce the value of the asset base and thus reduce the level of depreciation in the future. In theory, the net present value of increasing current revenues through higher depreciation rates equals the net present value decline in future revenues due to a decline in the company's asset value.

However, allowing distributors to choose their own depreciation profile may create an incentive for distributors to increase their depreciation rates in order to inflate their current cash flows. In particular, this incentive may occur where the distributors are confronting large P_0 s as a result of a building blocks price review. In order to reduce the size of the P_0 and thus protect their cash flows, distributors may artificially increase the rate at which they depreciate their assets. For example, during the last two price reviews in Victoria, distributors have chosen average depreciation rates consistent with average asset lives of between 15 and 18 years which are well below the economic lives of distribution assets. Further, there has been a change in approach to depreciation adopted by the distributors in response to large price cuts foreshadowed in Draft Decisions.⁴²

While in theory depreciation rates affect only the timing (rather than value) of cash flows, the choice of depreciation rate will affect the stability of prices over time and, under a TFP-based approach, the 'level' at which the trend is applied.

⁴² Essential Services Commission 2005 Electricity Distribution Price Review 2006-10, Final Decision, Volume 1 — Statement of Purpose and Reasons, p. 327-329.

Therefore, in transitioning to a TFP-based approach it is likely to be appropriate to review existing levels of depreciation against economic lives.

Transitioning to economic lives is likely to affect the start prices for a TFP-based regulatory approach but only likely to have a minimal impact on the TFP trend. In recent work undertaken by PEG, PEG suggests that changing from economic to regulatory depreciation is likely to affect the TFP trend by no more than 0.1 per cent per annum.

The extent to which any change in depreciation requires transitional price adjustments depends, in part, on the amount of rent that is left with distributors. Less focus on rent extraction by regulators generally reduces the need for transitional price adjustments for factors such as a change in depreciation treatment.

Economic depreciation is more consistent with how assets are actually utilised over their lifetimes and thus should lead to fewer financial and price discontinuities in regulation in the future.

4 APPLICATION OF TFP-BASED APPROACHES TO TRANSMISSION

The discussion in this paper has focussed on the relative merits of applying TFP-based approaches to the regulation of distribution services. However, it is valuable to consider whether TFP could be used in the regulation of transmission networks.

The Panel concluded that TFP-based approaches offer the most potential for industries where the estimate of long-term TFP growth represents a relatively good estimator of future cost or demand changes. On this basis, the Panel concluded that TFP-based approaches were more appropriate for the regulation of distribution services rather than transmission services because the transmission capital investment profile is more ‘lumpy’ than distribution.

The Commission agrees with this conclusion by the Expert Panel. There are important institutional and technological differences between energy transmission and distribution networks that may in the short to medium term limit the scope for using TFP to regulate transmission services.

First, transmission investments may lead to higher costs but can still produce customer benefits by promoting market-wide efficiencies through the effective operation of wholesale markets. Gas and electricity transmission networks integrate diverse energy supply sources and hence play a critical role in facilitating effective energy market competition.

This contrasts with energy distribution networks which primarily deliver services to end-users and have much less impact on the operation of upstream wholesale markets. At the distribution level, there is a much more direct link between the efficiency at which services are provided and the prices paid by end-users.

Second, the pattern of capital investment differs between transmission and distribution. 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.

The lumpiness of transmission investment is likely to make TFP trends estimated at the transmission level less stable than those at the distribution level. 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) declines. In contrast, a period where investments are either not necessary or are not undertaken is more likely to register relatively rapid TFP growth.

The potential instability of the TFP trend could limit the appeal of using a TFP-based approach to regulate transmission services. Also, TFP-based approaches link allowed price changes to trends in the industry TFP and thus the price path of a specific company cannot be adjusted to accommodate any lumpy investments that that company may need to undertake.

Approaches that are more cost-based, such as the building blocks framework, can accommodate situations where the investment profile is lumpy and uncertain because they are more closely tied to a company's own cost base.

Third, there is more diversity in the institutional arrangements governing energy transmission networks than distribution networks. Some gas and electricity transmission connections are not regulated. Some jurisdictions (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 jurisdictions this is not mandatory.

TFP-based approaches may be inappropriate where there is diversity in institutional arrangements because of its reliance upon an estimated industry-wide TFP trend. In other words, a TFP-based approach applies a 'one-size-fits-all' approach that may not take into account the different drivers that different companies may face.

In contrast, the institutional arrangements governing distribution networks are more uniform between jurisdictions. All distribution networks are regulated, there is no separation of network ownership and planning and distributors in each jurisdiction are responsible for implementing their planned investments.