Appendix A
Terms of reference

Pursuant to s. 45 of the National Electricity Law (NEL) and s. 83 of the National Gas Law (NGL), the Australian Energy Market Commission (Commission) has initiated a review into possible applications of a total factor productivity (TFP) based methodology in the determination of prices and revenues (Review).

Objective of the Review

This Review is seeking to provide advice to the Ministerial Council of Energy (MCE) on:

- the circumstances in which an application of a TFP based price setting methodology would contribute to the NEL and NGL objectives;
- the arrangements including information, reporting and data requirements that need to be put in place to facilitate its application; and

as appropriate, the development of proposed rules to support the applications of a TFP based form of control for any individual or group of electricity or gas distribution or transmission service providers.

Scope of the Review

Clauses 26I and 26J of Schedule 1 to the NEL and clause 42 of Schedule 1 to the NGL set the following matters relating to the use of a TFP methodology in revenue and pricing decisions and determinations on which the Commission may make a rule on:

a) making or amending an electricity (distribution or transmission) determination;

b) making an electricity access determination;

c) the use of a TFP methodology as an economic tool to inform and assist the Australian Energy Regulator (AER) in the application of the building block approach in making or amending electricity determinations or making electricity access determinations;

d) approving or making (or approving or making revisions or variations to) a full gas (distribution or transmission) access arrangement;

e) for the dispute resolution body to make a gas access determination;

f) the use of a TFP methodology as an economic tool to inform and assist the AER in the application of the building block approach in approving or making (or approving or making revisions variations to) full gas access arrangements; and

g) the use of a TFP methodology as an economic tool to inform and assist the dispute resolution body in applying or assessing the application of the building block approach in making gas access determinations.

The Commission will assess the suitability of each of the above possible applications as part of this Review.

Approach to the Review

In seeking to address the above objectives, the Commission will undertake a staged approach. The two stages are as follows:

Stage 1: will identify

a) the circumstances in which the use of a TFP based price setting methodology would contribute to the national electricity objective (NEO) and/or the national gas objective (NGO) in each of the possible applications identified in the scope of the review; and

b) whether those circumstances exist, or are likely to exist, in the National Electricity Market (NEM) or any market for natural gas services.

Stage 2: will develop draft rules (for either the National Electricity Rules and/or National Gas Rules) to support the application of a TFP based methodology for revenue and pricing decisions and access determinations, as appropriate to the recommendations made in stage 1.

Considerations

In conducting this Review, the Commission shall have regard to:

- MCE statement of policy principles;
- previous reviews and rule determinations relating to framework for energy regulation;
- the Expert Panel's assessment and findings on the use of TFP methodologies in revenue and pricing decisions; and
- analysis previously conducted by the Essential Service Commission of Victoria into the application and use of TFP.

This Review will be conducted in an open and transparent manner to provide all interested stakeholders with the opportunity to contribute at each stage of the Review process. The Commission will have regard to stakeholders' opinions raised during the course of the Review.

Timing and outputs

The Commission will deliver the following outputs for this Review:

- A **Framework and Issues Paper**, which will identify and consult on the range of issues requiring consideration and inform interested parties on the Commission's proposed assessment criteria;

- A **Stage 1 Draft Report**, which will set out the Commission's proposed recommendations on whether an application of a TFP methodology would promote the NEO and/or NGO; and
- A **Stage 1 Final Report**, which will set out the Commission's findings on whether an application of a TFP methodology would promote the NEO and/or NGO. The Commission will provide this report to the MCE for its consideration and brief it on its findings.

This process for Stage 1 can be summarised as follows:

Milestone	Timing
Framework and Issues Paper	December 2008
Framework and Issues Public Forum	February 2009
Stage 1 Draft Report	June 2009
Public Forum	June 2009
Stage 1 Final Report to MCE	August 2009

If the Commission considers that an application of a TFP methodology would promote either the NEO and/or the NGO it would then draft recommended rules under stage 2. The Commission intends to submit any such proposed rules to the MCE by November 2009. Stakeholders will be given an opportunity to comment on any draft proposed rules before the Commission provides them to the MCE for consideration.

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Appendix B
TFP and its roles in incentive regulation

Total factor productivity measures how businesses, industries or regions use all the inputs in their production processes (which includes capital, labour, materials and services) to produce outputs that are valued by customers. Regulators in overseas jurisdictions have used estimates of the industry growth rate of TFP in setting the revenue paths for network businesses and, in some cases, information on relative TFP levels has also been used.

This Appendix explains TFP, discusses the methodologies which can be used to derive TFP growth indices and the rationale for applying TFP in economic regulation.

B.1 Estimating TFP Growth

TFP measures capture how effectively a business (or a group of businesses) employs all of its inputs in order to produce its outputs. TFP growth is measured by the proportional change in output quantity divided by the proportional change in input quantity. The trend growth in TFP measures the average annual rate of change in productivity over a period of time. Hence TFP indices can be used to make comparisons between businesses at a specific point in time, as well as the performance of businesses (or the industry) over time.

Mathematically, TFP growth is calculated as:

$$\frac{\text{Proportional change in quantity of total output between the current period and the base year}}{\text{Proportional change in quantity of total inputs between the current period and the base year}}$$

To compute this measure, a methodology is needed to combine changes in the quantities of a diverse range of outputs and inputs into measures of the change in total output quantity and total input quantity, respectively. There are two broad approaches to doing this — the index number approach and the econometric approach. Both methods typically assume a flexible underlying production structure.

There are a number of advantages, as well as limitations, of each approach. In practice, index number approaches are predominantly used, particularly where there are a limited number of observations available. The index number method is relatively transparent and the results are readily reproducible. There is no practical limitation on the number of outputs and inputs that can be considered in the index number analysis, which is important since the TFP growth index ideally needs to include as many of the business's inputs and outputs as possible.

But the index number approach does not provide information on statistical properties such as confidence intervals. The econometric approach can provide

information on confidence intervals and statistical properties but typically requires a relatively large number of observations to be tractable. Furthermore, analysts can make alternative assumptions regarding error structures and estimation methods making the method less transparent and the results difficult to reproduce. [54]

There are a number of alternative index number methodologies that can be used under the index number approach. However, they all form measures of the changes in total output quantity and total input quantity from changes in the quantities of individual outputs and inputs, respectively. The differences between the methodologies mainly relate to the method of aggregating changes in individual components into the change in the overall output or input measure. Each calculation has different qualities and there is not one commonly accepted methodology used in estimating TFP. In practice, regulators tend to use either the Fisher or the Törnqvist indexing method.

For whichever particular index method is used, the following items are needed to calculate the industry TFP growth rate:

- the selection of the group of comparable businesses (defining the industry) over which to calculate the measure;
- the specification of the businesses' outputs and how to measure each;
- the specification of the businesses' inputs and how to measure each;
- the methodology for determining the weights for each output and each input in total revenue and total cost, respectively; and
- the time period over which TFP growth is to be calculated.

Output measures used should present the basket of services provided by the network business, with customer numbers, system capacity and volumes tending to be the main output dimensions included. The input variables that tend to be included cover both operational expenditure and capital inputs. The selection of which outputs and inputs to include in the calculation will often depend on the availability of data. As shown in the Brattle International Review report, the specification of network outputs and inputs has varied across the jurisdictions which have adopted TFP measures in network regulation.

The TFP growth calculation can be sensitive to the data set used and the methodology employed. There is often debate about the appropriate methodology to employ, the time period over which to undertake the calculation, the basis for including or excluding businesses in the base data and how output and input quantities should be measured. These methodological issues are discussed further in section B.4.

[54] One potential advantage to the econometric approach is that it can provide a wider range of results than the index approach since it is possible to determine scale and scope economies in addition to TFP growth rates.

B.2 Use of TFP in incentive regulation

B.2.1 The aims of incentive regulation

The aim of incentive regulation is to provide strong incentives for regulated businesses to reduce costs, improve service quality, and undertake efficient investment. The incentive to reduce costs is provided by setting the prices or revenue to apply during the regulatory period at the start of the regulatory period, regardless of what actual costs during the regulatory period turn out to be.

In doing so, incentive regulation attempts to replicate the discipline competitive market forces would impose on the regulated business if they were present. These forces compel businesses that realise productivity gains to pass these gains on to their customers in the form of lower prices, after accounting for changes in input prices. In a competitive market, output prices in the economy would grow at a rate equal to the growth rate of input prices net of productivity growth. This can be illustrated as follows:

(change in) allowed prices = (change in) input prices – (change in) productivity

There are two distinct aspects to incentive regulation. They are determining

- the initial level of the cap; and
- the rate of change to the cap.

The cap can either be on allowed revenue or prices and is estimated by the regulator to reflect the efficient level of costs for the business. Hence the business is incentivised to out-perform that cap. The rate of change sets the allowed path at which the business's inflation adjusted prices or revenues may change over time.

In incentive regulation, the rate of change is typically represented by a 'CPI-X' term. The X factor consists of two aspects: a) the estimation of the expected efficiency gains of the industry net of the general economy wide efficiency growth, and b) an allowance for the difference between the growth of input prices for the business and the economy wide input price growth rate.

The initial level of the cap and the rate of change to the cap – the X factor – can be set either according to business-specific analysis of costs, or on the basis of external benchmarks.

B.2.2 Building block methodology

The building block approach involves business specific analysis and determines the initial cap and the rate of change through summing up forecasts of the return on capital, depreciation, and operating and maintenance expenditure. The typical building block process is for regulators to assess business plans, make judgements about expenditure needs, make assessments about the scope for cost reductions, and then to set an allowed revenue over the regulatory period that provides the business with sufficient expected revenue to cover efficient costs including an appropriate rate of return.

Box 3.1: Building block methodology

The key features of the building block methodology to incentive regulation as applied in Australia are:

- the periodic determination of price or revenue caps that apply for a fixed term, usually of five years, and indexed to the CPI;
- the establishment of a regulatory asset value for fixed assets as at the beginning of each regulatory period, with this asset value derived by taking that determined at the beginning of the last period and updating it for additions, depreciation and disposals;
- the establishment of company-specific, forward-looking estimates of efficient operating costs, capital expenditure, depreciation and corporation tax for the period;
- where price (as distinct from revenue) is the control parameter, the establishment of forecast demand over the regulatory period;
- the bringing together of all the above information in an arithmetical calculation that derives one or more X factors for each year of the control period so that the net present value (NPV) of forecast revenues is equal to the NPV of forecast costs, including the cost of capital; and
- the possible inclusion of a range of incentive mechanisms (efficiency carryover mechanism, quality of service, demand management incentives).

Under the building block approach, the X factor is set to reflect the efficient level of expenditure that the business would need to incur over time to meet the required levels of service reliability and quality, expected demand growth and cost of capital financing. In doing so, the regulator is required to make assumptions about the future productivity of the business.

Under the current framework for electricity building block based determinations, the X factor used in the CPI-X formula does not always reflect efficiency but instead is used to smooth the revenue requirement over the period. The X factor is set to equal the net present value of allowed revenue over the control period to the total revenue requirement. Any efficiency adjustments are determined in setting the efficient level of costs for each component to the building block methodology.

Implementing a building block methodology is a very information intensive exercise and focuses on the service provider's own costs and estimates of what its efficient costs might be. It has the potential advantage of being able to focus on the specific circumstances facing each service provider and to be forward–looking. However, the

analysis of what the service provider's efficient costs might be subjective and non–reproducible as it depends on professional opinion rather than an explicit model.

The regulator invariably faces information asymmetry relative to the service provider and there is a risk the regulator can be 'gamed' by being mislead about the true level of efficient costs and how quickly efficiency gaps can be bridged. To reduce this risk the regulator may take a relatively intrusive or 'heavy handed' approach to setting price caps.

B.2.3 TFP methodology

TFP indices provide the potential for an alternative approach, where the X factor is set according to an external benchmark. As explained above, TFP growth measures the productivity growth of a sample of businesses over a defined time period. If the initial cap is set to recover the efficient level of costs, and the historical TFP growth rate reflects productivity growth that can be expected going forward, then the business should be able to earn a reasonable rate of return and recover efficient costs if TFP growth measures are used to determine the X factor.

A TFP growth estimate cannot be used to assess the level of profitability of a business and so does not provide information on the appropriate level of prices in the first year of the regulatory period. Therefore, TFP tends to often be used in conjunction with another methodology to determine the efficient initial cap at the start of the review period. The Victorian Rule change proposal suggested using the current building block methodology to set the opening prices.

B.2.4 TFP measures in CPI-X price caps

If initial prices are set at the unit costs of providing the regulated services, then revenue would be expected to continue to align with cost over time if prices are permitted to rise by the expected growth in unit costs. The expected growth in unit costs is equal to the change in input prices net of productivity growth. Therefore, the formula that underlies the CPI-X approach is:

$$\Delta \text{ allowed prices for regulated business} = \Delta \text{ input prices for the industry} - \Delta \text{ industry productivity}$$

To use this formula, regulators have to choose a price index to reflect changes in the industry's input prices. The most common choice for this index is the consumer price index (CPI) because of its familiarity among stakeholders and its relative robustness. But the CPI is actually an index of output prices for the economy rather than input prices. Normally we can expect the economy's input price growth to exceed its output price growth by the extent of economy–wide TFP growth (since labour and capital ultimately get the benefits from productivity growth). Therefore:

$$\Delta \text{ consumer prices} = \Delta \text{ economy input prices} - \Delta \text{ economy productivity}$$

Including this relationship in the formula for allowed price changes for the regulated business leads to:

$$\Delta \text{ allowed prices for regulated business} = \Delta \text{ consumer prices} - \{[\Delta \text{ industry productivity} - \Delta \text{ economy productivity}] - [\Delta \text{ input prices for the industry} - \Delta \text{ economy input prices}]\}$$

Using TFP as the measure of productivity, the formula becomes:

$$\Delta \text{ allowed prices for regulated business} = \Delta \text{ consumer prices} - \{[\Delta \text{ industry TFP} - \Delta \text{ economy TFP}] - [\Delta \text{ industry input prices} - \Delta \text{ economy input prices}]\}$$

Therefore, the X factor should reflect the difference between expectations of TFP growth in the industry concerned and the economy as a whole less the difference between input price growth faced by the business and the economy as a whole. This is because allowed prices are indexed against changes in CPI which is equal to the change in input prices less the change in productivity in the economy as a whole. [55,56]

B.3 TFP as a benchmarking tool

Under this application, TFP measures could be used by the regulator to assist in making the determination of allowed revenue and prices under the building blocks methodology. The use of TFP measures as an external benchmark can inform the regulator on past performance and the likely extent of any future productivity gains. The regulator can then make use of this information when determining the efficient level of future expenditure.

There is some debate over whether TFP measures or partial factor productivity measures - which assess the efficiency with which a single input is used – should be used to assist the regulator in applying the building blocks methodology.

For individual components of the building blocks, using partial factor productivity (PFP) measures — which assess the efficiency with which a single input is used — might be more appropriate. For example, operating expenditure could be assessed against the benchmark of operating costs per unit of output in the industry, where output is a comprehensive measure covering throughput, customer numbers and system capacity.

However, PFP measures are often impacted by factor substitution effects which can result in misleading information. For example, if capital expenditure is substituted for operating expenditure it has the effect of decreasing unit operating costs. For this reason, Ofgem has used TFP, rather than PFP, measures to assist it in the determination of appropriate operating expenditure for service providers.[57]

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55 If we assume that the change in input prices for the industry is the same as for the economy as a whole, then the formula for setting the regulated prices reduces to:

$$\Delta \text{ allowed prices for regulated business} = \Delta \text{ consumer prices} - [\Delta \text{ industry productivity} - \Delta \text{ economy productivity}]$$

56 An alternative way of presenting this relationship is as follows:

$$\Delta \text{ allowed prices for regulated business} = \Delta \text{ consumer prices} - (\Delta \text{ industry TFP} - (\Delta \text{ industry input prices} - \Delta \text{ consumer prices}))$$

57 See pages 21 to 29, of the Brattle International Review report.

However, it is recognised that TFP acts as a better benchmark for total expenditure than just for operational expenditure.

Like the full TFP application, a methodology will have to be developed for the calculation of the TFP and PFP measures. However, the design parameters discussed in chapter 6 do not need to be addressed under this application. The key difference is that the allowed price path is not dependent upon the TFP measure, and that the TFP measure is not the only source of evidence that the regulator will have regard to when determining allowed revenue. The importance attached to the TFP measures in the decisions is a matter for the regulator to decide, and the service providers will still be required to submit a proposal utilising the building blocks approach.

The use of external benchmarking[58] – the comparison of a firm's costs to an exogenous reference level – can improve the quality of the building blocks methodology. In addition, it can be used to strengthen the incentives facing the service providers by rewarding them for closing the gap between their actual efficiency and potential efficiency. It may also reduce the costs to regulators of making judgements about efficiency compared to other methods. Use of total factor productivity measures is only one of several possible benchmarking techniques available to the regulator.

However, benchmarking is only a tool and cannot substitute for judgements based on a wider range of evidence, including assessment of the business's own cost forecasts. Also, it depends heavily on the robustness of the methodology used in calculating the external benchmark and the ability of the benchmark to capture business conditions adequately.

The current framework allows for the regulator to make use of benchmarking techniques within the building blocks methodology. The NER requires the AER to have regard to the benchmark expenditure that would be incurred by an efficient business in determining the operational and capital expenditure for both distribution and transmission businesses.[59] It also specifies that the rate of return should be that 'required by investors in a commercial enterprise with a similar nature and degree of non-diversifiable risk' as that faced by the service provider (clauses 6.5.2(b) and 6A.6.2(b)).

The NGR makes particular reference to benchmarking in rule 87 on determining the rate of return. That is, the rate of return must be consistent with the service provider meeting benchmark levels of efficiency and using a financing structure that meets benchmark standards. This is the only specific reference in the NGR to benchmarking. Nevertheless, the NGR does not prevent the use of benchmark information to assist in the determination of the other building block components.

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58 A benchmark is deemed to be external if a business cannot influence the benchmark against which it is assessed through its own actions.

59 See clauses 6.5.6(e), 6.5.7(e), 6A.6.6(e) and 6A.6.7(e) of the NER. The NER also allow the AER to take into account any analysis (such as benchmarking) that it has undertaken for the purpose of assessing a transmission service provider's application to amend its revenue determination where a trigger event for a contingent project has occurred (clause 6A.8.2(d)).

The ESC has made use of PFP information for benchmarking to determine forecast operating expenditure. An example can be found in the final decision for the gas distribution access arrangements for 2008-2012. In this instance, the ESC outlined its preferred approach as:[60]

- establish a base level of recurrent operating expenditure using 2006 reported costs
- establish a base level of operating expenditure for new functions (referred to as the step change)
- apply a rate of change to operating expenditure to reflect growth and productivity.

The rate of change used by the ESC was estimated with the aim of reflecting changes in cost drivers (for example, wages), productivity gains in the industry and output growth. This approach was also used by the ESC for electricity distribution service providers.[61]

B.4 Deriving TFP estimates

This section discusses the methodological issues that arise in the calculation of a TFP growth rate. Methodological issues are important because disagreement on them can often lead to arguments among stakeholders over a) model specification, b) estimation procedures and c) the robustness of the results.

B.4.1 Measuring outputs for network and pipeline service providers

Output components used in the calculation should present the basket of services provided by the network business. However, one of the challenges in calculating TFP for a network business is the specification of exactly what the business's outputs are and how to measure the quantity and appropriate weight given to each of them.

For both gas and electricity service providers, there are important dimensions to output other than simply the volume of deliveries or throughput. The primary role of the network is to provide the coverage and capacity necessary to be able to meet likely demand for throughput. The network has to be designed to serve the highest potential peak as well as actual day to day demand and to transport product to the points where customers demand it. [62]

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60 ESC, *Gas access arrangement review 2008-2012: final decision*, 7 March 2008, p. 215.

61 ESC, *Electricity distribution price review 2006-2010: final decision, volume 1 statement of purpose and reasons*, October 2005, pp. 196-212.

62 It is useful to consider this in the context of a road analogy. The distribution business has responsibility for providing the 'road', ensuring it is properly maintained and that it can handle actual traffic volumes but the distribution business has little direct control itself over the volume of traffic going down the road. To measure the distribution business's output a measurement of system capacity (the length of road, thickness of the pavement and the number of lanes) is needed and not just the volume of throughput (or traffic in the road analogy).

Another important component of a network business's output is the quality of supply. For electricity network businesses, quality of supply encompasses reliability (the number and duration of interruptions), technical aspects such as voltage dips and surges and customer service (e.g., the time to answer calls and to connect or reconnect supply). For gas networks quality relates to safety, interruptions and available pressure.

Quality improvements can be brought about by increased use of capital and/or operating costs, but if quality measures are not included in the range of outputs used in calculating TFP growth, estimates of TFP growth may be biased downwards.

There are a number of methodological issues that arise with incorporating quality measures into the TFP growth calculation:

- the choice of quality variables. It is important to choose quality variables that matter to customers. These are typically ones which regulators have chosen to monitor, and data on these variables can be available (although not necessarily consistently provided across businesses or over time); and
- more importantly, there is not yet a satisfactory way of incorporating common reliability measures as outputs in TFP calculations as increases in quality are reflected in a decrease in the index rather than an increase. It is also difficult to place an objective value on quality output components.

Due to the difficulty of incorporating quality as an output in TFP measures, most regulators have omitted quality from the TFP calculation and have sought to regulate quality through side constraints and separate service quality incentive mechanisms.

Another output measurement problem is how to treat distribution businesses that have invested in providing a higher level of reliability in their systems. For instance, if an business improves its system to achieve an 'n–2' rather than 'n–1' standard or invests heavily in undergrounding, it will face the same problem as that identified above in that it will receive no output recognition for this but be 'penalised' on the input side. But this higher level of 'insurance' may be valued highly by customers in which case it should ideally be recognised as increased output.

B.4.2 Measuring inputs for network and pipeline service providers

Similarly, the range of inputs component used for the TFP growth rate calculation must reflect as many of the factors of production used by the service providers in providing its outputs as possible. Labour, capital and intermediate (materials and services) inputs are the input components generally used in TFP studies. In some jurisdictions, operating and maintenance expenditure is used instead of labour and intermediate inputs due to the high level of contracting out of functions by the

network businesses. This has made identification of total labour inputs problematic.[63]

Defining an appropriate measure of the capital employed by a network business is another difficult challenge for TFP studies. There are a number of different approaches to measuring both the quantity and cost of capital inputs. The quantity of capital inputs can be measured either directly in quantity terms (e.g., using measures of line length adjusted for voltage differences and transformer capacity) or indirectly using a constant dollar measure of the depreciated value of assets. The main difference between these approaches is what they imply for the assumed physical depreciation profile of network assets.

Network assets tend to be long lived and produce a relatively constant flow of physical services each year over their lifetime rather than producing a given percentage less physical service each year. Consequently their true physical depreciation profile is unlikely to be (as proxied by the use of physical measures based on line length and transformer capacity) declining balance or straight line (as reflected in constant price depreciated asset value measures).

Therefore, TFP growth estimates which use the constant price depreciated asset value to measure the quantity of capital may over-state productivity growth since they will imply that annual capital input quantities for a particular asset have decreased over time, whereas they are more likely to have remained relatively constant.

A further problem with the use of constant price asset values to proxy capital input quantities is that the methodology used for setting the starting RAB may differ across the industry which means that changes in the RAB (which would affect estimates of TFP growth) are not comparable. Hence, comparisons with overseas businesses may be problematic if the different jurisdictions have applied different methodologies for determining asset bases. The use of replacement cost valuation methods versus historic cost methods would be a particular problem.

If there are substantial fluctuations in capital expenditure from year to year, then this would likely lead to volatility in the input index if asset value based capital quantities are used. This could lead to misleading results in the TFP analysis. This issue of investment lumpiness is one argument that has been raised against the use of TFP in determinations for transmission businesses.

There are also direct and indirect approaches to measuring the annual cost of capital inputs. The direct approach calculates an explicit annual user cost of capital which takes account of depreciation, opportunity costs and capital gains. The indirect approach allocates the residual between total revenue and operating and maintenance costs as the cost of capital inputs in any one year.

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63 Separate price and quantity series are required for each input. An appropriate price index has to be used to convert annual nominal expenditures to constant price terms which can then be used as a proxy for input quantities.

B.4.3 Determining the appropriate weights for outputs and inputs

Since the index number approach essentially forms a weighted average of the change in output and input quantities to form the change in aggregate output and input quantities, respectively, weights are required for each output and input component. TFP growth is then measured by the ratio of the change in the output quantity index to the change in the input quantity index over the period. Determining the appropriate weights is very important because the precise impact of each output and input component inevitably depends on its allocated weight.

For most industries which produce multiple outputs, revenue shares are used as the output weights as prices are set to reflect marginal costs and so revenue shares and output cost shares will coincide. However, for service providers the various dimensions of output are often not charged for separately and pricing structures have evolved to reflect billing convenience rather than to reflect underlying costs. In such circumstances, the choices are to use observed revenue shares (even though they are unlikely to reflect underlying costs) or to use estimated output cost shares which are usually derived from an econometric cost function. There is an ongoing debate over which of these approaches should be used.

Including quality measures as an output can make determining the appropriate weights more complicated. Ideally, this should reflect the value that customers place on quality compared to other characteristics. However, it can be difficult to find suitable proxies for the value consumers place on quality relative to other dimensions of output.

Likewise, input weights should represent the relative contribution of each input component to the total cost of producing the services. However, as discussed above, capital input costs can be calculated either directly from estimates of depreciation, opportunity costs and capital gains or indirectly as the residual between total revenue and operating and maintenance costs. If the business is not earning a commercial rate of return on its capital stock then there may be significant differences between the input weights that result from these two approaches to measuring capital input costs.

A related methodological issue is whether to vary the allocated weights over the sample period or to leave them fixed. The rationale for varying the weights is because the relative contributions of the input and output components change over time. Where sufficient information exists to produce year–specific weights these should be used. But in some cases (such as where econometric output cost shares have to be used) an overall average share may have to be used across all observations.

B.4.4 Scale effects

Economies of scale effects could potentially be important in a TFP analysis because strong scale economies would mean that when output is increasing over time, unit costs would tend to decrease even in the absence of any change in underlying productivity. Therefore, if there are economies of scale, unadjusted estimates of TFP growth could overstate the underlying trend during a period of increasing volumes.

For capital intensive industries such as network and pipeline service providers, when there is excess capacity, the marginal cost of supplying another customer with energy or supplying another unit is small, so economies of scale are considerable for small increases in output. However, when there is no excess capacity, or the increase is large enough to require additional investment, the need to expand networks means that economies of scale are considerably reduced.[64]

For the purpose of setting X factors in a mature and stable industry, scale economies may matter less. If volume growth in the future is expected to be at similar levels to the past, and scale economies are not expected to change much, then it would be necessary only to assess unadjusted TFP growth. However, if volume growth is expected to be different during the regulatory control period compared to the TFP calculation period, then an adjustment for scale effects may be required.

In the UK, including a scale effect in the estimation methodology reduced the calculated TFP growth by 0.2% to 0.3%.[65]

B.4.5 Exceptional and extraordinary past expenditure

One-off cost events may need to be addressed. These could be removed from the historical data to ensure that the TFP growth estimate properly reflects the long term efficiency trend. However, it is often difficult to isolate the impact of these events and they are, in any case, part of the cost of doing business and need to be recognised.

A related issue to consider is the degree of control the businesses had over their past expenditure. There may have been some cost items that were not within the businesses scope of control, (i.e., due to force-majeure events, new legislation and compliance costs). Under the regulatory framework, businesses are allowed to pass through such costs when they occur subject to some conditions. How these situations should be addressed in TFP analysis requires careful consideration.

The timing of past network roll-outs also needs to be considered. In Australia much of the current electricity network was rolled out in the 1950s to 1970s. Instead of the investment profile of distribution businesses over time being relatively flat, it tends to be relatively 'peaky'. This means that replacement investment requirements are likely to be similarly 'bunched'. The long term cycles this creates in TFP performance – particularly if capital input quantities are being proxied by constant price depreciated asset values – need to be allowed for and may make simple extrapolation of past TFP trends inappropriate.

64 In infrastructure industries, these characteristics mean that marginal costs typically are far lower than average costs.

65 See pages 2, of the Brattle International Review report.

B.4.6 Business cycle

Businesses may alter their utilisation rates of production factors in line with cyclical changes in demand rather than actually alter the level of production factors employed.[66] Some of the movement in utilisation rates – for example, overtime payments and the hire of equipment – will be captured in the level of operating costs. However, some utilisation rates, particularly the level of utilisation of capital stock, are difficult to capture. Consequently, to the extent that movements in capacity utilisation go undetected by the input variables, the resulting TFP growth rate will be biased in a pro-cyclical manner. In other words, TFP growth estimation will be biased upwards in boom periods and downwards during recessions.

The most widely used approach to overcome this issue is to ensure that the period examined covers at least a full business cycle. In this way, the under and over statements of TFP cancel each other out. An alternative approach would be to incorporate a capacity utilisation variable into the analysis. However, this latter approach is subject to data availability problems.

B.4.7 Comparability of businesses

The achievable rate of productivity growth may differ from one business to another as a result of specific circumstances under which each business operates (e.g., urban high density or rural low density, age of network). There are two responses to this situation. The first is to only include businesses with similar operating environment conditions in comparison to the business in question. Alternatively include a more diverse range of businesses in the calculation but make explicit adjustments for differences in operating environment conditions. The latter can sometimes be done by careful choice of output specification but may require econometric analysis.

Therefore it might be appropriate for the regulator to check that the operating characteristics of the businesses used in the industry wide estimation is comparable to the regulated business under consideration. As highlighted above, issues such as scale economies, business cycles and methodologies used in RAB determinations need to be considered when computing TFP growth. These issues also need to be considered when selecting the sample group of businesses, especially with respect to including overseas businesses in the calculation.

Alternatively, it may be appropriate to split the industry into sub-groups of businesses, for example, rural businesses and urban businesses and calculate separate TFP estimates.

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66 Possible due to the high costs associated with redundancies / recruitment and mothballing / constructing capital stock.

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Appendix C
Summary of submissions to the Rule Change Proposal

This appendix provides a summary of the stakeholder submissions received in the first round consultation on the Rule Change Proposal from the Victorian Government regarding TFP. The proposal seeks to amend the NER to allow the use of the TFP methodology as an alternative economic regulation methodology to be applied by the AER in approving, or amending, determinations for electricity distribution network service providers.

On 24 July 2008, the Commission published a notice under section 95 of the NEL advising of its intention to commence the Rule change process and initial consultation on the proposal. The Commission received 10 submissions, copies of which are available on the Commission's website.

Stakeholders raised a range of policy, regulatory and methodology issues that will need to be canvassed and resolved before a TFP approach could be specified in the NER and applied in practice. A majority of submissions also commented that a comprehensive review is needed to address the significant policy and regulatory issues that are involved and that an AEMC review would be an appropriate way of addressing them. This summary discusses the industry comments under the following topics:

- overview of submissions;
- proposed process and assessment of the Rule change proposal;
- conditions necessary for TFP to be applied; and
- specific aspects of the proposed application of TFP.

C.1 Overview of stakeholder submissions

All submissions (except SP AusNet) express concern and opposed the inclusion of the TFP approach, as proposed by Victoria, in the National Electricity Rules (the Rules) at this stage. Submissions commented that, while there may be merit in implementing a TFP based methodology as an alternative to building blocks, the issues have not been fully considered and further analysis and research is needed. They recommended that the Commission undertake a review into TFP before any further assessment of specific Rule change proposals. EnergyAustralia considered that it is inappropriate to propose a Rule change to allow TFP in the absence of a study on the applicability and suitability of a TFP framework to the Australia regulatory arena.

Many submissions also considered that this was not the appropriate time to introduce significant reform into the distribution regulation since the current framework has only recently being implemented and should be given more time to become established. Participants questioned whether the introducing TFP would undermine the transition towards a nationally consistent framework.

Submissions also considered that many of the issues raised by the Expert Panel have not been addressed and that the Proposal doesn't provide sufficient reasoning on why it would better promote the National Electricity Objective than the current building blocks approach.

Ergon Energy stated that it did not support the introduction of TFP as an alternative to the building block control setting method at this time. It referred to the Expert Panel recommendations and noted that the issues raised by the Expert Panel have not been sufficiently addressed. Ergon noted that Chapter 6 of the National Electricity Rules was recently developed under a fully consultative approach and has only just commenced operation. Country Energy expressed reservations as to the need to provide for a TFP methodology when to date this approach remains untested within the NEM. It stated that the current building blocks approach used in economic regulation is well established and understood.

Energex was concerned that if TFP was adopted, it will seriously undermine the current regulatory framework and would undermine the drive by COAG for a nationally consistent energy regulation framework. Energex noted that adopting a TFP approach would lead to inconsistencies in arrangements between electricity network businesses and also between electricity and gas distribution businesses.

AER made a similar point, stating that the proposal is effectively specific to Victoria and this needs to be considered against the operation of a nationally consistent regulatory framework. AER stated that the Commission should have regard to the current transition towards a national framework for regulation of DNSPs and that this transition should be given the opportunity to become better established before significant additional change is introduced.

Citipower/Powercor/ETSA Utilities saw merit in having a TFP approach evaluated and potentially included into the Rules but noted that the TFP approach is in its infancy, is untested in Australia and applications overseas have been very limited. ENA was concerned that an inappropriate designed TFP regime will have implications for the medium financial sustainability and viability of electricity distribution businesses.

Integral Energy stated that although TFP could, in theory, offer the potential for lighter handed regulation and greater efficiency, the current rule change proposal should be rejected because it fails to demonstrate that the proposed approach meets the National Electricity Objective more efficiently that the current arrangements.

Many of the submissions recognised that the current form of DNSP revenue regulation is reasonably well understood and operates effectively. Integral Energy stated that the building blocks methodology is well understood, having been developed over a period of more than ten years and used in virtually every electricity regulatory revenue decision over that time. In addition, this certainty is important in providing an appropriate climate for investment in essential infrastructure, which is characterised by assets with lives spanning many decades. Integral Energy submits that these arrangements should be given an opportunity to be tested through experience rather than complicating or substituting them and thereby introducing greater regulatory risk to the DNSPs and their customers.

United Energy expressed support for alternative regulatory approaches where the linkage between costs and revenue is relaxed. It considered that the building block methodology as current applied has many of the characteristics of cost of service regulation and a new approach is needed if further efficiency gains are to be captured. However, United Energy did not consider that the proposal was sufficiently innovative enough because it maintained the use of building blocks in setting the opening prices. United Energy advised that a wider review of alternative forms of regulation should be undertaken.

Only SP AusNet welcomed the inclusion of TFP into the Rules as it would provide an opportunity to advance to a better form of regulation that has the potential to provide better outcomes.

C.2 Proposed process and assessment

Submissions also commented on the Commission's proposed process and the appropriate assessment of the proposed Rules.

C.2.1 AEMC Issues Paper

Both SP AusNet and Energex supported the Commission's decision to publish an Issues Paper before making a draft Rule determination. These businesses agreed that there is a need for an improved understanding of the TFP regulatory approach.

C.2.2 Assessment criteria

Regarding the criteria for assessing the rule change proposal, Integral Energy argued against the Victorian Government statement that that including TFP as an option means that a full review of the TFP approach is not required. It stressed that the NEL is clear that the Rule change process must demonstrate a more efficient outcome than a status quo for each rule change proposal.

C.2.3 Application of TFP for the next Victorian distribution determination

SP AusNet was strongly of the view that the DNSPs in Victoria should have an opportunity to adopt TFP regulation in the next review (which is scheduled to be completed before December 2010). However, it accepted that the current timeframes may prove to be too onerous if all the relevant TFP matters are canvassed in the *framework and approach paper* (which the AER is must published by 31 May 2009) .

As an alternative approach, it suggested an arrangement where TFP model should be developed by the AER in a standalone guidance paper outside the framework and approach paper. On this basis, the Rule change would not necessarily be required to be in place to be strictly within the timeframe provided for the *framework and approach paper*. Nevertheless, SP AusNet did accept the TFP model would need to be finalised by early 2009 in order for the Victorian network businesses to consider whether to adopt the TFP model and provide the necessary information in their proposal to the AER for a pricing determination.

In its submission, the AER argued strongly that it would not be practical or prudent to introduce a TFP approach for the 2011-2015 Victorian electricity distribution reset. There would not be sufficient time for the AER to develop and publish the required guidelines on the TFP methodology and would undermine the regulatory certainty and transparency of the current arrangements.

C.2.4 Need for a Review to be undertaken before Rule changes

Most of the submissions raised concerns that the application of TFP-based pricing approach was being considered via a Rule change proposal and not through a MCE directed review.

ENA was concerned that the Rule change mechanism and its legislatively prescribed timetables may not have the flexibility and scope to comprehensively examine all of the issues raised by this very significant proposed Rule change. Jemena was in agreement with this point, and considered that the Rule change process is too restrictive a framework in which to consult on such a fundamental change to economic regulation because the consultation is effectively constrained to the proposal at hand. Jemena considered that any draft rule changes should only be developed following a comprehensive review of the concept and possible application of TFP.

Ergon Energy was strongly of the view that the timing of the proposed Rule Change is premature. It considered that there is a reasonable expectation that the threshold issues identified by the Expert Panel, and acknowledged by the MCE, would be thoroughly reviewed, consulted upon and addressed prior to the introduction of any specific Rules allowing TFP as an alternative revenue control setting mechanism. Ergon Energy considered that in the absence of a detailed review, the current proposal can not be comprehensively assessed against the National Electricity Objective.

ENA recommended that the AEMC undertake a full and comprehensive review of how TFP would be administered before the detailed wording of the proposed Rule change can be considered. Likewise, both the joint ETSA Utlilities/Citipower/Powercor submission and the Country Energy submission stated that the MCE should direct the AEMC to undertake a full review of the TFP methodology in preference to this Rule change proposal. This will allow comprehensive and rigorous analysis of all facets of TFP and not just those included in the Rule change proposal and would give the businesses greater confidence that the complex issues would be addressed in a considered and appropriate way.

C.3 Necessary conditions for TFP methodology

C.3.1 Industry not in a steady state

A number of parties questioned whether the industry is currently in a relatively steady state and that the long term estimate of TFP would be a good estimator of future cost changes. For this reason, submissions did not consider that the

application of TFP would satisfy the revenue and pricing principles set out in the NEL.

Ergon Energy did not consider that the industry is currently in a relatively steady state. It noted that the National Electricity Market is continuing to undergo significant regulatory reform with Chapter 6 of the Rules has only just commenced operation and has introduced significant changes regarding how distribution services are regulated. Ergon also considered that it is likely to be impossible for the industry to be in a steady state. Ergon Energy stated that this is a highly theoretical concept that never actually exists in practice. All businesses are inherently dynamic in nature and need to constantly change in response to market and regulatory developments.

Energex considered that it is far from clear that past TFP performance is a reasonable indicator of future performance as TFP performance from period to period tends to be highly variable and in most industries productivity is highly heterogenous across businesses.

EnergyAustralia, Country Energy and Integral Energy considered that the electricity distribution industry is not in a steady state and pointed to the current NSW DNSP regulatory revenue proposals as evidence. Under these proposals, the DNSPs have requested significant non-linear increases in capital and operational expenditure, suggesting that these businesses would not be suitability for TFP.

Similarly, Ergon Energy did not consider that the industry is at a point in its 'life cycle' where forward-looking capital expenditure has a relatively smooth profile. Ergon Energy is currently experiencing significant load growth in its area which requires substantial investment in its network infrastructure and noted that high load growth will be a factor on other distribution networks.

C.3.2 Quality of the existing data is not sufficient

All participants recognised that the successful implementation of a TFP approach requires significant data. However, many questioned the quality of the existing data.

Energex stated that implementing a TFP approach requires consistent time series information that is not currently available for the majority of distributors. AER noted that one important pre-condition for the use of any TFP based approach is the development of a full national cost and operational parameters data base, from a board range of DNSPs. AER stated that it is currently developing such a data-base under the new NER provisions in Chapter 6, but that this will take some time to be completed.

Citipower/Powercor/ETSA Utilities noted that the proposal does not mandate AER to use audited historical outturn information. This has been an issue in Victoria where the Essential Services Commission and its consultants have made periodical adjustments to audited outturn information at their discretion which has made it impossible for DNSPs to understand and replicate the estimate.

C.3.3 Inconsistency with services classification requirements

Ergon Energy considered that TFP is likely to be impractical as a revenue control setting method because DNSPs will have different services included within their standard control services category. Therefore, they will have different cost components. As a consequence, the information used in the calculation of both their "inputs" and "outputs" (i.e. productivity) for these services will not be comparable between DNSPs, and therefore not suitable to apply to a TFP approach.

C.3.4 Increased information collection and reporting requirements

Jemena stated that the development and implementation of any alternative form of regulation will involve considerable cost and effort in consultation on rule changes and in establishing guidelines and other associated administrative arrangements. Therefore, it suggested that in order to justify such cost and effort there should be a reasonable expectation at the outset that:

- the benefits predicted for the option are real and attainable; and
- the option, once available, will be taken up by a reasonable number of eligible businesses.

Ergon Energy was concerned that, even if it does not choose to use TFP for itself, it (and other DNSPs) may be required to collect, maintain and provide information to the AER to aid its application of, or inform its calculation of, TFP for the DNSPs that do choose to be regulated under this approach. Ergon Energy believed that these information requirements would impose an unnecessary administrative burden on Ergon Energy (and other DNSPs), and greatly incentivise DNSPs to game the presentation of the information used in the calculation of both their "inputs" and "outputs". Such gaming would undermine the validity of the TFP calculation as it relies very heavily on DNSPs to guide the "inputs" and "output" information needed to calculate the X factor.

ENA also stated that consideration must be given to the level of data collection costs imposed on individual businesses to support a TFP approach.

Some participants considered that there would be loss of synergies for the AER in conducting concurrent revenue determinations for DNSPs (as it does currently) if there were two forms of price setting methodologies to apply.

C.3.5 Proposal does not provide a settled, well specified methodology

Energex considered that there a series of contractual and practical measurement issues that need to be addressed in the development of a TFP methodology. These include how to account for quality, determining the appropriate measurement of capital including differences in capital utlisation, and defining the appropriate outputs to be included in the TFP calculation. It considered that these issues were not adequately addressed in the proposal.

Likewise, Integral Energy noted that the proposal provided very little information on how the approach would operate in practice. It considered that this made it difficult to properly assess the proposal and would lead to significant uncertainty for participants if the proposal was accepted. ENA also stated that there was not sufficient certainty on some of the key operational features to make a judgement on whether the proposed Rule change is likely to contribute to the NEO.

The Citipower/Powercor/ETSA Utilities joint submission made a similar point. The submission stated that the lack of detail, certainty and clarity presented in the proposal made it difficult to assess the impact of proposal against the NEO.

Most of the submissions raised significant concerns about the level of discretion that the Proposal suggested be provided to the AER. They stated that in comparison, the Rules are relatively prescriptive about key aspects of the building block control setting method which, in their view, appropriately limits the discretion of the AER.

SP AusNet recognised that the modelling of the TFP estimate is likely to be controversial. It noted that distribution networks do not produce easily measured output or units of production from which to calculate the TFP estimate. SP AusNet considered that the Rules need to be balance the objectives of providing sufficient flexibility on the detailed design issues and providing DNSPs with sufficient regulatory certainty regarding the AER application of the TFP approach.

C.3.6 Consistency with the Revenue and Pricing Principles

Energex considered that the application of a TFP approach would represent a retrograde step from the regulatory improvements that have been made in recent years with the greater emphasis being placed on ensuring that regulation does not have unintended impacts on investment incentives. Energex noted that there have been some difficulties experienced in New Zealand with incentivising new investment within a TFP environment.

SP AusNet considered that settling prices with references to industry averages would not necessarily be inconsistent with pricing and revenue principles in the NEL. This is because the industry averages should mirror the operation of a competitive market which provides all participants with the reasonable opportunity to recover efficient costs.

Ergon Energy believed that the discussion of TFP confuses absolute and relative "input" and "output" measures. TFP only deals with relative improvements in efficiency or productivity, not absolute improvements. This means that:

- DNSPs could be rewarded on the basis that they achieve "above average" productivity, and therefore performing relatively well, although they may not have made any absolute improvements in their own productivity; and
- DNSPs could be penalised on the basis that they achieve "below average" productivity, although they might have demonstrated absolute improvements.

Accordingly, Ergon Energy concluded that there is no reason to believe that a DNSP would be allowed only to recover its absolute efficient costs under TFP. Ergon

Energy also notes that the Proposal does not appear to have considered to the implications for customers of penalising DNSPs that are "below average". In a practical sense, these DNSPs would be able to earn less revenue while needing to make up their notional performance "shortfall" in the future. Accordingly, in Ergon Energy's opinion, TFP is a regressive, not progressive, revenue control approach that may embed and widen the existing gap between the performance levels of DNSPs in the NEM.

C.4 Victorian Government proposed approach for TFP

Submissions also made comments and raised concerns on specific aspects of the proposed design of the TFP approach put forward by the Victorian Minister in the Rule change proposal.

C.4.1 Requirement for the DNSP consent for application of TFP

All the network businesses stressed that it must be for a business (and the business alone) to initiate the transition from building block to TFP regulation. The businesses stated that there must be no avenue for TFP regulation to be imposed on a business without its consent. SPAusNet stated that it would be unacceptable if the Rules created a situation where TFP could be imposed on a network business. In general, the businesses supported this aspect of the proposal although, EnergyAustralia would prefer an explicit statement to the effect that the AER is not empowered to impose a TFP approach without the consent of the network business.

EnergyAustralia stated that the proposal does not provide certainty as to when the TFP approach could be considered "locked in" during the regulatory determination process. It thought that it was not clear when the AER would be require to make its decision to either accept or reject a TFP methodology and that there is a risk that the DNSPs will be force to prepare two regulatory proposals in parallel – which would clearly be costly and a waste of resources. EnergyAustralia considered that the proposal does not contain an adequate assessment framework on which the AER would based its decision to either accept or reject TFP.

C.4.2 Uncertainty on the pool of businesses for calculation of the X factor

Participants commented that it was not clear from the draft Rule change proposal how the 'pool' of DNSPs will be determined for the purposes of calculating TFP. The Citipower/Powercor/ETSA Utilities joint submission stated that establishing appropriate arrangements for the development of a TFP estimate and the collection and management of relevant data is central to ensuring that a robust and credible TFP estimate is derived.

Ergon Energy was concerned that there is a potential for DNSPs to be included in the 'pool' even if they have not elected to use TFP themselves, or have different combinations of services and services groupings that comprise the 'standard control' classification, or even if the business is not at a 'steady state'. It noted that the draft proposal also states that DNSPs will not be included in the pool if they are 'expected to experience a lower or higher productivity growth than the industry average'.

Ergon Energy thought that this seems be impossible to predict and to contradict the stated objectives of TFP.

SP AusNet noted that the Victorian DNSPs have performed well over the past ten years. It raised a concern that it would be unfair for the Victorian distributors to be disadvantaged by comparisons with state companies that haven't achieved the same productivity gains and are 'catching up'.

C.4.3 Against the use of overseas data

The Rule change proposal allows the AER the option of including overseas distribution data for the calculation of the TFP estimate. However Citipower/Powercor/ETSA Utilities considered that it would be highly problematic to include overseas jurisdictions data. They noted that with differences in accounting policies, tax laws and corporate structures, there would need to considerable normalisation of the data.

EnergyAustralia also raised a concern about the possible use of US data. It considered that given the current investment phase facing distribution businesses, there is likely to be too few Australian comparators available to measure industry productivity. However EnergyAustralia is alarmed at the potential inclusion of US data as comparators because different regulatory frameworks, and even different capitalisation policies is likely to render such data incomparable.

C.4.4 TFP criterion

An important component to the Rule change proposal is the insertion of a calculation objective –referred to as the TFP criterion – to direct the application of the TFP approach. Under this criterion, the AER must have regard to the ability of the DNSP to recover at least its efficient costs under the TFP estimated X. The purpose of this is to ensure that various issues such as asset valuation and depreciation are addressed consistently in the TFP and X factor calculations.

However, SP AusNet expressed concern that as drafted the criterion does not provide a clear indication of its intended purpose. In its view the proposed criterion provides no guidance to the AER because it is tautological – it simply states that if a DNSP's performance is the same as assumed in the X factor calculation, then the DNSP should at least recover its efficient costs.

SP AusNet noted that, in particular, that the setting of the initial tariffs in a TFP approach is equally important to the setting of the X factor. If wide discretion is afforded to the AER in setting the initial tariffs, the potential benefits of the TFP approach could be compromised.

C.4.5 Applying a rolling X will increase revenue uncertainty

Submissions argued against the proposal to allow the use a rolling X mechanism (where X is calculated annually by the AER based on the previous years' total productivity data). Both Ergon Energy and the Citipower/Powercor/ETSA Utilities

submission considered that a rolling X mechanism would introduce a degree of randomness and uncertainty into the price determination. Ergon Energy stated that at the commencement of the regulatory control period, the DNSP only knows the X factor calculation for the first year and has no certainty in relation to the value of X for the remainder of the regulatory control period. The revenue uncertainty created under this approach is not consistent with how investment decisions are made by utilities where forward certainty of funding levels is required.

Citipower/Powercor/ETSA Utilities also considered that a rolling X mechanism would lead to controversy as to the procedures of how new sample businesses are introduced into (or removed from) the pool of businesses whose data is used to calculate the rolling X factor. Citipower/Powercor/ETSA Utilities considered that this would damage the credibility of the TFP approach and noted that a rolling X factor approach has not been applied in the US.

SP AusNet strongly supported the proposal that DNSPs should be able to choose between rolling and fixed X factors.

C.4.6 Accounting for firm-specific characteristics

Some businesses also disagreed with the proposal to not allow for firm-specific adjustments to the X factor to account for impacts on individual distributors. Citipower/Powercor/ETSA Utilities did not agree with the assumption that normalisation should be excluded because all businesses have the same opportunities with respect to technical change and economics of scale and scope.

Citipower/Powercor/ETSA Utilities noted that under the Proposal, this only left the business with the option of seeking to opt out of the TFP approach if there were specific events that affected its cost structure that it considered the TFP framework did not accommodate.

C.4.7 Uncertainty about how opening prices are calculated

Participants commented that the Proposal includes providing the AER with broad discretionary powers to make adjustments to the opening prices. In contrast, DNSPs are provided with limited certainty as to the operation of the Rules. SP AusNet noted that the setting of the initial tariffs in a TFP approach is equally important to the setting of the X factor. It was concerned that if wide discretion is afforded to the AER in setting the initial tariffs, the potential benefits of the TFP approach could be compromised.

C.4.8 Reverting back to the building block approach

The Victorian proposal contains the provision that once network businesses have become subject to TFP then they would not have singular discretion to opt out of the methodology at a future pricing reset, on the basis that this would be condoning opportunistic behaviour. A number of the network businesses raised concerns about this provision.

Both the Citipower/Powercor/ETSA Utilities and ENA submissions questioned whether the requirement in the NEL that businesses have a "reasonable opportunity to recover at least efficient costs" would be met, when the AER is able refused to consent to the business to reverting back to building blocks. ENA considered that a business would be seeking to revert back when it considered that its productivity trend performance was likely to depart from the industry average.

In addition, Citipower/Powercor/ETSA Utilities thought that it was unsatisfactory for the AER to block the businesses from reverting back to building blocks, especially with the proposal excluding the use of off-ramps and normalisation provisions to account for firm-specific events. These businesses consider that the proposal increases the risk that DNSP would not earn a reasonable rate of return.

SPAusNet considered that there is not any sound economic or regulatory rationale for denying a request from a DNSP to revert back to building blocks since building blocks accords with the NEO. For SPAusNet, the option to revert back without the AER approval is a necessary safe harbour for any business which opts for TFP.

C.4.9 Too much discretion for the AER

Under the Rule change proposal, the AER will be required to make a series of key decisions including determining:

- the methodology, and pool of businesses, used for the calculation of the X factor;
- the nature of the relationship between the opening price and the X factor; and
- whether the TFP methodology is suitable for that particular business.

Many submissions disagreed with the extent of discretion proposed and also stated that appropriate accountabilities, including review mechanisms, would be needed to govern the proposed AER discretionary decisions. The submissions noted that in comparison, the Rules are relatively prescriptive about key aspects of the building block control setting method which, in their view, appropriately limit the discretion of the AER.

Ergon Energy noted that although the AER must provide guidelines on these matters and a guideline approach would provide some certainty, it could diminish the separation between "rule maker" and "rule enforcer". It considered that there is too much discretion given to the AER to develop key aspects of the revenue control setting method.

ENA suggested that a high number of subjective decisions could lead to an increase in regulatory uncertainty that would outweigh any of the benefits from having TFP. United Energy considered that the extent to which important matters of detail should be left to non-binding guidelines developed by the AER needs to be tested. United Energy stated that the there are a number of decisions in the proposed scheme that are likely to have significant consequences for businesses that these should be reviewed.

Citipower/Powercor/ETSA Utilities stated that the proposal passes much more discretion to the AER in the development and application of the TFP approach than the AER currently has in the application of the building block approach. These businesses considered that given the absence of practical experience of TFP, it would be preferable that the Rules are more, rather than less, prescriptive on how TFP is developed and applied.

C.4.10 Using building blocks to determine the opening prices

Some parties questioned the use of building blocks to set the opening prices for a DNSP using TFP. Both Jemena and United Energy considered that this was perpetuating the very problem that besets the building blocks methodology.

SP AusNet suggested that the use of off-ramps to re-calibrate prices during the control period was an equally valid method for managing the risk of cost-price divergence. It considered that the frequent re-setting of prices to reflect costs would substantially reduce the potential benefits of the TFP approach. SP AusNet encouraged the Commission to ensure that the TFP approach provides a genuine alternative to building block regulation. Ideally, for SP AusNet there should be no need for prices to be referred back to actual costs once the scheme is operational.

C.4.11 WACC and depreciation

Participants recognised that the weighted average cost of capital (WACC) and depreciation will continue to be key inputs to the assessment of the opening price adjustment as well as for the ongoing calculation of TFP and performance monitoring. Given the importance of these issues, participants criticised the proposal for not providing sufficient detail on how these factors are to be determined. United Energy and Jemena noted that under the proposal the business would not even be required to make a submission on WACC as part of its pricing proposal.

C.4.12 Forecasting will still be required under the proposed TFP approach

One of the benefits claimed for TFP regulation is that it obviates the need for forecasting (which is a significant contributor to the cost of administering building block regulation). However, submissions noted that forecasting will still be required to play a key part under the proposed TFP approach. Jemena and United Energy noted that there are at least two instances in the proposed scheme where there is an implicit requirement for forecasting. That is, in the criteria for deciding whether a business is eligible to choose TFP regulation (see proposed clauses 6.2.4A (b)(2) and (3)) and in applying the 'TFP Criterion' (see proposed clause 6.6A.3). Jemena and United Energy both considered that it was difficult to see how the revenue and pricing principles in the NEL can be satisfied without regard to forecasts.

C.4.13 Length of the regulatory control period

The Citipower/Powercor/ETSA Utilities joint submission disagreed with the proposal that the AER ultimately decides as to the length of the regulatory control

period. They considered that the AER will always tend to apply the standard five years period. Therefore, in order for the benefit of longer regulatory periods to be realised under TFP, Citipower/Powercor/ETSA Utilities proposed that the AER should be obliged to accept the regulatory period (of up to 10 years) that is proposed by the distributor.

C.4.14 Off-ramps and pass through provisions

SP AusNet questioned the Victorian proposal in relation to the re-settling of prices at a pre-determined date and the arguments against the use of off-ramps provisions. SPAusNet argued that first, the power of the incentives would be greatly improved if longer (or indefinite) regulatory periods were adopted. Second, it considered that for longer regulatory periods, off-ramps provide a low-cost mechanism for ensuring that the net effect of any unexpected input cost and productivity changes are shared appropriately between the company and its customers. SP AusNet's view was that the Rules should be sufficiently flexible to allow DNSPs to choose between off-ramps and pass-through arrangements.

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Appendix D
Relevant NEL and NGL provisions

D.1 National objectives

The NEO is set out in section 7 of the NEL:

> The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to—
>
> (a) price, quality, safety, reliability and security of supply of electricity; and
>
> (b) the reliability, safety and security of the national electricity system.

The NGO is set out in section 23 of the NGL:

> The objective of this Law is to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.

D.2 Revenue and Pricing Principles

D.2.1 NEL

The revenue and pricing principles applicable to electricity are set out in section 7A of the NEL.

(1) The revenue and pricing principles are the principles set out in subsections (2) to (7).

(2) A regulated network service provider should be provided with a reasonable opportunity to recover at least the efficient costs the operator incurs in—

  (a) providing direct control network services; and

  (b) complying with a regulatory obligation or requirement or making a regulatory payment.

(3) A regulated network service provider should be provided with effective incentives in order to promote economic efficiency with respect to direct control network services the operator provides. The economic efficiency that should be promoted includes—

  (a) efficient investment in a distribution system or transmission system with which the operator provides direct control network services; and

(b) the efficient provision of electricity network services; and

(c) the efficient use of the distribution system or transmission system with which the operator provides direct control network services.

(4) Regard should be had to the regulatory asset base with respect to a distribution system or transmission system adopted—

(a) in any previous—

(i) as the case requires, distribution determination or transmission determination; or

(ii) determination or decision under the National Electricity Code or jurisdictional electricity legislation regulating the revenue earned, or prices charged, by a person providing services by means of that distribution system or transmission system; or

(b) in the Rules.

(5) A price or charge for the provision of a direct control network service should allow for a return commensurate with the regulatory and commercial risks involved in providing the direct control network service to which that price or charge relates.

(6) Regard should be had to the economic costs and risks of the potential for under and over investment by a regulated network service provider in, as the case requires, a distribution system or transmission system with which the operator provides direct control network services.

(7) Regard should be had to the economic costs and risks of the potential for under and over utilisation of a distribution system or transmission system with which a regulated network service provider provides direct control network services.

D.2.2 NGL

The revenue and pricing principles applicable to gas are set out in section 24 of the NGL.

(1) The revenue and pricing principles are the principles set out in subsections (2) to (7).

(2) A service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs in—

(a) providing reference services; and

(b) complying with a regulatory obligation or requirement or making a regulatory payment.

(3) A service provider should be provided with effective incentives in order to promote economic efficiency with respect to reference services the service provider provides. The economic efficiency that should be promoted includes—

(a) efficient investment in, or in connection with, a pipeline with which the service provider provides reference services; and

(b) the efficient provision of pipeline services; and

(c) the efficient use of the pipeline.

(4) Regard should be had to the capital base with respect to a pipeline adopted—

(a) in any previous—

(i) full access arrangement decision; or

(ii) decision of a relevant Regulator under section 2 of the Gas Code;

(b) in the Rules.

(5) A reference tariff should allow for a return commensurate with the regulatory and commercial risks involved in providing the reference service to which that tariff relates.

(6) Regard should be had to the economic costs and risks of the potential for under and over investment by a service provider in a pipeline with which the service provider provides pipeline services.

(7) Regard should be had to the economic costs and risks of the potential for under and over utilisation of a pipeline with which a service provider provides pipeline services.

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Appendix E
Measures of inputs and outputs for TFP growth estimates

In 2003, the ACCC engaged Dr Denis Lawrence (then with Meyrick and Associates) to undertake a scoping study into data collection issues associated with the implementation of incentive regulation in electricity transmission and distribution. [67] Dr Lawrence provided a list of data variables required for TFP measurement, which is set out in table E.2.[68] This list included 10 key output variables, 10 key input variables and a few operating environment variables for both the electricity transmission and distribution sectors. The variables required for gas transmission and distribution are likely to be similar.

In its submission to the Expert Panel on Access Pricing, the ESC distinguish between (what it considers) necessary data components and desirable components. This is shown in table E.1.

Table E.1: ESC's proposed data needs for TFP

Data category	Necessary	Desirable
Output	total number of customers delivered, total volume delivered and peak demand	delivery volume was broken down into each customer segment
Output cost shares	revenue for total number of customers, total volume and peak demand to weight them in determining the output index	revenue to be broken down into each customer segment
Cost	total operating and maintenance expenditure, the optimized depreciated replacement cost of the plant for the earliest year available, and the dollar value of additions to the plant	salaries and wages associated with operating and maintenance expenditure and superannuation contributions and other elements charged to operating and maintenance expenditure
Input	input price indexes	more specific input quantity measures, for example data on labour quantity (number of employees) or the cost of labour ($ per employee)

Source: ESC submission to the Expert Panel, March 2006, p. 20.

67 Denis Lawrence, *Scoping study into data collection issues for incentive regulation: report by Meyrick and Associates for the ACCC*, 19 November 2003.

68 Denis Lawrence, *Data collection for incentive regulation – output and input measures: report by Meyrick and Associates for the ACCC*, 21 October 2004.

Table E.2: Lawrence's output and input data variables for TFP

	Electricity transmission	Electricity distribution
Output Variables	• Throughput • Maximum demand • Line and cable length by voltage level • Transmission circuit availability • Number of loss supply events by time • Average outage duration • Line Losses • Revenue	• Throughput by customer class • Customer numbers by class • Line and cable length by voltage level • Coincident peak demand • Distribution related system average interruption frequency index (SAIFI) • Distribution related system average interruption duration index (SAIDI) • Line Losses • Revenue by customer class
Input Variables	• Total operating and maintenance expenditure by category • Number of full time equivalent employees in operating and maintenance activities • Labour costs in operating and maintenance activities • Line and cable length by voltage level • Installed transformer capacity • Optimised replacement cost by nature of asset • Depreciated optimized replacement cost by nature of asset • Asset life by nature of asset (overall and residual)	• Total operating and maintenance expenditure by category • Number of full time equivalent employees in operating and maintenance activities • Labour costs in operating and maintenance activities • Line and cable length by voltage level • Installed transformer capacity • Optimised replacement cost by nature of asset • Depreciated optimized replacement cost by nature of asset • Asset life by nature of asset (overall and residual)
Operating Environment variables	• Energy density (energy delivered per customer) • Customer density (customers per km of line)	• Energy density (energy delivered per customer) • Customer density (customers per km of line)

Source: Denis Lawrence, *Data collection for incentive regulation – output and input measures: report by Meyrick and Associates for the ACCC*, 21 October 2004.

Appendix F
Estimates of TFP growth rates in Victoria

In Australia, the Essential Services Commission of Victoria (ESC) has been evaluating alternative approaches to regulation of monopoly services, to assess the effectiveness of current regulation and the potential for improving regulatory instruments. In this project, the ESC, assisted by Pacific Economics Group (PEG), has been evaluating the use of TFP based approaches as an alternative to the building blocks methodology in the regulation of electricity distribution services.

As part of this work, PEG has calculated the trend in TFP growth for the five Victorian electricity distribution businesses over the 11 year period between 1995-2006. Using an index based approach, PEG has estimated a TFP growth rate of 2.56% for the Victorian electricity distribution industry over this period. However, it was recognised that there was a burst of productivity gains following the privatisation and PEG argued that the TFP growth rate of 1.71% (calculated for the period 1998 to 2006) would be close to the long term TFP growth trend for Victorian electricity distribution. This rate is considerably higher than the 0.7% TFP growth rate PEG found for US electricity distribution businesses for the period 1988–2006 and 0.9% for 1998–2006.[69]

According to the ESC, the results demonstrated there was little evidence that different X factors were needed to account for variations in the exogenous factors that exist between Victorian distributors. Analysis undertaken by PEG quantified the impact of scale and density factors on each of the businesses TFP growth rate compared to the industry as a whole. It found that the difference between the impact of these factors on a business TFP trend and the industry trend rate ranged between 0.02% to 0.17% compared with the industry rate of 2.95% calculated for the period 1995 to 2003.[70]

The ESC also broadened the scope of its research into TFP to investigate whether a national TFP growth rate can be estimated for regulated electricity distribution network service providers throughout Australia. It released its analysis in December 2006.[71]

However, there were significant gaps in the data gathered from the jurisdictions and PEG was not able to extend the TFP methodology that it used previously to estimate the Victorian TFP growth rate to the other participating jurisdictions. Instead it used a methodology it considered second best but which was able to be implemented using the limited data available.

The outcome of this analysis suggested that the TFP trend for the jurisdictions included in the study (NSW, Victoria, South Australia and Tasmania) is 0.88 per cent

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69 PEG, *Calibrating rate indexing mechanisms for third generation incentive regulation in Ontario: report to the Ontario Energy Board*, February 2008.

70 PEG, *TFP research for the Victorian power distribution industry*, December 2004.

71 ESC and PEG, *Total factor productivity and the Australian electricity distribution industry: estimating a national trend*, December 2006.

per annum although it is unclear from the report what time period this covers and whether the time period is common across the included jurisdictions.

There are significant differences in the TFP trends across the jurisdictions included in the study. PEG estimated that TFP had grown most rapidly in Victoria, at about 2.14 per cent per annum. TFP growth in Tasmania was somewhat lower, at about 1.8 per cent per annum. However, TFP growth is essentially flat in both NSW and South Australia, with estimated TFP trends of 0.14 per cent and -0.03 per cent, respectively. Compared with Victoria and Tasmania, TFP growth has been much slower in South Australia because output has grown much more slowly. In contrast, TFP growth has been slower in NSW because input quantity growth (especially capital inputs) has grown at a more rapid pace.

There was extensive debate on the appropriate methodology and interpretation of the PEG results for Victoria between the Victorian electricity distribution businesses and the ESC. In a series of reports for the businesses, Dr. Denis Lawrence criticised the PEG study on a range of grounds including:[72]

- failure to include the important supply side dimension of network length and capacity which will disadvantage rural and, to a lesser extent, suburban distributors;
- giving a large weight to throughput measures over which DBs have little influence and which have a low marginal cost and, hence, should be given a low weight;
- use of the deflated asset value approach to measuring capital input quantities which is likely to overstate the rate of depreciation and hence underestimate the quantity of capital used (and hence overestimate TFP growth);
- failure to adequately recognise that the convergence effect following privatisation will lead to a progressive slow down in TFP growth rates; and
- increasing estimated TFP growth rates by excluding periods of slow output growth and operational expenditure increases when there appeared to be no case for doing this.

In more recent work for the Victorian gas distribution businesses, Dr. Lawrence constructed a detailed TFP model[73] using a number of different specificational choices to those adopted by PEG in its electricity work. The main differences between the PEG and Lawrence specifications are set out in table F.1 below.

72 Denis Lawrence, *Review of Pacific Economics Group report "TFP research for Victoria's power distribution industry": report by Meyrick and Associates for AGLE, CitiPower, Powercor, TXU Networks and United Energy*, January 2005.

73 Denis Lawrence, *The total factor productivity performance of Victoria's gas distribution industry: report by Meyrick and Associates for Envestra, Multinet and SP AusNet*, March 2007.

Table F.1: PEG and Lawrence methodologies for Victorian TFP growth estimates

Item	PEG (2004) Electricity	Lawrence (2007) Gas
Index Method	Törnqvist	Fisher
Output components	Number of customers, volumes on-peak and volumes off-peak and non-coincident demand	Number of customers, throughput and pipeline system capacity
Output weighting	Revenues weights. Weights were updated annually to reflect changes in revenue shares	Output cost shares based on econometric cost function estimation. Constant weights for whole period.
Input components	Operational and maintenance expenditure and capital input quantity proxied by single deflated, depreciated asset value series	Operational and maintenance expenditure and capital input quantity proxied by physical quantities for six different asset categories.
Weights	Exogenous capital cost measure. Costs did not equal revenue	Capital cost calculated as residual. Costs equals revenue
Investment Programmes	No allowance made for future investment programmes	Not addressed
Sensitivity Analysis	None	A range of alternative specifications examined

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Appendix G
Industry characteristics

This appendix provides some background material on each of the energy industry sectors. It also provides information on the dispute resolution provisions in the NEL and NGL.

G.1 Industry background

G.1.1 Electricity transmission

Each state participant in the national electricity market has an interconnected system of high powered transmission lines that moves electricity from power stations to major load centres. Each jurisdiction in the national electricity market is dependant on a monopoly transmission system that is subject to economic regulation by the AER.

The key transmission service providers are: Powerlink (Queensland), TransGrid (NSW), SP AusNet (Victoria), Transend (Tasmania) and ElectraNet (SA). In Victoria, VENCorp plans and directs augmentations to the SP AusNet transmission system. It does not own any transmission assets but is deemed to be a transmission service provider under the NER. While TransGrid owns, operates and manages the vast majority of the NSW-ACT electricity transmission system, EnergyAustralia (who is predominately a distribution service provider) also owns and operates certain transmission assets in the Sydney area.[74] Only ElectraNet and SP AusNet are not wholly government-owned entities.

In addition to the transmission networks, the national electricity market also includes interconnectors between the networks. These include the privately owned (but regulated) Terranora (formerly Directlink) and Murraylink.[75]

The electricity transmission systems differ in structure and operating characteristics. For example, the ElectraNet system is characterised by long distances, low energy density, a small customer base and a peaky demand profile in summer. While Powerlink operates a network that covers long distances, its peak demand is for the entire summer season (November to March) and it faces high demand growth. In contrast, Transend's network is much smaller geographically, and in terms of line length, and connects numerous small generators.[76]

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74 AER, *Transmission network service providers electricity regulatory report for 2006-07*, August 2008, pp. 13-16.

75 NERA, *The wholesale electricity market in Australia: a report to the Australian Energy Market Commission*, March 2008, p. 18.

76 AER, *Transmission network service providers electricity regulatory report for 2006-07*, August 2008, pp. 13-14.

The need for capital expenditure will depend on, in part, the expected growth rate of demand, the age of the transmission system, and jurisdictional technical and reliability requirements. To the extent that such matters differ between service providers, their requirements to undertake capital expenditure will differ. This may make capital expenditure comparisons difficult to undertake and understand. The differences between the service providers for 2006-07 is indicated in the AER's regulatory report using two benchmarks – capital expenditure as a proportion of average asset base value and capital expenditure as a proportion of peak demand.

Information on the actual and forecast capital expenditures for the various electricity transmission service providers for 2002-03 to 2006-07 is set out in the AER's regulatory report. It highlights that capital expenditure can fluctuate from year to year and also suggests that capital expenditure levels from only a few years ago may not be a very good indicator of the capital expenditure undertaken more recently.[77] The rising capital expenditures of the transmission service providers reflects both the need to invest in new assets and the increasing costs to build those assets.[78] Recent and forecast capital expenditure for the electricity transmission service providers is illustrated in the figure below.

Figure G.1: Actual and forecast electricity transmission capital expenditure

	TransGrid	EnergyAustralia	SP AusNet	Powerlink	ElectraNet	Transend
2003	272	31	41	223	38	
2004	289	32	57	178	37	62
2005	139	40	74	225	57	55
2006	158	44	103	274	55	69
2007	232	39	111	259	77	98
2008	366	61	81	671	47	43
2009	307	45	116	601	126	36
2010	524		112	448		155
2011	436		132	455		167
2012	538		139	366		101
2013	507		122			97
2014	372		149			96

Notes:
Actual expenditure for 2003-2007 and forecast for 2008-2009. Values in real 2007 dollars for year ending 30 June. AER, *State of the energy market 2008*, November 2008, p. 123.

Data for 2010-2014 from AER, *Draft decision: TransGrid transmission determination 2009-10 to 2013-14*, 31 October 2008, p. 87 (2007-08 dollars); AER, *Draft decision: Transend transmission determination 2009-10 to 2013-14*, 21 November 2008, p. 144 (2008-09 dollars); AER, *Final decision: SP AusNet transmission determination 2008-09 to 2013-14*, January 2008, p. 84 (2007-08 dollars); AER, *Final decision: Powerlink Queensland transmission network revenue cap 2007-08 to 2011-12*, 14 June 2007, p. 59 (2006-07 dollars).

77 AER, *Transmission network service providers electricity regulatory report for 2006-07*, August 2008, pp. 44-46.

78 AER, *State of the market 2008*, November 2008, p. 123.

G.1.2 Gas transmission

Gas transmission pipelines that are covered under the NGL are subject to economic regulation by the AER (and in WA, the ERA).

While there are numerous pipelines, the gas transmission pipeline sector is dominated by only a few owners. The key pipeline owners are APA Group, Epic Energy and Jemena Limited. None of these businesses are government-owned.

Gas transmission pipelines differ considerably in terms of operating characteristics. The clearest example of this is the difference between the GasNet System, which operates under a market carriage management system, and other pipelines that operate under a contract carriage system. [79]

There are also differences between transmission pipelines in terms of geography, usage, size and capacity and type of end-users. The extent of the differences are highlight by the fact that the currently covered pipelines include the Dampier to Bunbury Natural Gas Pipeline (DBNGP) in WA and the Dawson Valley Pipeline (DVP) in Queensland. The DBNGP consists of 1 845 km of pipeline to transport gas from the north west of the state to demand centres located at Perth and the south west of WA. The pipeline's diameter varies between 24 and six inches. The pipeline is currently undergoing and extensive augmentation program and already has nine compressor stations.[80] In contrast, the DVP is 47 km long with a diameter of six inches. It has a maximum capacity of 30 TJ/day. [81] The covered pipelines are listed below.

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79 Under contract carriage, which is typically used, a user and a pipeline owner will enter into a contract on the service to be provided to the user. Users are often charged a two part tariff reflecting their reserved capacity and actual throughput. Under market carriage, which is used for the management of the GasNet System in Victoria, users do not reserve capacity on the pipeline through a contract with the pipeline owner. Users are required to notify the independent pipeline operator (VENCorp) of their gas requirements for the day and tend to be charged according to actual throughput. NERA, *The gas supply chain in eastern Australia: a report to the Australian Energy Market Commission*, March 2008, p. 44.

80 DBNGP access arrangement information, appendix 1, 30 December 2003.

81 DVP access arrangement information, (undated), p. 3.

Figure G.2: Covered gas transmission pipelines

Pipeline name and ultimate owner	Description (length, diameter, capacity)
Moomba to Sydney Pipeline (APA Group)	2 029 km (not all covered), various, 230 TJ/day
Central West Pipeline (APA Group)	255 km, 168 mm, 10 TJ/day
Central Ranges Pipeline (APA Group)	292 km, 168 & 219 mm, na
Roma to Brisbane Pipeline (APA Group)	434 km, 273 mm, 205 TJ/day
Carpentaria Pipeline (APA Group)	840 km, 323 mm, 102 TJ/day
Dawson Valley Pipeline (Anglo Coal & Mitsui)	47 km, 168 mm, 30 TJ/day
Amadeus Basin to Darwin Pipeline (NT Gas)*	1 512 km, 356 & 324 mm, 54 TJ/day
Dampier to Bunbury Natural Gas Pipeline (DBNGP (WA) Transmission)	1 488 km, 208 & 660 mm, 785 TJ/day
Goldfields Gas Pipeline (Goldfields Gas Transmission)*	1380 km, 350 & 400 mm, 110 TJ/day
Kalgoorlie to Kambalda Pipeline (Southern Cross Pipelines Australia)*	44 km, 219 mm, na

Notes: * APA Group is the majority owner.
na not available.

Source: Code Registrar website, National Gas Market Bulletin Board website, various AAI.

Of the 11 transmission pipelines currently servicing the capital cities, five are presently covered pipelines. Those subject to regulation by the AER are: the Roma to Brisbane, Moomba to Sydney, and Amadeus Basin to Darwin pipelines and the GasNet System.[82] The ERA is the regulator for the Dampier to Bunbury Natural Gas Pipeline. Accordingly, there are a relatively small number of pipelines that may potentially be involved in a TFP based approach to determining reference tariffs. In addition, it should be noted that the coverage status of pipelines is able to change over time according to coverage and coverage revocation decisions made by the relevant Ministers.

82 The Moomba to Sydney Pipeline is partly covered. The covered portion of the pipeline is now subject to light regulation. NCC, *Light regulation of the Moomba to Sydney Pipeline System: final decision and statement of reasons*, 19 November 2008.

Box G.1: What is a covered pipeline?

As under the former regulatory framework, only pipelines that are specified as covered pipelines are subject to economic regulation. A coverage decision is made by the relevant Minister following receipt of a recommendation from the National Competition Council (NCC). The NCC must consider certain criteria (NGL, s. 15) and conduct a public consultation process in considering an application for coverage (or an application for revocation of coverage). Any party can apply to the NCC for a pipeline to be covered, or for coverage to be revoked, at any time. Accordingly, the status of a pipeline may change over time.*

In determining that a pipeline is to be a covered pipeline, the NCC must also determine the form of regulation. That is, whether the pipeline be subject to full regulation (and be required to submit a full access arrangement to the AER for approval) or light regulation (where an access arrangement is not required). All covered pipelines are subject to the dispute resolution processes of the NGL.

For the purposes of the start of the NGL, the majority of pipelines that were covered under the former regulatory regime were to be covered pipelines under the NGL.

* In addition to coverage via the NCC processes, there are two other avenues to coverage. A pipeline will be deemed as a covered pipeline by voluntarily submitting (and having approved) a full access arrangement to the regulator (NGL, s. 127). A pipeline will also be deemed a covered pipeline if it has made use of the competitive tender provisions of the NGL and has a CTP access arrangement in place (NGL, s. 126).

The profile of capital expenditure for gas transmission pipelines tends to be large and lumpy. The augmentation of a transmission pipeline will be achieved through the addition of compressors or the construction of looping.[83] New areas and end-users may be serviced by the extension of an existing pipeline to the area or the construction of a new pipeline.

The AER has identified a number of new projects that are under construction or committed over the next few years. The projects include the construction of pipelines and the addition of compressors. While the majority of the identified projects are located in Queensland, the most significant is the stage 5B expansion of the DBNGP at a forecast cost of $690 million.[84]

[83] AER, *State of the energy market 2008*, 2008, p. 264. Compressor stations raise the pressure of a pipeline, allowing more gas to flow. Looping also achieves additional pipeline capacity by duplicating sections of an existing pipeline. Both compression and looping are generally referred to as 'expanding' the capacity of a pipeline.

[84] AER, *State of the energy market 2008*, 2008, pp. 264-266.

G.1.3 Electricity distribution

Electricity distribution systems provide electricity from connection points on a transmission system to end users. Distribution systems are focussed on supplying a particular geographic area through low voltage power lines. In some instances, these may be underground. To supply all end-users, a distribution network consists of a significant length of power lines. The current distribution service providers for the national electricity market total 12 and are identified below. While there are a number of distribution service providers, there is presently minimal common ownership across the states and the ACT. The six distribution businesses in NSW, Queensland and Tasmania are wholly owned by the relevant state governments.

Figure G.3: Electricity distribution service providers

State/territory	Service providers (line length)
Qld	Energex (48 115 km), Ergon Energy (142 793 km)
NSW	EnergyAustralia (47 144 km), Integral Energy (33 863 km), Country Energy (182 023 km)
ACT	ActewAGL (4 623 km)
Victoria	Citipower (6 488 km), Powercor (80 577 km), United Energy (12 308 km), Solaris (5 579 km), SP AusNet (29 397 km)
Tasmania	Aurora Energy (24 400 km)
SA	ETSA Utilities (80 644 km)

Note: Solaris is wholly owned by Jemena. United Energy is part owned by Jemena.

Source: AER, *State of the market 2008*, 2008, pp. 142-143.

Each of these service providers are subject to economic regulation by the AER.

There are significant differences between the various distribution networks. Geographically, the largest network is operated by Country Energy. It consists of 182 023 km of power lines across regional NSW. In comparison, EnergyAustralia and Citipower service the high demand but relatively small geographic areas of the Sydney and Melbourne CBDs respectively. [85]

An alternative approach to compare the relative size of service providers is to compare the regulated asset bases of the networks. On this basis, the Queensland distribution service providers are significantly larger than the businesses in the ACT, Tasmania and Victoria.[86]

Capital expenditure programs have varied considerably between service providers. This reflects the differences in the scale of the networks, age of assets and forecast demand. Some jurisdictional regulatory and technical requirements will also influence capital expenditure programs. Such differences need to be acknowledged when implementing a TFP methodology to assist in revenue and pricing decisions.

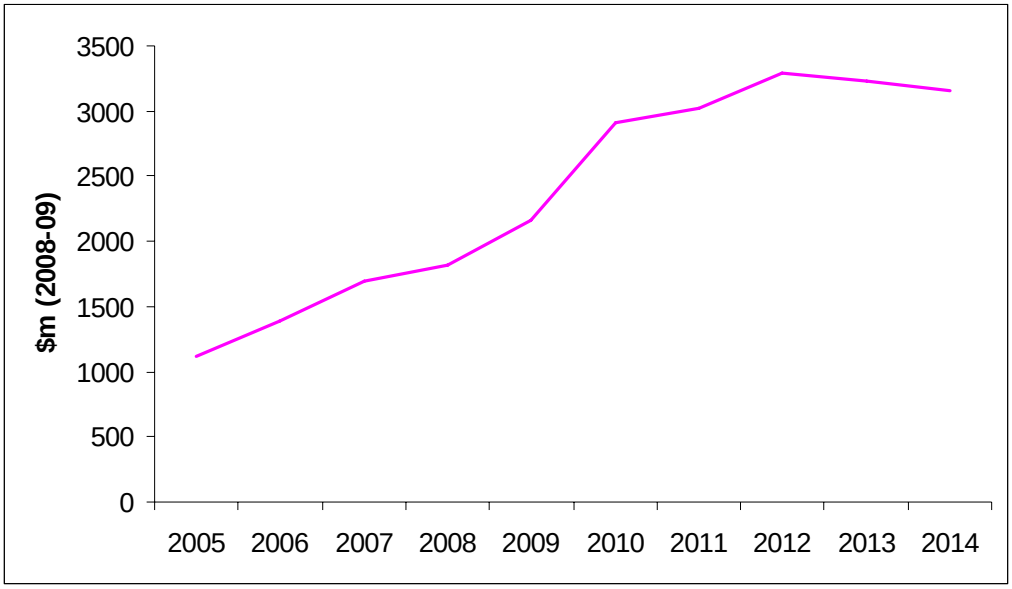
The Commission also notes that investment by distribution service providers has increased over the last decade bringing stable or improving reliability for users of the

85 AER, *State of the energy market 2008*, 2008, pp. 142-143.

86 AER, *State of the energy market 2008*, 2008, pp. 142-143.

networks.[87] This is illustrated by the figure below on total capital expenditure (actual, estimated and forecast) for the NSW distribution service providers.

Figure G.4: NSW electricity distribution capital expenditure, 2004-05 to 2013-14



Source: AER, NSW draft distribution determination 2009-10 to 2013-14, 21 November 2008, pp. 122-124.

G.1.4 Gas distribution

Gas distribution systems link transmission pipelines from a city gate to end-users. Gas flows through high and medium pressure pipelines to form a backbone to the distribution system and to service high demand areas. Low pressure pipelines then transport gas to end-users throughout the distributor's geographical area.

Similar to gas transmission pipelines, certain gas distribution systems are subject to economic regulation under the NGL. The majority of the major distribution systems in large population centres are, for the purposes of the NGL, covered pipelines. Certain regional distribution systems are also covered pipelines.

The table below identifies the covered gas distribution systems in Australia. As the table illustrates, there is a variation in the size of distribution service providers – whether measured by pipeline length, throughput or value of the asset base. The table also indicates that unlike the electricity distribution sector, there is some common ownership of gas distribution systems across the jurisdictions. The key distribution service providers are currently Jemena Limited and Envestra Limited.

87 AER, *State of the energy market 2008*, 2008, pp. 150-151.

Figure G.5: Covered gas distribution systems

Name (ultimate owner)	Description (mains length, throughput, (asset value (2007 dollars))
Jemena Gas Network (NSW) (Jemena)	Sydney, Newcastle, Wollongong and regional centres 23 800 km, 132 PJ/year, $2 088 m
Central Ranges System (APA Group)	Tamworth and surrounds 250 km, na, na
Wagga Wagga Natural Gas Distribution Network (Country Energy)	Wagga Wagga and Uranquinty 622 km, 1.4 PJ/year, $47 m
ACT (ActewAGL)	ACT, Yarrowlumla and Queenbeyan 3 621 km, 7.2 PJ/year, $247 m
Multinet Gas (DUET and Jemena)	Melbourne (east and south east) 9 513 km, 61.4 PJ/year, $888 m
Victorian Distribution Network (Envestra)	Melbourne, central and north east Victoria and Albury region 9 350 km, 59 PJ/year, $859 m
Jemena Gas Network (Vic) (Jemena)	Western Victoria 9 140 km, 71.3 PJ/year, $955 m
Allgas (APA Group)	area south of Brisbane River, Qld 2 515 km, 13.9 PJ/year, $307 m
Queensland Distribution Network (Envestra)	Brisbane, Rockhampton and Gladstone 2 261 km, 5.3 PJ/year, $235 m
SA Distribution Network (Envestra)	Adelaide and surrounds 7 377 km, 29.1 PJ/year, $851 m
AlintaGas Networks (Babcock & Brown Infrastructure and DUET)	mid west and south west of WA 12 157 km, 31 PJ/year, $708 m

Note: na not available

Source: AER, *State of the market 2008*, 2008 p. 276, various company websites

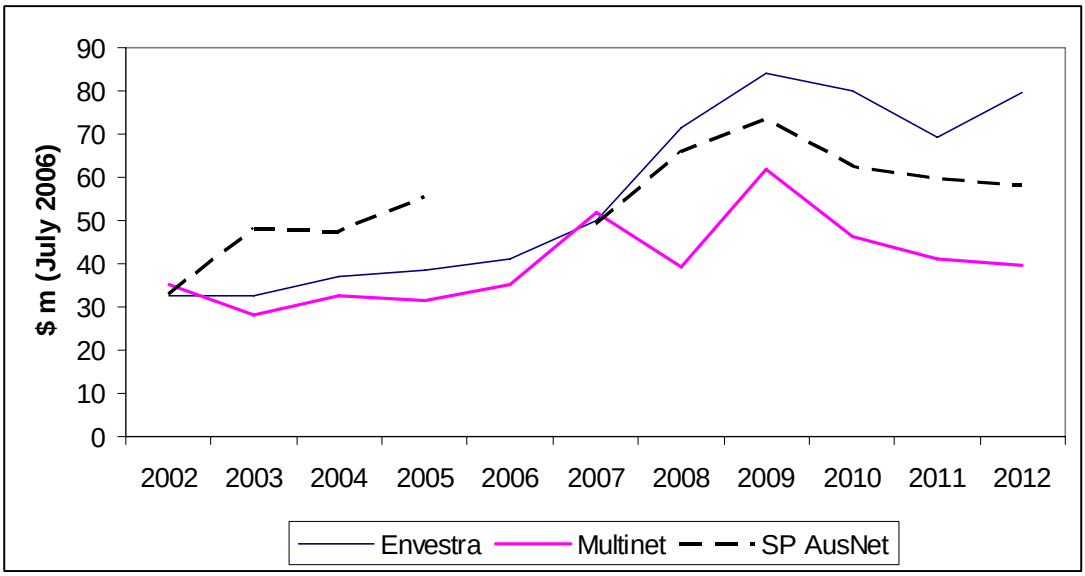
Investment in gas distribution systems includes improvements to the existing assets and incrementally extending into new centres. Typically, expenditure of this nature is relatively consistent over time because of its incremental nature. As a result, output and investment growth is more stable over time and, accordingly, more conducive to the application of a TFP based methodology for the regulation of these businesses.[88]

From time to time, capital expenditure in gas distribution will also include development of new distribution systems (for example, at Tamworth and in Tasmania). This expenditure tends to be more lumpy in nature.

However, the Commission understands that gas distributors are anticipating forecast capital expenditure that is significantly greater than recent levels of expenditure. The figure below for the Victorian gas distribution service providers, provides an indication of the anticipated future capital expenditures in the sector.

88 ESC, Submission to the Expert Panel, March 2006, p. 27.

Figure G.6: Victorian gas distribution capital expenditure, 2001-02 to 2011-12



Source: ESC, Gas access arrangement review 2008-2012: final decision, 7 March 2008, pp. 420-423; 431-432.

G.2 Dispute resolution and access determinations

In addition to its role in making decision that set regulated revenues and prices, the AER has a role in settling disputes about access to the services provided by regulated energy infrastructure. The NEL and NGL both provide for rules on TFP to be made with respect to access determinations.

Under the NEL, an access determination is a decision made by the dispute resolution body (defined as the AER) in relation to an access dispute between a user or prospective user of a network service and the relevant electricity transmission or distribution service provider (s. 125). An access dispute may arise on any matter relating to access to an electricity network service. Failing the resolution of the dispute through an alternative dispute resolution process or the termination or withdrawal of a dispute, the AER must make a determination on access by the user or prospective user (s. 128). In doing so, the AER must give effect to a revenue or pricing determination (s. 130). However, if the dispute is in regard to negotiated services, then the AER must consider how best to resolve the dispute. One tool that it may use is some form of the building block approach and/or benchmarking.

Under the NGL access disputes are disputes between users or prospective users of a pipeline (either transmission or distribution) and the relevant service provider about the terms and conditions of access to the services provided by the pipeline.[89] If a

[89] The provisions do not apply to uncovered pipelines or greenfield pipelines subject to a 15 year no-coverage determination. In the case of international pipelines that are the subject of a 15 year price regulation exemption, the resolution of an access dispute must not refer to price or revenue (NGL s. 180).

dispute is not resolved through an alternative dispute resolution process or is not withdrawn then the dispute resolution body (which is the AER) must make an access determination to resolve the dispute. It may cover any matter relating to the provision of pipeline services.

In making an access determination, the dispute resolution body must give effect to the applicable access arrangement as relevant to the dispute (s. 189). However, if the dispute is in regard to a pipeline subject to light regulation and there is no access arrangement in place, the dispute resolution body may be required to determine the terms and conditions, including tariffs, of access to pipeline services to resolve the dispute.