SPI POWERNET
A subsidiary of Singapore Power International

Appendices to SPI PowerNet's Response to the ACCC Draft Decision on Victorian Transmission Revenue Caps 2003 to 2008

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SPI PowerNet Pty Ltd
ABN 78 079 798 173

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Appendix A
Efficiency Carryover Design

EFFICIENCY CARRYOVER DESIGN

A Report for SPI PowerNet

Prepared by NERA

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Sydney

n/e/r/a

National Economic Research Associates
Economic Consultants

Level 6, 50 Bridge Street
Sydney NSW 2000
Australia

Tel: (+61) 2 8272 6500
Fax: (+61) 2 8272 6549
Web: http://www.nera.com

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EXECUTIVE SUMMARY

This paper is intended to inform the Australian Competition and Consumer Commission's (ACCC) consideration of the appropriate design of an 'efficiency carryover mechanism' to be incorporated into SPI PowerNet's regulatory framework. The focus of the proposal relates to the carryover to be applied at the 2008 reset and beyond.

Role of an Efficiency Carryover

An efficiency carryover mechanism allows a regulated business to 'carryover' some or all of the efficiency gains (or efficiency losses) made in the current regulatory period into the following regulatory period(s).

There are three key objectives for an efficiency carryover mechanism:

1. Non-distorting incentives for the timing of efficiencies;
2. Non-distorting incentives for the type of efficiencies; and
3. Appropriate magnitude of incentive for efficiencies.

However, the appropriate form of efficiency carryover mechanism needs to be considered as part of the wider regulatory framework. In particular, it is important to consider the interaction between the efficiency carryover mechanism and the process adopted by the ACCC for setting expenditure benchmarks in future regulatory periods. Incentives for cost savings arising out of an efficiency carryover mechanism can be reversed or destroyed by a poorly set out process for determining future expenditure benchmarks.

The ESC's 'Rolling-Carryover' Mechanism

An important context for our analysis is the existence of the efficiency carryover mechanism which has been adopted by the Victorian Essential Services Commission (ESC) as part of the regulatory framework applying to both the Victorian electricity and gas distribution businesses.

Our analysis in this paper is that the ESC's mechanism achieves the objectives of not distorting the timing of investment, and provides an appropriate magnitude of incentives for business' to make efficiency gains.

In relation to not distorting incentives for the *type* of efficiency, the ESC's mechanism allows businesses to retain the same proportion of gains from a saving in operating expenditure or a once-off saving in, or deferral of, capital expenditure. However, businesses retain a lower proportion of any *recurrent* savings in capital expenditure. Businesses may therefore have an incentive to substitute capital expenditure for operating expenditure.

We note that this potential bias is not peculiar to the ESC's carryover mechanism, and also arises under the standard 5 year revenue/price cap. Our proposal for the carryover mechanism to apply to SPI PowerNet allows for a specific adjustment to the regulatory asset base where the business/regulator can make a strong case that the cost saving/increase is ongoing in nature, in order to address this potential bias.

Setting Benchmarks for Future Periods

In this report we set out two rules for the setting of expenditure benchmarks under an ESC type efficiency carryover. These rules are required so as not to undermine the incentives of an efficiency carryover mechanism. In particular, we argue that in the absence of a 'last year' problem[1]:

- benchmark expenditures should be based on the best estimate of likely expenditure at the beginning of the regulatory period less any observed deferral of expenditure from the previous regulatory period; and
- benchmark expenditures should not extrapolate past trends in costs into the future – except to the extent that a portion of those trends can be identified as being driven by factors beyond the businesses control (such as factor cost changes and an ageing asset base).

In order to be able to rely more heavily on revealed cost information in setting future benchmarks, there needs to be a presumption that past costs are a good guide to future costs. This will be the case where the level of costs is stable from year to year and there are no discrete changes in costs from one regulatory period to the next. However, outturn costs may not be considered a good guide to future costs where costs tend to be lumpy and variable, where costs exhibit a cyclical trend or where there are changes in the underlying cost drivers or obligations placed on the business, or changes in external input costs.

Proposed Efficiency Carryover Mechanism to apply to SPI PowerNet

We propose the application of the following rolling carryover approach for SPI PowerNet:

- the carryover of efficiency gains for five years following the year in which the gain is made;
- the adoption of a symmetrical approach in carrying over both efficiency gains *and* efficiency losses (ie, spending in excess of benchmarks);

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1 The last year problem is where accurate information on actual expenditure in the last year of the regulatory period is not available for calculation of the efficiency carryover to be applied at the beginning of the next regulatory period.

- the carryover amount calculated in relation to both operating & maintenance and capital expenditure, in relation to the expenditure benchmarks only, ie, no allowance for an efficiency carryover in relation to SPI PowerNet's network augmentation expenditure, on the assumption that appropriate incentives will be built into contractual arrangements;
- adjustment of the benchmark forecasts in calculating the carryover amount to take account of any cost differences arising from changes in legislated or regulated obligations during the period together with changes covered by the revenue cap's pass through arrangements;
- an efficiency gain (loss) for operating expenditure calculated as an increase (decrease) in recurrent operating expenditure;
- an efficiency gain (loss) in capital expenditure calculated as the regulatory WACC, multiplied by the difference between that year's capital expenditure and the original benchmark forecast *plus* an additional adjustment for expenditure savings that are found to be ongoing in nature;
- the efficiency gain (loss) for the last year of the regulatory period to be assumed to be zero, and:
  - for operating expenditure the future benchmarks will be set without regard to any observed efficiency savings in the last year of the regulatory period; and
  - for capital expenditure, the benchmark capital expenditure assumed for t-1 is used in determining the opening asset base for year t, with a subsequent adjustment to take account of the difference between outturn and benchmark capital expenditure in t+6.

This approach largely mirrors the ESC's approach. The key area of difference is the inclusion in our proposal of an additional adjustment in the calculation of the carryover associated with ongoing capital expenditure savings.

Proposed Approach to Setting Future Benchmarks for SPI PowerNet

We propose that the approach to setting future expenditure benchmarks for SPI PowerNet should comply with the two 'rules' set out above.

The 'lumpy' and cyclical nature of SPI PowerNet's operating costs means that setting opex benchmarks will be necessarily more complex than for businesses which face a constant operating cost trend. In particular, the ACCC will need to consider:

- what operating expenditure in the penultimate year is not expected to be repeated in the next regulatory period, and, conversely, what expenditure is necessary in the next regulatory period which was not required in the earlier period – to address the 'lumpiness' of SPI PowerNet's operating costs;

- any trends in operating expenditure, as a result of ageing assets. Although the current part of the cycle is one with increasing operating costs, ultimately we would expect that costs will fall (and the cycle will start again), as older assets are replaced;
- the changes in business scope/obligations between the regulatory periods; and
- changes in other factors beyond SPI PowerNet's control, such as exchange rate changes and changes in insurance costs - these cost factors may be increasing or decreasing.

1. INTRODUCTION

1.1. Purpose and Approach

The purpose of this paper is to inform the Australian Competition and Consumer Commission's (ACCC) consideration of the appropriate design of an 'efficiency carryover mechanism' to be incorporated in SPI PowerNet's regulatory framework.

We note that the ACCC's did not address the issue of an efficiency carryover mechanism in SPI PowerNet's Draft Decision. SPI PowerNet's application proposed an efficiency carryover in respect of out-performance over the Tariff Order period (1998 to 2002), which was based on a transitional mechanism, together with broad principles for efficiency carryover mechanisms to apply at the 2008 reset and beyond. The only mention made of these issues in the SPI PowerNet Draft Decision is on p.13 which sets out the principles on which the Draft Decision is based – "operating and maintenance expenditures will be subject to a single regulatory period glide path while other components of the building block will face a P_0 adjustment". This statement appears inconsistent with the Draft Regulatory Principles and also with the ACCC's Draft Decision on Powerlink, in which the ACCC allowed a carryover of capital expenditure efficiency in relation to the construction of the Queensland to NSW Interconnector (QNI).

An efficiency carryover mechanism is the means whereby the incentive on the regulated business to make efficiency gains is enhanced, by permitting the business to carryover those gains from one regulatory period to the next. It also provides the regulated business with an equal incentive to make savings in each year of the regulatory period, rather than concentrating savings in the early years of each period.

In this report we set out a concrete proposal for how an efficiency carryover mechanism applied to SPI PowerNet would ideally operate and, perhaps more importantly, how it should interact with the process adopted by the ACCC for setting expenditure benchmarks in future regulatory periods.

An important context for our analysis is the existence of the efficiency carryover mechanism which has been incorporated by the Victorian Essential Services Commission (ESC) in its Final Determination in relation to the Victorian electricity distributors. The ESC has also adopted the same approach to the efficiency carryover in its current review of the Access Arrangements of the Victorian gas distribution businesses. The ACCC has had reference to the ESC's methodology in its Draft Decision on GasNet's 2002 access arrangement, where it calls the ESC's methodology a "rolling carryover" mechanism. In that decision the ACCC recommended the adoption of the rolling carryover mechanism for GasNet's operating expenditure *and* the adoption of what it described as the ESC's methodology for setting future operating expenditure benchmarks on the basis of, at least in part, past expenditure.[2]

While considerable analysis has gone into developing the rolling carryover mechanism there is less certainty around the process by which future benchmarks are set. The process for setting such benchmarks raises important issues as incentives for cost savings arising out of an efficiency carryover mechanism can be reversed or destroyed by a poorly set out process for determining future expenditure benchmarks. In this report we argue that these two issues are inseparable and that both require the same degree of transparency and elaboration in order for the primary objective of incentive regulation (revelation of efficient costs) to be achieved.

In arriving at the proposal presented in this report we have had regard to:

- the objective of incentive regulation in general and the role of an efficiency carryover mechanism in particular, and the interaction between the efficiency carryover mechanism and future expenditure benchmarks;
- the approach taken by other regulators (in particular the ESC in Victoria) to the efficiency carryover and setting future expenditure benchmarks;
- the nature of individual cost categories and the impact this may have on the optimal design of the efficiency carryover regime applied to that cost category and the use of past costs in setting future expenditure benchmarks; and
- the interaction of the efficiency carryover mechanism with other aspects of the regulatory regime.

Having assessed these issues in general, we apply them in particular to SPI PowerNet. In doing so we endeavour to identify the extent to which there are particular characteristics of SPI PowerNet's business that would require a differentiated form of carryover mechanism compared to other regulated businesses.

1.2. Structure

The report structure is as follows:

- Section 2 sets out the key principles and objectives underlying the adoption of a regulatory regime based on incentives, and highlights the role of an efficiency carryover mechanism within that regime and the use of outturn expenditure data in setting expenditure benchmarks;

2 ACCC, *Draft Decision: GasNet access arrangement*, 14 August 2002, p.176.

- Section 3 sets out how the efficiency carryover mechanism adopted by the ESC is expected to work, including its interaction with the setting of future expenditure benchmarks;
- Section 4 considers the use of outturn cost data in setting regulatory benchmarks for future regulatory periods more generally, and identifies circumstances where such an approach would not be appropriate;
- Section 5 considers the interaction of the efficiency carryover mechanism with other aspects of the regulatory regime, namely the form of price control, service standards, the WACC, the length of the regulatory period and regulatory accounts; and
- Section 6 presents a proposal for the appropriate application of an efficiency carryover mechanism to SPI PowerNet, with particular consideration of the relevant characteristics of SPI PowerNet's costs and the implications for setting future expenditure benchmarks.

2. INCENTIVE REGULATION, EFFICIENCY CARRYOVER AND EXPENDITURE BENCHMARKS

2.1. Objectives of an Efficiency Carryover Mechanism

It is possible to set out three objectives that an efficiency carryover mechanism (and its interaction with other aspects of the regulatory regime) should ideally be designed to meet:

1. Non-distorting incentives for the timing of efficiencies.

2. Non-distorting incentives for the type of efficiencies.

3. Appropriate magnitude of incentive for efficiencies.

By way of example, the first objective will be met if a regulated business has no greater incentive to implement efficiencies in the first year of a regulatory period compared to the last (or vice versa). This is often thought of as the primary objective of an efficiency carryover mechanism.

Similarly, the second objective requires that the regulated business has no greater incentive to pursue operating expenditure efficiencies at the expense of capital expenditure efficiencies. Similarly, the efficiency carryover mechanism should not create an artificial incentive to shift spending between capital and operating expenditure. For example, an efficiency carryover mechanism that did not allow for the carryover of capital expenditure (in)efficiencies but did allow for the carryover of operating expenditure (in)efficiencies may create an incentive to achieve lower operating expenditure by over-spending on capital expenditure. This is because the business would be able to carryover the benefits of the under-spend on operating expenditure into the next regulatory period but would not be forced to offset this against the over-spend on capital expenditure.

Finally, the third objective recognises that the length of time that a business is able to carryover (ie, 'keep') efficiencies for will impact on the absolute magnitude of the monetary incentives to pursue those efficiencies. The longer a business can keep efficiencies the greater the likelihood of the business more quickly reducing costs, but the longer it is until lower costs are reflected in lower prices to final customers. Thus, the design of the efficiency carryover, in terms of the length of that carryover, involves making a decision on an appropriate weighting of these two factors.

Put simply, the design of the efficiency carryover mechanism, via the creation of non-distortionary incentives to make savings, has the aim of minimising either total costs or average prices. In the long run these two objectives will be the same, but in the short run it is likely that there will be a trade off between them.

2.2. Information Ignorance and Information Asymmetry

It is an obvious point, but one worth making, that if a regulator knew with certainty the average efficient level of costs incurred in providing a service the regulator could simply set regulated prices/revenues on the basis of these known efficient costs. The business would have an automatic incentive to achieve this level of efficiency since, if it did not, it would not make a normal profit.[3] There would be no need for the regulator to revise expenditure benchmarks even if the business did not reach the level of efficiency set by the regulator as this would, by definition, have been due to the business operating below the level of efficiency which could be achieved by an average firm. There would be no need for 'incentive regulation', nor any need to base future expenditure benchmarks on past performance.

The above is a purely hypothetical situation. In reality, the regulator and often the business itself, will not know with any certainty what the minimum efficient level of cost is for providing a service. Furthermore, efficient costs in one period may exceed or may be less than efficient costs in the next period. This leads to the classic conundrum faced by regulators and regulated businesses. If the regulator sets prices based on an ill-informed estimate of efficient costs then the regulator runs the risk of forcing losses on the regulated firm that are not justified by any inefficiency on its part. This in turn may threaten the financial viability of the business and is likely to reduce the willingness of investors to provide capital to regulated businesses, therefore increasing future costs to the extent that investors demand higher rates of return.

On the other hand, if the regulator bases prices/revenues on the outturn costs incurred by the regulated business then the business may have little or no incentive to operate at efficient cost levels, as there may be an expectation that any revealed reductions in costs will automatically and quickly be 'taken away' in the form of lower regulated prices/revenues. In fact, regulated business may have an incentive to operate inefficiently in such circumstances.

2.3. Incentive Regulation

The adoption of 'incentive regulation' is an attempt to address the conundrum discussed above. Incentive regulation is a broad term used to capture a regulatory process that places a lag between any revealed cost reduction and the opportunity for a regulator to reduce regulated prices/revenues on the basis of this revealed reduction.[4] During this lag the

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3 That is, it would not make a return on capital invested equal to the cost of financing that capital.

4 This is a slight over simplification as incentive regulation can operate without such lags if lump sum 'payments' to the business for cost reductions are feasible. Such payments can be in the form of higher prices/revenues for a short period followed by an immediate adjustment of prices/revenues to those associated with the newly revealed cost structure. However, this involves erratic movements in prices and, in practice, a simple lag between cost and price movements has been employed.

business benefits from any cost reduction as its regulated prices/revenues do not fall commensurately with its costs. The longer is this lag period, the greater will be the benefit to the business.

In Australia it has been common practice to set a pre-determined path for prices/revenues over a five-year regulatory period, generally based on escalation by a 'CPI-X' factor in each year within the period. As a result, any cost savings revealed by the business during the five-year period do not lead to a reduction in the prices which the business can charge, and are therefore kept by the business until the end of the five-year period. However, at the beginning of the next regulatory period the regulator is able to take account of any cost reductions revealed in the last regulatory period when setting the expenditure benchmarks that determine the price/revenue path for the next regulatory period.

Such a process attempts to guarantee to the business that it will be able to benefit from pursuing cost efficiencies even if, in so doing, it reveals a lower cost structure to the regulator. Relative to a situation where a business has no incentive to pursue lower costs, both customers and businesses benefit. Businesses benefit for the remainder of the current regulatory period, while customers benefit from the beginning of the next regulatory period.

2.4. Role of an Efficiency Carryover Mechanism

Under the incentive regulation regime described above, the magnitude of the benefit to a business of achieving a reduction in costs depends on which year within the regulatory period the cost reduction is achieved. If a cost reduction is achieved in the first year of a regulatory period then a business will benefit from that cost reduction for that year and for the remaining four years of that regulatory period, since the regulated price/revenue path for that period will not be adjusted to reflect the lower level of costs. However, if the cost reduction is achieved in the last year of the regulatory period, the business will only benefit from that cost reduction in that year alone.[5] This is because, from the first year of the next regulatory period the regulator is able to take account of revealed cost reductions and set lower regulated prices/revenues for the following regulatory period.

Under the simple incentive scheme discussed above, there is an incentive for the regulated business to concentrate its efforts on achieving efficiency savings in the early years of the regulatory period, and to defer making any efficiency savings towards the end of the period. It may also reduce the incentive for the business to pursue efficiency savings at all, to the extent that some savings cannot be delayed or are not able to be carried out within a single year. Such incentives to defer making savings are inefficient and inhibit the objectives of incentive regulation.

[5] Assuming that the regulator is able to observe any revealed cost reductions in the final year of the regulatory period.

As listed above, it is the first objective of an efficiency carryover mechanism to address this problem by ensuring that efficiency savings achieved by the business towards the end of one regulatory period can be carried over and enjoyed by the regulated business into the next regulatory period. For example, the ESC's efficiency carryover mechanism is designed in such a manner that any cost reductions below benchmark levels are able to be 'kept' by the business for five years following the year in which the saving is made, regardless of when in the regulatory period the cost saving is achieved. The ESC's mechanism is discussed more fully in section 3.

Where such a mechanism implies a 'carryover' of savings from one regulatory period to the next, the amount of the saving is added to the required revenue calculated for the business for the next regulatory period. In the next regulatory period, prices/revenues are therefore based on:

- the expenditure benchmarks calculated for the next regulatory period;
- a return on the capital base and depreciation; *plus*
- any efficiency carryover amounts.

2.5. Role of Expenditure Benchmarks

The efficiency carryover only describes one side of the incentive regulation 'coin', namely the mechanism by which businesses are able to 'keep' savings for a given number of years. The opposite, and equally important, aspect of an efficiency mechanism is the mechanism by which observed savings are actually taken from businesses and passed onto customers in the form of lower than otherwise prices. That is, the process by which observed efficiencies are used to reduce expenditure benchmarks in future regulatory regimes.

Where the regulatory regime has incentives in place for businesses to reduce costs to efficient levels, the regulator can use such 'revealed costs' to inform its estimates of efficient costs. To the extent that efficient costs are expected to remain constant over future time, the regulator can potentially use outturn cost data as a direct proxy for the efficient costs applying in the next regulatory period.

By increasing the incentive on businesses to reduce costs, the adoption of an efficiency carryover mechanism may therefore allow the regulator to adopt a more mechanistic approach to establishing future expenditure benchmarks, based on revealed costs from the previous period.

The ESC's efficiency carryover mechanism (and the mechanism proposed by the ACCC to apply to GasNet) is designed with the expectation that, other things being equal, the operating expenditure benchmark established for the first year of the next regulatory period will be set equal to outturn operating expenditure in the second to last year of the previous regulatory period. This approach has been taken in order to ensure that the business can carryover the benefit of any cost reductions in the last year of the regulatory period into the next, even though there will be no data available on outturn expenditure in that year from which to explicitly calculate an efficiency carryover amount. This aspect of the ESC's approach is discussed in more detail in the following section 3.3.

At one extreme it would be possible for the regulator to set expenditure benchmarks based *purely* on outturn cost performance. That is, the 'expectation' that benchmarks will be based on outturn expenditure becomes a formal requirement. We term this the 'mechanistic' approach to determining expenditure benchmarks. However, a purely mechanistic approach is unlikely to be appropriate in practice, since there may be strong reasons to expect that past costs will be a biased estimator of future costs. In this situation, adopting a purely mechanistic approach may result in significant and avoidable over/under recovery of costs by a regulated business. We discuss this further in section 4.

In consequence, the regulator will invariably wish to retain some level of discretion in relation to establishing future expenditure benchmarks. However, the adoption of an efficiency carryover mechanism means that outturn expenditure can be expected to play a more significant role in the regulator's decision as to future expenditure benchmarks. In turn, the use of outturn cost data in setting future benchmarks, means that cost reductions in one regulatory period affect both the efficiency carryover *and* the expenditure benchmarks established for the next regulatory period. As a result, it is not possible to analyse the incentives for cost reductions in one regulatory period without understanding both how the efficiency carryover is calculated *and* how expenditure benchmarks will be set.

Given that the regulator can be expected to retain some level of discretion in relation to establishing future expenditure benchmarks, a primary purpose of this report is to set out appropriate guidelines for how such discretion should be exercised, in order that the objectives of incentive regulation (and the efficiency carryover mechanism) are promoted.

3. THE ESC'S EFFICIENCY CARRYOVER MECHANISM

The ESC introduced an efficiency carryover mechanism in its Electricity Price Determination for the Victorian electricity distribution businesses 2001-2005. It has subsequently adopted the same mechanism by the gas distribution businesses in its review of their 2003-2007 Access Arrangements. In both cases the ESC has set out the approach which is to apply from the next regulatory period, but has made some adaptations in applying the mechanism in calculating the efficiency carryover from the initial regulatory period. These adaptations recognise the fact that the carryover mechanism cannot influence past behaviour and was not explicitly specified as part of the regulatory arrangements for the initial regulatory period.

3.1. Key Features of the ESC's Carryover Mechanism

The ESC's approach to the efficiency carryover has the following key features:[6]

- the carryover mechanism focuses on the difference between benchmark forecasts and outturn expenditure in the same regulatory period in relation to operating and maintenance and capital expenditure;
- in calculating the efficiency carryover, the benchmark forecasts are adjusted to take account of differences between forecast and outturn growth and any cost differences arising from changes in legislative obligations;
- an efficiency gain (loss) in operating and maintenance expenditure in any year is calculated as a reduction (increase) in the level of recurrent operating and maintenance expenditure, compared to the benchmark forecast in that year;
- an efficiency gain (loss) in capital expenditure is calculated as the regulatory WACC, multiplied by the difference between that year's capital expenditure and the original benchmark forecast. No adjustment is included for differences in depreciation;
- any efficiency gains (or losses) will be retained by distributors for five years *after* the year in which the gains are achieved;
- efficiency gains and losses will be treated symmetrically. In determining the overall gain or loss in any one year, the ESC will look at the combined gains or losses calculated for capital expenditure plus operating and maintenance expenditure; and
- the efficiency gain (loss) for the last year of the regulatory period will be assumed to be zero, but

[6] See the Office of the Regulator-General, *Electricity Distribution Price Determination 2001-05, Volume I Statement of Purpose and Reasons*, September 2000, page 84-90.

- the presumption in setting the benchmark for operating expenditure for the first year of the next regulatory period (year t), will be that it is equal to the assumed outcome for the last year in the current regulatory period (year t-1), *multiplied by any improvement in efficiency the ESC assumes appropriate between years t-1 and year t*. The assumed outcome for t-1 is in turn set on the basis of outturn operating expenditure in year t-2, multiplied by any implied efficiency gain embodied in the original expenditure benchmarks between t-2 and t-1; and

- capital expenditure in year t-1 will be assumed equal to the (adjusted) benchmark amount, and the opening asset base in year t will be determined on the basis of this assumed amount. Any correction to account for the difference between outturn capital expenditure and assumed expenditure in year t-1 will be made at the start of the subsequent regulatory period (ie, year t+5).[7]

3.2. Adjustments to the Original Benchmarks

In relation to adjustments to the original benchmarks when calculating the efficiency carryover amount, the ESC's initial position was that there should be no adjustment to benchmarks for any factors other than changes in the legislative obligations placed on distributors.[8] However, this position was successfully appealed by one of the electricity distributors, and the ESC noted in its subsequent Re-Determination that it would adjust the original benchmarks to reflect changes between the forecast and outturn number of new connections (one of the key drivers of the distributors' costs).[9]

In the ESC's Final Decision on the 2003-2007 Access Arrangements for the Victorian Gas distributors,[10] it has proposed a mechanism for carrying out such an adjustment for differences between outturn and forecast growth. Specifically, the ESC has proposed that a fixed dollar amount per new connection for capital expenditure and for operating and maintenance expenditure be set out, together with the forecast of new connections expected over the new regulatory period. At the time of the next review, the expenditure benchmarks

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7 The ORG's Price Determination Vol 1 at page 85 refers to the capital expenditure *benchmark* for year t being set assuming no efficiency gain in year t-1 in excess of the original benchmark. However, the detailed discussion on page 88 of the same volume makes clear that it is the opening *asset base* for year t (rather than the capital expenditure benchmark for that year) which is set on the basis of the original benchmark for year t-1. The ESC's Review of Gas Access Arrangements Draft Decision, July 2002 p. 123 recognises that the ESC's assumption of last period gains for capital expenditure impacts the opening asset base assumed for the following regulatory period rather than the capital expenditure benchmarks for the next period.

8 Office of the Regulator-General, *Electricity Distribution Price Determination 2001-05, Volume I Statement of Purpose and Reasons*, September 2000, page 84.

9 Office of the Regulator General, 2001 Electricity Distribution Price Review, Re-Determination, December 2000, page 4.

10 ESC, *Review of Gas Access Arrangements, Final Decision*, 2002.

would then be adjusted on the basis of the fixed dollar amounts, to reflect the difference between forecast and outturn connections, and the efficiency carryover amount established with respect to the adjusted benchmark.

In addition, the ESC has proposed that the distributors include provisions for making adjustments to the benchmarks to reflect any cost differences arising from changes in business scope over the regulatory period. The distributors are to quantify the impact on their costs of any changes in scope, and the regulator will take this into account and will consider adjusting the expenditure benchmarks before calculating the efficiency carryover amount for the next regulatory period.

3.3. Setting Future Expenditure Benchmarks

3.3.1. Operating expenditure benchmarks

As noted above, one of the key features of the ESC's efficiency carryover mechanism is that it establishes an explicit link between the operating expenditure benchmark in the next regulatory period and outturn operating expenditure in the current period.

An important rationale for the ESC's approach is as follows. Information on outturn operating expenditure for the last year of the regulatory period will not be available at the time the efficiency carryover amount is calculated. Thus an efficiency carryover amount for that year will not be able to be calculated. In order to provide the business with an incentive to make efficiency gains in this final year, despite the absence of an efficiency carryover amount, the ESC has said that it will assume that operating expenditure in the final year of the regulatory period is equal to the outturn level of operating expenditure achieved in the fourth year of the regulatory period, multiplied by the efficiency gain embodied in the original expenditure benchmarks between the fourth and final year of the period.[11] The ESC's 'presumption' will then be that the operating expenditure benchmark for the first year of the next regulatory period will be set equal to the assumed outcome for the last year of the current period, multiplied by any improvement in efficiency the ESC considers appropriate to assume between those two years.[12]

The impact of this approach is that any reduction in costs below the benchmark levels in the last year of the regulatory period, whilst not being included as an efficiency carryover, would result in outturn costs being below the benchmark levels applying at the start of the next regulatory period. This would result in the business retaining the benefit throughout the five years of the following regulatory period, and is therefore equivalent to the benefit it

11 There will therefore be an efficiency gain of zero for that year.

12 Office of the Regulator-General, *Electricity Distribution Price Determination 2001-05, Volume I Statement of Purpose and Reasons*, September 2000, p. 85 and p.88.

would have received if the efficiency carryover amount could have been calculated directly for this final year.

However, it is important to appreciate that the ESC's approach in establishing the operating expenditure benchmark for the next regulatory period is not purely mechanistic. Although the ESC has stated that its 'presumption' will be that the benchmark for the first year of the next regulatory period will be set equal to the assumed outturn value for the last year of the previous period, it also notes explicitly that 'the determination of new period benchmarks will also need to take into account issues arising at that time.'[13]

One such issue explicitly identified by the ESC is the appropriate assumption to be made regarding expected efficiency gains between the last year of the current regulatory period and the first year of the next period. In its Final Decision on the Gas Access Arrangements, the ESC adopted the assumption that the operating expenditure benchmark for 2003 (ie, the first year of the new regulatory period) is equal to outturn expenditure in 2001, multiplied by the assumed efficiency gain embodied in the benchmarks between 2001 and 2002, multiplied *further* by the increase in productivity which the ESC has assumed is appropriate for the gas distributors over the next regulatory period. That is, benchmark operating expenditure for 2003 already reflects a productivity gain in relation to previous outturn expenditure.

The way such assumed productivity gains are arrived at can potentially have important impacts on the effectiveness of the efficiency carryover at providing businesses with an incentive to reduce costs. This is discussed further in section 4.5 below.

In addition, in allowing itself to 'take account of issues arising at that time' the ESC is able to adjust future operating expenditure benchmarks from outturn expenditure to reflect any changes in costs between regulatory periods resulting in changes from the regulatory obligations placed on distributors or driven by external events. In its Final Decision on the Victorian gas distributors' Access Arrangements, the ESC has adjusted outturn operating expenditure in 2001 to taken into account the cost impact of full retail competition, changes in licence fees and insurance premiums.[14]

3.3.2. Capital expenditure benchmarks

In relation to capital expenditure, again there will be no outturn data from which to calculate an efficiency carryover amount for the last year of the regulatory period. However, in contrast with operating expenditure, there is no direct link between the ESC's approach to the efficiency carryover mechanism for capital expenditure for the last year of the regulatory period and the capital expenditure benchmarks established for the next regulatory period.

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13 Office of the Regulator-General, *Electricity Distribution Price Determination 2001-05, Volume I Statement of Purpose and Reasons*, September 2000, p. 88..

14 As noted by the ACCC in its Draft Decision on GasNet's Access Arrangements, p. 175.

Rather, the ESC states that its 'presumption' will be to assume that outturn capital expenditure in the final year of the regulatory period equals benchmark capital expenditure (ie, an efficiency gain of zero), and to use this assumed capital expenditure for the last year of the regulatory period, together with outturn capital expenditure in relation to the previous years, in rolling forward the asset base to establish the opening asset base for the next regulatory period.[15]

As a result, the business will benefit from any reductions in capital expenditure in the final year of the regulatory period by having its regulated revenue for the next regulatory period determined on the basis of an *asset base* which includes asset values not actually purchased. However, the ESC's approach to the carryover mechanism does not tie the capital expenditure *benchmarks* for the next regulatory period to outturn capital expenditure in the previous period.

3.4. Rolling Forward the Asset Base

As described in section 3.1, information on outturn expenditure (capital and operating) in the last year of the regulatory period will not generally be available at the time of the next review. The ESC has proposed dealing with this issue by calculating revenues for the next review period 'as if' outturn expenditure in the last year was equal to benchmark expenditure for that year.

For capital expenditure, the ESC calculate the opening capital base for the next regulatory period 'as if' the business had spent the benchmark capital expenditure for the final year of the previous regulatory period (year t-1). For example, if the business spends $100m less than benchmark expenditure in t-1, it will nonetheless have that $100m included in its opening asset value for the next regulatory period. It is important to note that by increasing the regulatory asset base the business receives both a higher return on capital and higher depreciation throughout the next regulatory period. However, for savings made in any other year the ESC's efficiency carryover mechanism only carries over savings in relation to return on capital and not depreciation.

In order for the ESC's efficiency carryover mechanism not to provide an incentive to make capital savings in the final year of a regulatory period the capital base must therefore be adjusted in year t+5 to remove the under-spend in year t-1.

This effectively means that an under-spend on capital in year t-1 will result in return of capital which is greater than the initial under spend. For example, if a business under spends $100m in year t-1 then the regulatory asset base at the beginning of year t+5 will be calculated, ignoring other capital expenditures, as:

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15 Any difference between actual and assumed capital expenditure in year t-1 will be adjusted for at the beginning of the subsequent regulatory period.

> **(The opening asset base at the beginning of year t** (which includes the $100m not actually spent in year t-1)**)** less **(depreciation of the opening asset base at beginning of year t** (including assumed depreciation on the $100m not spent)**)** less **(the $100m not spent)**

Such an approach is appropriate as it maintains the financial value of capital invested by the business.

3.5. Evaluating the ESC Mechanism Against the Objectives

It is useful to evaluate the ESC efficiency carryover mechanism against the three objectives of an efficiency carryover mechanism set out in the previous section, namely:

- not distorting incentives for the timing of efficiencies;
- not distorting incentives for the type of efficiencies; and
- providing appropriate magnitude of incentive for efficiencies.

3.5.1. Non distortionary incentives for timing of efficiencies

Under the ESC's mechanism, the net present value of the benefit to a business from making a saving is not dependent on the year in which that saving is made. The ESC's mechanism achieves the first of the three objectives set out above.

3.5.2. Non distortionary incentives for the type of efficiencies

In order to determine whether the treatment of capital efficiencies under the ESC's mechanism provides symmetry/neutrality with the treatment of operating and maintenance efficiencies, it is necessary to examine what proportion of the total savings associated with an efficiency for each type of expenditure the business is able to retain. If this proportion is roughly the same there will be neutral incentives for efficiency savings between each expenditure class. However, to the extent this is not the case there will be a bias towards one type of saving and against the other.

If a business achieves an operating and maintenance savings and if future benchmarks are always adjusted to reflect net savings evident at the end of the regulatory period then the share of total savings the business receives is given by the present value of a six year annuity divided by the present value of a perpetuity. This can be understood by noting that if a $X saving is achieved and is maintained forever the value of this to the business is the same as a six year annuity of $X. However, the total economic benefit is the value of a perpetuity (ie, $X forever).[16] The following equation sets this out:

$$\text{Business share of O\&M savings} = \left(\frac{X}{WACC} - \frac{X}{WACC*(1+WACC)^6}\right) \Big/ \frac{X}{WACC} \qquad \text{(Eq 1)}$$

At a WACC of 7 percent, this translates to around 33 percent of $X – ie, 33 percent of the total economic benefits will be retained by the business.

In contrast to operating and maintenance, a capital saving is carried over at a value equal to the saving multiplied by WACC (rather than the entire capital expenditure saving). In other words, for any given under-spend in any given year the business only retains the capital financing savings associated with that under-spend and does so for only six years (the period of the efficiency carryover).

In evaluating the impact of this approach it is useful to divide potential capital expenditure under-spends[17] into three separate categories:

1. A one-off efficiency saving of $X (say due to a particular project in year t being completed at lower cost than provided for in the expenditure benchmarks);

2. Deferral of $X (say due to the delaying of a particular project scheduled in the benchmarks for 'year t' to 'year t+z');

3. Ongoing reductions in capital expenditure of $X per year in perpetuity (say due to a policy change in the mix between capital and operating cost expenditure or a policy change in the classification of capital and operating expenditure).

If the under-spend is of type 1, then the total economic benefit to society of the efficiency is simply equal to $X. The benefit to the business under the ESC's efficiency carryover is equal to $X*WACC for six consecutive years. The NPV of such a benefit is given by the annuity formula:

$$\text{Benefit to business} = X*WACC*\left(\frac{1}{WACC} - \frac{1}{WACC*(1+WACC)^6}\right) \qquad \text{Eq 2}$$

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16 While this example uses a perpetual saving in O&M to illustrate the point the same equation holds for a non perpetual saving in O&M. This is because a saving in year t whcich is offset in year t+z (a non perpetual saving) can be considered to be made up of two offsetting perpetual changes in O&M. Thus, if the equation holds for both independently it must also hold for both combined.

17 The same analysis applies to over-spends (concentrating on under-spends allows us to avoid clumsy repetition of the term under-spend/over-spend).

At a WACC of 7 percent, this also translates to around 33 percent of $X, ie, 33 percent of the total economic benefits. This is the same sharing ratio as applies to operating and maintenance savings (as discussed above). Indeed, it can be seen that equation 1 and 2 are the same equation (expressed slightly differently).

The same formula can be shown to apply to a capital saving of type 2, provided that any shifting of capital expenditure into future regulatory period is **not** reflected in increased capital expenditure benchmarks in those regulatory periods. If this is not the case then the business's sharing ratio for any deferral efficiency can be as high as 15 times the true value of the deferal if, for example, the deferral was only for 2 years. That is, the business is able to retain 15 times the true economic benefits (and customers are worse of as a result of the deferral by 14 times the true value of the deferral). This highlights the main theme of our paper – that the implications of an efficiency carryover mechanism cannot be examined independently of the process for setting future benchmarks.

If the under-spend is of type 3 then the total economic benefit is equal to the present value of a perpetuity of $X. However, under the ESC mechanism the value of the saving to the business is only equal to a 6 year annuity of $X*WACC per year.[18] That is, the real economic benefits are based on $X per year but the benefits to the business are based on $X*WACC. Not surprisingly this leads to a significantly lower sharing ratio as given by the following formula:

$$\text{Benefit to business} = X * WACC * \left(\frac{1}{WACC} - \frac{1}{WACC * (1 + WACC)^6} \right) \Big/ \frac{X}{WACC} \qquad \text{Eq 2}$$

For a WACC of 7 percent, this translates to a sharing ratio of 2 percent - which is, not surprisingly, 7 percent of 33 percent (ie, WACC times the sharing ratio associated with operating and maintenance).

The effect of this lower sharing ratio for ongoing reductions in capital expenditure on incentives is threefold:

- firstly, a business has a greater incentive to make $1 of ongoing economic savings on operating and maintenance costs that it does to make $1 of ongoing economic savings on capital costs;

[18] This is strictly only true if the ongoing capital saving is achieved at the end of the regulatory period. If the ongoing capital saving is achieved earlier in the regulatory period the sharing ratio will be higher – as there would, in effect, be an annuity benefit to the business for each year of the regulatory period that the ongoing capital expenditure reduction was achieved.

- secondly, a business has an incentive to shift expenditure from operating expenditure to capital, ie, it will have an incentive to incur $1 higher capital costs in order save less than $1 in operating and maintenance costs. This is because ongoing increases in capital expenditure will not be penalised as heavily as ongoing reductions in operating and maintenance expenditure will be rewarded; and

- thirdly, a business has an incentive to reclassify costs as operating costs to the extent that it considers there are potential ongoing savings to be made in those costs (and vice versa).

The extent to which this is an issue depends on the extent to which capital expenditure and operating expenditure can be substituted for each other in both an economic and an accounting sense. It is a standard economic assumption that there is substitutability between 'capital' and 'labour' in most production processes. In infrastructure businesses the amount of operating and maintenance costs tends to increase with the average age of capital assets. By replacing its capital assets earlier than otherwise a business can achieve a reduction in ongoing operating expenditure at the expense of an increase in ongoing capital expenditure.[19] This is one method by which capital expenditure can be substituted for operating expenditure. Capital expenditure can also be substituted for operating expenditure in an accounting sense simply by changing the classification of expenditure from capital to operating expenditure.

3.5.2.1. *Bias not peculiar to ESC's mechanism*

It is important, and interesting, to note that the ESC's efficiency carryover mechanism does not introduce the above bias in favour of substituting capital for operating costs. Precisely the same bias will exist under a standard 5 year revenue/price cap with no efficiency carryover. This is because businesses are only ever penalised for surpassing capital expenditure benchmarks in relation to the capital finacing costs incurred within the regulatory period (assuming that outturn capital expenditure above benchmarks gets rolled into the asset base at the beginning of the next regulatory period). However, businesses benefit by the full value of any operating and maintenance expenditure reductions against benchmarks within the period.

3.5.2.2. *Correcting/managing bias*

In order to remove the above biases it is necessary for a business to expect to be penalised/benefit in the same proportion for ongoing capital and operating expenditure

[19] A policy change which results in assets being replaced earlier in their life results in a permanent increase in capital expenditure per period. To see this imagine assets were replaced at the end of 10 year instead of at the end of 20 years. This would mean that double the number of assets were being replaced each year – with a consequent doubling of required capital expenditure.

deviations from benchmarks. The ESC's mechanism does not currently provide this symmetry for ongoing capital cost changes.

One way of improving the ESC's mechanism would be to add an additional discretionary element of the efficiency carryover mechanism. Such an approach would require that a business was able to make a convincing case that a particular capital expenditure saving is likely to be ongoing. Such a case would require the business to show why certain policies they had implemented had led to any out-performance of benchmarks and why that policy is likely to have permanent effects on capital expenditure. If such a case were made it would be appropriate to add to the business's regulatory asset base an amount that provides them with an appropriate share of the associated benefits.

In terms of actually calculating that amount, if the predetermined sharing ratio is "S" then the business should have an amount added to their regulatory asset base equal to S, multiplied by the value of such an ongoing efficiency, less any benefits already received by the business during the regulatory period. This is set out mathematically in the following formula – the change in the regulatory asset base for an ongoing reduction in capital expenditure in period t:

$$=\left[S*\frac{X_t}{WACC}-X_t*WACC*\left(\frac{1}{WACC}-\frac{1}{WACC*(1+WACC)^6}\right)\right]*(1+WACC)^{6-t} \qquad \text{Eq 3}$$

Where: t=1,6 is the first year of the current/next regulatory period
Xt is the under/over spend relative to the (adjusted[20]) benchmarks in period t
the adjusted benchmark in period t is the original benchmark for that period less the sum of Xt for t<Z
t=1 is the first year of the regulatory period;

The first term inside the square brackets is equal to S times the perpetuity value of total future benefits – assuming that X is maintained in perpetuity. The second term inside the square brackets is the annuity value of capital financing benefits already enjoyed by the business under the ESC's existing efficiency carryover. The last term outside the square brackets simply carries these values forward from period t to the beginning of the next regulatory period.

While the above discussion is in terms of an ongoing reduction in capital expenditure the same applies for an ongoing increase in capital expenditure – except that the value of X in equation 3 would be zero. However, in the case of an increase in capital expenditure, it would be the regulator who would have to make the case that the increase would be in the nature of an ongoing increase.

[20] This formula requires that, for the purpose of calculating the efficiency carryover for capital expenditure savings after period t, all benchmarks within the current regulatory period are reduced by Xt.

3.5.3. Providing appropriate magnitude of incentive for efficiencies.

The ESC's mechanism provides for a business to keep approximately 30 percent of any expenditure savings. This sharing ratio is derived from an NPV calculation of benefits to the business divided by total savings in perpetuity, all calculated at a real discount rate of 7.5 percent. As discussed in the previous section, the same sharing ratio applies to savings in operating expenditure, and to one-off savings or deferral in capital expenditure. (The sharing ratio for recurrent capital expenditure savings is somewhat lower).

There was considerable debate during the ESC's price review processes for both the electricity distribution businesses and the gas distribution businesses as to the appropriate sharing ratio between businesses and customers. The sharing ratio that is most appropriate will depend, in part, on the emphasis placed on cost reductions versus price reductions. In other words, there is a trade-off between the extent of the efficiency savings made (which will be higher the greater the share of those savings retained by the business) and the speed with which those savings are passed on to customers (the greater the share of the savings retained by business, the longer customers have to wait to benefit from the savings through lower prices).

It is important to note that there is no pre-determined 'optimal' sharing ratio. The optimal relationship between the share of gains retained by the business and the cost savings made depends on the underlying assumptions made regarding the responsiveness of the business to changes in the share of efficiency gains made – ie, the impact on business' incentives to make efficiency gains as the sharing ratio changes.

The precise relationship between business efficiency responsiveness and the share of gains retained is unknown. On the assumption that the relationship is linear, the optimal sharing ratio can be shown to be 50%.[21] The ESC's 30:70 sharing ratio assumes that this relationship is diminishing. That is, efficiency gains from increasing the share of gains retained by the business diminish as the share retained by the business increases. Such a view reflects a common assumption in economics.

21 Brian Williamson, NERA Topic, October 1997. Note that this analysis does not take into account allocative efficiency considerations.

4. SETTING BENCHMARKS FOR FUTURE PERIODS

To the extent that there are sufficient incentives built into the regulatory framework for the business to reveal its efficient costs, the business' outturn costs can be taken as a strong guide to efficient costs. The regulator can therefore use information on outturn costs as a guide to efficient costs in setting benchmarks for future periods. As discussed earlier, an approach where the regulator relies solely on outturn costs in setting future benchmarks can be termed a 'mechanistic approach'.

4.1. The Attraction of a 'Mechanistic Approach'

The regulated business will always have better information in relation to its business than the regulator. It will also have an incentive as far as possible to present information to the regulator in such a way as to result in more generous expenditure benchmarks being set. Given that the regulator is aware of this incentive, it in turn will have a tendency to demand more and more detailed data from the business, to ensure that it can establish as complete and accurate picture as possible of the efficient costs that the business faces.

One of the common complaints voiced by regulated businesses is the 'forensic' approach that can be taken by regulators in conducting a regulatory review, and the consequent intrusiveness and requirement on the businesses to produce large quantities of very detailed information.

An advantage of establishing a more mechanistic approach to setting future expenditure benchmarks is that it therefore enables a reduction in such 'intrusiveness', and in the amount of information required to be provided by the business, and which must be analysed by the regulator. Given that the regulator will always be at an informational disadvantage in analysing business' future cost and demand forecasts, the less the regulator has to rely on such forecasts in determining future benchmarks the better. Introducing a greater degree of mechanism in setting future expenditure benchmarks is therefore, other things being equal, a desirable goal.

4.2. Future Efficient Costs May Differ From Past Efficient Costs

In order to be able to rely more heavily on revealed cost information in setting future expenditure benchmarks, there needs to be a presumption that past costs are a good guide to future costs.

In some cases the level of efficient costs achieved in the past will be a good indication of the level of efficient costs faced in the future. This will be the case where the level of costs is stable from year to year and where there are no discrete changes in costs from one regulatory period to the next (for example, as a result of changes in the obligations placed on regulatory businesses). That is, for some cost categories in some industries, the underlying level of efficient costs may not be expected to change significantly over time.

However, this need not always be the case. To the extent that past efficient costs are not a good predictor of future efficient costs, then the regulator will need to retain discretion to adjust future benchmarks from past levels.

There are some circumstances in which it is clear that outturn costs may not be considered a good guide to future costs, namely:

i. where costs tend to be lumpy and variable;

ii. where costs are cyclical;

iii. where there are changes in the underlying cost-drivers between regulatory periods;

iv. where the obligations placed on regulated businesses and/or the scope of its regulated activities changes; and

v. where input costs are themselves changing over time.

Using past costs as a basis for establishing future costs will be particularly problematic where costs are lumpy and variable. High outturn expenditure in the previous regulatory period may, for example, reflect particular capital works in that period which are not required in the following period. Setting capital expenditure benchmarks for the following period on the basis of outturn capital expenditure in the earlier period would therefore over-estimate the businesses' efficient costs in the second period. Conversely, in a situation in which expenditure was not undertaken in the current period, but will be required in the subsequent period, setting benchmark expenditure equal to outturn expenditure will result in a under-recovery of efficient costs by the business. As such, this highlights that a purely mechanistic approach would be less appropriate in establishing benchmarks for these types of costs.

There are also cases where costs are cyclical, and will vary over time. For example, maintenance, refurbishment and replacement expenditure may all be expected to increase as the age of the underlying assets increases. In such cases, past expenditure is not a good guide to the required future efficient level of expenditure. Required expenditure can be expected to rise over time until the assets are replaced, in which case efficient expenditure will drop, and the cycle will begin again.

Changes in the underlying drivers of a business' costs from one regulatory period to the next will also, by definition, affect the costs they face. For example, where costs are driven by the number of new customers being connected (as is the case for electricity and gas distribution), any change in expected new connections from one regulatory period to the next can be expected to result in future costs being different to the revealed level of costs in the past. In this case it would be appropriate to make some form of adjustment to outturn expenditure in using them to determine appropriate future expenditure benchmarks.

A further example of underlying cost drivers is the obligations placed on regulated businesses. Using outturn expenditure in setting benchmarks is likely to be inappropriate in situations where there is a change in the obligations faced by regulated businesses, or a change in the scope of their (regulated) activities. For example, any change in the service standards which businesses are required to meet can be expected to impact on their efficient costs. Similarly, if a business is required to take on new activities, this will change the costs they face from one regulatory period to the next. It would therefore be necessary for the regulator to include an adjustment to account for the step-change in costs arising from the change in obligations, to the extent that it uses past costs as the basis for setting future expenditure benchmarks.

Finally, it is important to recognise that input costs themselves vary over time. Real increases (or decreases) in wage rates or other factor prices would require outturn expenditure to be adjusted to reflect these input cost changes, before being used as the basis for establishing future benchmarks. Such changes are, however, likely to be a trend rather than a step-change in costs. As such, the expected future change in input costs will also be used to determine the appropriate future trend in the expenditure benchmark over the course of the next regulatory period.

4.3. The ESC's Approach to Setting Expenditure Benchmarks

As discussed in the previous section, the ESC's approach to the efficiency carryover explicitly ties the determination of the operating expenditure benchmark for the first year of the next regulatory period to the outturn expenditure achieved by the business in the penultimate year of the current regulatory period. The rationale for establishing this tie is to ensure that the business is rewarded for making efficiency gains in the last year of the regulatory period, in the absence of data on outturn expenditure which would allow an efficiency carryover amount to be explicitly calculated.

However, despite this explicit linkage, the ESC's approach to establishing future operating expenditure benchmarks is not a purely mechanistic one. The ESC has indicated that it will take into account 'issues arising at the time', and the approach it has adopted in practice is one of adjusting for step-changes in costs arising from changes in business' obligations and external cost drivers, as well as allowing for expected changes in productivity (which can reflect input cost changes).

In addition, we note that for electricity and gas distribution businesses, operating costs tend to be relatively stable. This is partly reflective of the fact that for many such businesses the average asset age remains relatively constant over time – that is, a steady state has been achieved between capital expenditure and depreciation of assets. Such characteristics make an approach which bases future expenditure trends on outturn expenditure more appropriate. In contrast, capital expenditure costs for these distribution businesses can be lumpy and can exhibit cyclical cost trends. The ESC's efficiency carryover approach does not link future capital expenditure benchmarks with outturn expenditure. Rather, the regulator maintains full discretion in determining these future cost benchmarks.

4.4. Inevitability of Discretion

Given the potential characteristics of costs described in section 4.2 above, it is clear that a regulator will inevitably need to retain discretion in determining future expenditure benchmarks, and that future expenditure benchmarks cannot in all cases and circumstances simply mechanistically be set on the basis of past costs, even where those past costs are considered to be efficient. Preventing the regulator from recognising cases where future expenditure will differ from past levels, and allowing it to adjust benchmarks accordingly to avoid either under- or over-recovery of costs by the businesses, would be a sub-optimal outcome.

However, in this situation it is important to be transparent about how such discretion will be used, in order not to undermine the incentives for businesses to make efficiency savings. This is done in a general sense in section 4.5 below. In the final section of this report we also put forward a proposal for how such discretion should be exercised in the specific case of SPI PowerNet.

4.5. Rules for the Exercise of Discretion

In this section we propose two rules for the setting expenditure benchmarks in order to preserve the integrity of the efficiency carryover mechanism. In summary, they are that, in the absence of a 'last year' problem[22], benchmark expenditures:

1. should be based on the best estimate of likely expenditure at the beginning of the regulatory period less any observed deferral of expenditure from the previous regulatory period; and

2. should not extrapolate past trends in costs into the future – except to the extent that a portion of those trends can be identified as being driven by factors beyond the businesses control (such as factor cost changes and an ageing asset base).

4.5.1. Deferral of expenditure

A purely mechanistic approach that sets future benchmarks exactly equal to past costs has the desirable property that it does not provide artificial incentives to defer expenditure from one period to the next. This is because any under-spend against benchmarks in one regulatory period results in an automatic reduction in benchmarks for the next regulatory period. Thus, if a saving arises from a deferral of expenditure, then benchmarks in the next period will be automatically lower by the amount of the deferral and the business will

[22] The 'last year' problem is where accurate information on actual expenditure in the last year of the regulatory period is not available for calculation of the efficiency carryover to be applied at the beginning of the next regulatory period. This section ignores this problem in order to simply set out fundamental principles. The resolution of the last year problem does not alter these fundamental principles.

automatically lose the benefit of the deferral when the period of deferment ends (ie, when the business is forced to incur the deferred cost).

However, the fact that past costs are inevitably a poor indicator of future costs means that a purely mechanistic approach to setting future benchmarks on the basis of past costs will generally not be feasible. That is, the regulator will have to take into account factors other than past costs when setting future benchmarks. However, in setting future benchmarks the regulator must ensure that costs that have been allowed for in past benchmarks (but not actually incurred) are not double-counted by being included again in future benchmarks. In other words, it will be necessary to ensure that future expenditure benchmarks are not made artificially high as a result of the business deferring expenditure from one regulatory period to the next.

For example, imagine that:

- $Xm was allowed for a particular program of expenditure in one regulatory period;
- that program was not actually undertaken in that regulatory period; and
- that program will now need to be undertaken in the next regulatory period.

Under this scenario the benchmarks for the next regulatory period will need to be based on the best estimate of likely costs to be incurred, less $Xm (which is the deferral of costs from one regulatory period to the next). This will mean that the business is able to benefit from the deferral of expenditure only for the period of the efficiency carryover or the period of the deferral (whichever is the lesser). This is in proportion with the economic benefits to society/customers from a deferral in costs.

While this process is necessarily 'forensic' in that it requires the regulator to distinguish between 'new' and 'deferred' expenditures, such a process is inevitable to the extent that the regulator retains any discretion to set future benchmarks differently from outturns. Given that the retention of such discretion is inevitable (due to the fact that past costs are an imperfect predictor of future costs) we consider it highly desirable to make explicit the guidelines for how that discretion will be exercised.

The above analysis gives rise to the following general rule for the exercise of discretion in setting future benchmarks in a manner that does not undermine the incentive properties of the efficiency carryover mechanism.

> *"Future benchmarks should be based on the best available evidence of required expenditure at the beginning of the regulatory period less any amounts which represent expenditure on programs that have already been allowed for in past expenditure benchmarks "*

4.5.2. Assuming a trend efficiency saving

It is possible for the regulator to adopt a partly 'mechanistic' approach whereby outturns are used to set the benchmark cost for the first year of the new regulatory period but where an additional trend reduction (or increase) in costs during a regulatory period is also assumed. There are three possible rationales for assuming such a trend, namely that:

i. factors beyond the business' control, such as falling input costs, will result in cost reductions during the regulatory period;

ii. the regulator is of the opinion that the business is capable of changing its manner of operation in order to achieve efficiency savings during that regulatory period and the regulator has formed this opinion without reference to past efficiency savings achieved by the business; or

iii. the regulator is of the opinion that the business is capable of changing its manner of operation in order to achieve efficiency savings during that regulatory period and the regulator has formed this opinion based on observations of past efficiency savings achieved by the business.

If the assumed trend reduction (or increase) in costs is based on the first or second of the above rationales, there is little or no consequences for the incentives for efficient behaviour by the firm. This is because in both such cases the trend is set without reference to past apparent efficiency gains/losses made by the business. However, this is not the case in relation to the third rationale.

If the regulator were to impose an efficiency saving trend based on the observation of past efficiency savings, this would run the risk of undoing any incentives apparently provided in the efficiency carryover mechanism. This is for two reasons:

- first, if the regulator **correctly** surmises from past efficiency gains that future efficiency gains are available and then incorporates these in future benchmarks, the regulator is, in effect, reducing the proportion of the benefit from these efficiencies that will be kept by the business. For example, if the business implemented a plan that reduced operating costs by 1 percent every year into the future, and if the regulator reflected these falling costs in future benchmarks, then the sharing ratio between the business and the consumer would fall from above 30/70 (if the trend is not reflected in future benchmarks) to around 10/90 percent (if the trend is reflected in future benchmarks). With such a low sharing ratio, it is possible that the business will have substantially less incentive to achieve efficiencies;

- second, the regulator may be **incorrect** when it infers that past efficiencies are able to continue to be achieved in the future. In this situation, it is possible that the business could be made worse off as a result of making efficiency savings.

This suggests that if a business expects a regulator to base future expenditure trend estimates on past savings then the best outcome it can hope for is that it will keep approximately 10 percent of the value of total savings and the worst is a negative amount (if that trend does not materialise). It is reasonable to expect a rational business to be indifferent or even cautious about attempting to implement such cost savings.

We also note that, while it is theoretically possible for the regulator to form an opinion consistent with rationale ii) above, it is in practice very unlikely. The rationale for incentive regulation is information asymmetry and a lack of knowledge by the regulator on how efficiencies could be achieved. If the regulator knew how efficiencies could be achieved there would be no need for incentive regulation. It follows that rationale ii) will generally be inappropriate, except in rare circumstances (such as immediately following the privatisation of a business with well known inefficient practices).

This leads us to a second important guideline for the use of discretion in setting expenditure benchmarks, namely:

> *"Any trend imposed on future benchmark costs should be based on forecasts of the impact of factors beyond the businesses control – such as changes in input costs or increasing average age of assets. Past efficiency savings should not be used as a rationale for assuming future efficiency savings – even if such a view is likely to be correct."*

4.5.3. Recent ACCC Decisions

We note that the ACCC's approach to the setting of benchmarks for overhead costs in the Electranet decision appears to be consistent with this rule in that trend reductions are based on estimates of economy wide total factor productivity. (Although, we do not necessarily endorse the ACCC's approach as being an accurate reflection of trend cost reductions for Electranet, we do endorse the principle that if such trends are to be imposed they should be based on observations of variables beyond the control of the business).

It is also interesting to note that GasNet[23] has argued for an efficiency carryover mechanism that requires any change in future benchmarks set by the ACCC to be reflected in the efficiency carryover for that regulatory period. Such an approach has the effect of preventing a regulator from being able to reduce future benchmarks without providing the regulated business with compensation in the form of a higher efficiency carryover. The consequences is that it reduces the risk that a business will not have an incentive to make efficiency savings due to the fear that the regulator will require it to continue making such savings by enforcing a trend reduction in costs (for which it provides no compensation in the form of an efficiency carryover). The potential downside of such an approach is that it does not allow the regulator to adjust future benchmarks for changes in costs outside the

[23] See ACCC Draft Decision *GasNet Australia access arrangement provisions for the Principal Transmission System* 2002 for discussion.

business's control without also providing a benefit/impost to the business in the form of a positive/negative efficiency carryover (a benefit/impost that it would not 'deserve').

Nonetheless, it should be recognised that the approach suggested by GasNet, with some relatively simple modifications (such as making it symmetrical), can provide exactly the same outcomes as the ESC's efficiency carryover. This will be the case if:

- changes to benchmarks due to factors beyond the business's control are excluded from the calculation of the efficiency carryover in the GasNet proposal; and

- the setting of benchmark expenditure (in concert under the ESC efficiency carryover mechanism) does not include anticipated efficiencies by the regulated business.

The GasNet proposal serves to highlight the importance of future benchmark expenditures used in conjunction with the ESC's efficiency carryover not anticipating efficiencies yet to be made by the regulated business.

The ACCC's Draft Decision for SPI PowerNet does not explicitly address the issue of how future regulatory period benchmarks will be set, and neither does the ACCC's Draft Statement of Regulatory Principles (DSRP). However, it possible that the DSRP anticipates this issue when it discusses the problem of relying on historical efficiencies to estimate future efficiencies.[24]

[24] See footnote 79 on page 89 of the DSRP.

5. OTHER INTERACTIONS WITHIN THE REGULATORY REGIME

Before presenting our proposal for the efficiency carryover mechanism to be applied to SPI PowerNet, we consider the interaction of the efficiency carryover mechanism with other aspects of the regulatory regime.

5.1. The Form of Price Control

The form of price control, and in particular the extent to which actual revenues under the price control can react to changes in circumstances, is important in considering the operation of the efficiency carryover. The ESC's efficiency carryover mechanism was designed in the context of a tariff basket form of price control. Consequently, the ESC initially proposed that there would be no adjustment to the expenditure benchmarks in calculating the efficiency carryover to reflect differences between forecast and outturn growth. Where actual demand was in excess of forecasts, under the tariff basket form of price control the distributor would receive additional revenue, which would compensate it for the additional costs incurred.

SPI PowerNet faces a revenue cap form of price control. As a result, there are no 'built-in' adjustments in regulated revenue to reflect changes in underlying cost drivers. For SPI PowerNet, therefore, it will be important in calculating the appropriate carryover amount to ensure that appropriate adjustments are made for differences between outturn and forecasts for key cost drivers. We note that such adjustments are consistent with the approach that is now proposed by the ESC.

5.2. The WACC

We note that where the weighted average cost of capital is set too high/low it can negate/amplify incentives under various efficiency carryover mechanisms. For example, if the regulatory WACC is set above the true WACC a business has an incentive to over invest in capital. This incentive will tend to counteract the incentive to make savings on capital expenditure. Similarly, where the WACC is set too low this will give a business an incentive to make inefficient reductions in capital expenditure.

5.3. Service Standards

It is important to note that the efficiency carryover mechanism (and incentive regulation in general) is designed under the assumption that businesses are not able/ have no incentive to reduce expenditure at the inappropriate expense of service standards. Consequently, it is necessary for the regulatory framework also to provide some form of disincentive to prevent deteriorating service standards. In Victoria, the ESC introduced both explicit service performance targets, and a service incentive scheme (the 'S-factor') which rewarded (or penalised) electricity distributors for achieving service in excess of (or below) these targets.

6. APPLICATION TO SPI POWERNET

In this section we set out our proposal for the appropriate design of an efficiency carryover mechanism for SPI PowerNet. Before doing so, we set out the key characteristics of SPI PowerNet's costs which have driven the formulation of this proposal.

6.1. Relevant Characteristics of SPI PowerNet's Costs

There are two distinguishing features of SPI PowerNet's costs that have implications for the appropriate form of carryover mechanism:

- a high incidence of both 'lumpy' and cyclical operating expenditure; and
- the treatment of capital expenditure costs for network augmentation outside of the capital expenditure expenditure benchmarks.

We consider each of these in turn below.

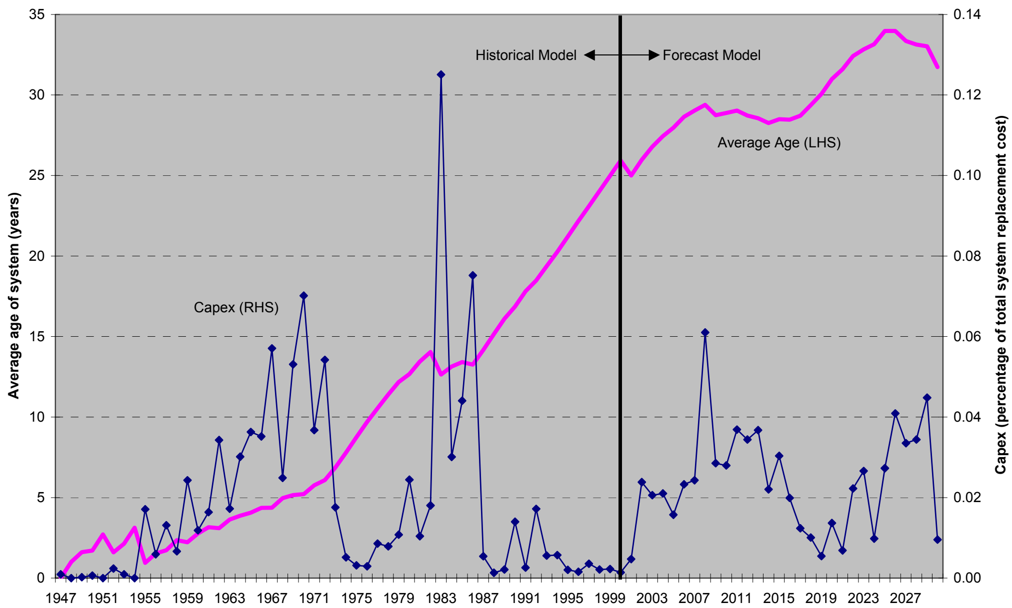
6.1.1. Operating & maintenance costs

In contrast with some other regulated businesses, many of SPI PowerNet's operating and maintenance costs are 'lumpy', rather than being continuously incurred throughout the regulatory period.

SPI PowerNet's maintenance costs vary depending on the life of the underlying assets. As the asset base ages, it requires a greater amount of maintenance to ensure the same asset performance. The average age of SPI PowerNet's assets is shown in Figure 6.1, and can be seen to be increasing. This in turn implies an increase in underlying maintenance expenditure. However, eventually a point will be reached at which the assets will be replaced, resulting in a drop in maintenance costs. Maintenance costs can therefore be expected to follow a cyclical pattern, rather than a constant trend. The implication is that such costs will vary between regulatory periods.

In addition to an overall rising trend in operating & maintenance expenditure, such expenditure also exhibits a degree of 'lumpiness'. This lumpiness occur, both as a result of assets reaching the age at which they suddenly require increased maintenance, and also as the result of capital assets being replaced. We understand that many of SPI PowerNet's capital assets require very little maintenance until they reach a certain age, at which point there is a 'step-change' in the amount of associated maintenance required. For example, maintenance is needed for older assets to combat corrosion, which is not an issue for assets below a certain age. In contrast, the replacement of a capital asset may result in a temporary reduction in the amount of maintenance required. These changes are likely to be lumpy, given the large proportion of assets of similar ages, and the periodic nature of asset replacement programs.

Table 6.1: SPI PowerNet's Ageing Asset Base



Source: SPI PowerNet

These characteristics of SPI PowerNet's operating & maintenance costs have two key implications:

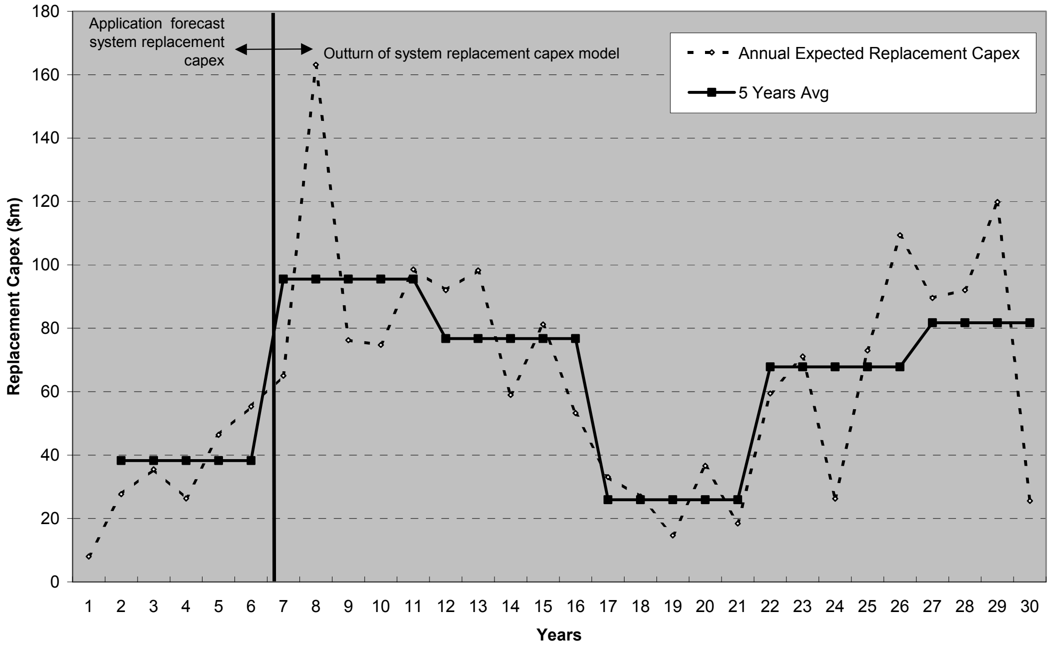
i. Firstly, to the extent that there is a cyclical operating cost trend, this should be taken into account by the ACCC in setting SPI PowerNet's future operating cost benchmarks. This has implications for the 'last year' treatment of the efficiency carryover mechanism applied to SPI PowerNet, specifically, the appropriate use of outturn data in setting future operating expenditure benchmarks; and

ii. Secondly, as discussed in section 4.2, in basing future benchmarks on outturn expenditure, where costs are 'lumpy' the regulator should consider both whether there was operating expenditure in the previous year that is not required in the future period; and whether operating expenditure is required in future periods that was not required in the past.

6.1.2. Capital expenditure costs

In common with other regulated network businesses, SPI PowerNet's replacement capital costs tend to be lumpy, and will vary between regulatory periods. Figure 6.2 provides a forecast of SPI PowerNet's replacement capital expenditure.

Figure 6.2: SPI PowerNet's Projected Replacement Capital Expenditure



Source: SPI PowerNet

The lumpiness of SPI PowerNet's capital expenditure implies that, in using past capital expenditure as a guide to setting future capital expenditure benchmarks, the regulator needs to consider the extent to which there was capital expenditure in the previous year which is not required in the future period; and the extent to which capital expenditure is required in future periods which wasn't required in the past. That is, in line with the discussion in section 4, it will not be appropriate for the regulator to take a purely mechanistic approach to setting future capital expenditure benchmarks.

In addition, SPI PowerNet is unique amongst electricity transmission businesses in relation to the treatment of future network augmentation costs, which are not included within SPI PowerNet's capital expenditure benchmarks for a regulatory period.

Under the arrangements applying in Victoria, augmentation capital investment within a regulatory period is undertaken in response to tenders run by VenCorp. These tenders may be contestable or non-contestable.

Where such tenders are contestable, the value of the assets covered by the tender are treated as remaining outside of SPI PowerNet's asset base. The contract for such assets will typically include long-term fixed payment provisions. However, these arrangements are outside of SPI PowerNet's regulated revenue cap, and do not impact on regulated prices.

In the majority of cases, however, the network augmentation tenders run by VenCorp are non-contestable. In this case, the regulatory treatment which has been proposed by SPI

We note that the SPI PowerNet Draft Decision states that the ACCC intends to design and implement an incentive scheme to provide appropriate incentives to maintain or improve service quality for all TNSPs. The ACCC states that this scheme will provide an incentive (or penalty) in addition to the MAR that a TNSP can earn. We also note that SPI PowerNet's outage rebates scheme already provides this type of incentive.

5.4. Length of the Regulatory Period

The length of the regulatory period will also impact on the efficiency carryover. In general the efficiency carryover mechanism must allow the business to keep savings for at least the length of the regulatory period (generally 5 years) as otherwise the business will still have an incentive to achieve savings in the early years of the regulatory period. The ESC's efficiency carryover mechanism allows the business to keep savings for six years (including the year in which savings are made) which is the maximum length that can be adopted without the efficiency carryover mechanism running across several regulatory periods.

5.5. Regulatory Accounts

Where the efficiency carryover amount is applied only to some costs a business will have an incentive to shift costs from one cost type to another. For example, if the efficiency carryover is only applied to operating expenditure (as is the case with the ACCC's GasNet decision) then business will have an incentive to classify costs as capital rather than operating costs (thereby increasing the apparent 'savings' on operating cost).

This means that if differential treatment of cost classes is applied, the regulator will have to undertake greater forensic examination of regulatory accounts.

PowerNet to the ACCC is that the capital value of the assets associated with the augmentation are rolled into SPI PowerNet's regulated asset base at the time of the next regulatory review, at the value specified in the contract. This value may either be fixed, or may be part-fixed, part-variable. Prior to the inclusion of the assets in SPI PowerNet's asset base at the next regulatory review, SPI PowerNet is paid the return on those assets (plus depreciation) directly under the terms of the augmentation contract.

Given the role of VenCorp in relation to network augmentation in Victoria, the value of anticipated augmentations are not expected to be included in the capital expenditure benchmarks set by the ACCC for SPI PowerNet for the next regulatory period. Any efficiencies achieved by SPI PowerNet in putting in place such augmentations below the expected capital cost, therefore will not be automatically picked up by an efficiency carryover mechanism that focuses solely on the difference between benchmark and outturn capital expenditure.

6.2. Proposed Efficiency Carryover Mechanism to apply to SPI PowerNet

This section sets out the proposed efficiency carryover arrangements proposed for SPI PowerNet, given the cost characteristics noted above and the discussion in the preceding sections of the report.

The evaluation in section 3.5 of the efficiency carryover mechanism adopted by the ESC concluded that it achieves the key objective of smoothing the incentives on the regulated business to make efficiency gains throughout the regulatory period, and provides an enhanced incentive on the business' to make efficiency gains. However, we also noted that the ESC's mechanism does not eliminate a bias in favour of substituting capital for operating expenditure. In that section we suggested that this bias could be managed by introducing a specific adjustment to the regulatory asset base where the business/regulator can make a strong case that the cost saving/increase is ongoing in nature.

Consequently, we are of the view that the 'rolling carryover' approach adopted by the ESC, with the above-mentioned adjustment, is an appropriate arrangement for achieving the objectives of the carryover of efficiency gains. In general, we therefore support the application by the ACCC of the same mechanism to SPI PowerNet, with a modification to ensure neutrality between capital expenditure and operating expenditure savings.

Specifically, we support the application of the following rolling carryover approach for SPI PowerNet:

- the carryover of efficiency gains for five years following the year in which the gain is made;
- the adoption of a symmetrical approach in carrying over both efficiency gains *and* efficiency losses (ie, spending in excess of benchmarks) - the principle of symmetric

treatment is important in ensuring that the incentive properties of the regime are maximised;

- the carryover amount calculated in relation to both operating & maintenance and capital expenditure, in relation to the expenditure benchmarks only, ie, no allowance for an efficiency carryover in relation to SPI PowerNet's network augmentation expenditure, on the assumption that appropriate incentives will be built into contractual arrangements;
- adjustment of the benchmark forecasts in calculating the carryover amount to take account of any cost differences arising from changes in legislated or regulated obligations during the period together with changes covered by the revenue cap's pass through arrangements;
- an efficiency gain (loss) for operating expenditure calculated as an increase (decrease) in recurrent operating expenditure;
- an efficiency gain (loss) in capital expenditure calculated as the regulatory WACC, multiplied by the difference between that year's capital expenditure and the original benchmark forecast *plus* an additional adjustment for expenditure savings that are found to be ongoing in nature (as set out in Section 3.5);
- the same approach to the 'last year' as adopted by the ESC, ie, the efficiency gain (loss) for the last year of the regulatory period will be assumed to be zero, and:
  - for operating expenditure the future benchmarks will be set without regard to any observed efficiency savings in the last year of the regulatory period as discussed in section 6.3 below; and
  - for capital expenditure, the benchmark capital expenditure assumed for t-1 is used in determining the opening asset base for year t, with a subsequent adjustment to take account of the difference between outturn and benchmark capital expenditure in t+6.

The approach outlined above largely mirrors the ESC's approach. We discuss some of the key elements (and differences) below.

6.2.1. Application to both capital expenditure and operating expenditure

In relation to the application of the carryover mechanism to both operating expenditure and capital expenditure, this proposal is consistent with the ESC's treatment, but is in contrast with the proposal by GasNet (accepted by the ACCC in its Draft Decision), that the efficiency carryover apply only to operating expenditure. As discussed in section 3, in order to ensure that the incentives in relation to the trade-off between operating expenditure and capital expenditure are not distorted, we believe that the efficiency carryover mechanism for SPI PowerNet should apply to both. We note that the issue of capital and operating expenditure substitutability is likely to be of greater significance to SPI PowerNet than it is for GasNet.

6.2.2. Inclusion of a specific adjustment for ongoing capital expenditure savings

The key area of difference between the ESC's approach and our proposal is in relation to the inclusion of an additional adjustment in the calculation of the carryover associated with ongoing capital expenditure savings. This adjustment addresses the concerns discussed in section 3.5 that the ESC's mechanism may provide a bias in favour of making operating expenditure savings, rather than capital expenditure savings.

6.2.3. Treatment of non-contestable augmentations

We noted above that network augmentations are not included in SPI PowerNet's capital expenditure expenditure benchmarks. As a result, capital expenditure efficiencies in relation to augmentations would not automatically get picked up in the application of an efficiency carryover arrangement to SPI PowerNet. We have therefore considered whether it would be appropriate to include an additional component in the efficiency carryover calculation to reflect the difference between expected and outturn capital expenditure in relation to network augmentation carried out by SPI PowerNet.

In relation to contestable augmentations, these take place outside of SPI PowerNet's regulated revenue cap. The contract for such assets will typically include long-term fixed payment provisions. To the extent that SPI PowerNet incurs a cost in providing those assets above or below the fixed price agreed, then it bears this as either an 'efficiency loss', or an 'efficiency gain'. However, these arrangements stand outside the regulated revenue cap. It would not be appropriate (nor is it necessary) to include within regulated prices an 'efficiency amount' with respect to this capital expenditure.

In relation to non-contestable augmentations, expenditure on these augmentations are expected to stand outside of the regulated revenue until the next regulatory review, and then to be rolled-in to the asset base on the basis of the asset value agreed in the contract. This asset value may be fixed, or may have a variable element which relates to the actual cost incurred.

The extent to which SPI PowerNet can benefit from achieving efficiency savings in relation to non-contestable capital expenditure augmentations will depend crucially on the form of the contract it enters into with VenCorp. For contracts where the asset price is fixed, SPI PowerNet would realise an 'efficiency benefit' to the extent that its actual capital costs were less than the contracted amount. SPI PowerNet's proposal to the ACCC is that these assets should be rolled into the regulatory asset base at the contract value. Under these circumstances, SPI PowerNet would benefit from the 'efficiency gain' for the entire life of the asset (rather than only 5 years, under the efficiency carryover mechanism). In contrast, if SPI PowerNet were to spend in excess of this amount, it would bear that loss for the entire life of the asset (and the loss would be the WACC and depreciation, since the full value of the asset would never get rolled into the regulatory asset base.) As a result, there would be no need to provide an additional 'efficiency carryover amount' in relation to these augmentations, as part of SPI PowerNet's regulated revenue.

In contracts where the asset value is part fixed and part variable, then the incentive for SPI PowerNet to make an efficiency saving (ie, to construct the asset at a cost below that anticipated) will depend crucially on the form of the contract, which will determine both the payments to SPI PowerNet during the regulatory period and the value of the asset which would be rolled into the asset base at the start of the next regulatory period. These contractual provisions in turn will determine the extent to which SPI PowerNet gets to benefit from achieving efficiencies in capital expenditure investment, and how long it gets to benefit.

In addition, it is important to note that any impact on SPI PowerNet's incentives can only determine the *magnitude* of the incentive to make savings, and not either the timing of those savings (since the timing of non-contestable augmentations are determined by VenCorp and not SPI PowerNet) or the trade-off between capital expenditure and operating expenditure (since, by definition, the network augmentation will relate only to the former). The potential role of an efficiency carryover amount in this context is therefore more limited.

Our conclusion therefore is that the appropriate mechanism for providing SPI PowerNet with an incentive to achieve capital expenditure efficiencies in relation to non-contestable augmentations is as part of the contract itself, rather than through a separate efficiency carryover component of regulated revenue.

6.2.4. Adjustment to the expenditure benchmarks in calculating the efficiency carryover

The ESC's mechanism allows for adjustments to the expenditure benchmarks against which efficiency is calculated for variations in expenditure brought about by changes in scope and for changes between forecast and outturn growth.

In relation to SPI PowerNet, similar adjustments for changes in legislative or regulatory requirements on the businesses' costs, eg, arising from the imposition of tighter service standards would be appropriate. It would also be necessary to adjust the benchmarks to reflect changes which are covered by the pass-through arrangements – such changes would already have been assessed by the ACCC as part of a pass through request. However, the number of customers is not a cost driver for SPI PowerNet. As such, there would be no need to adjust the expenditure benchmarks to take account of differences between forecast and outturn growth in customers.

In relation to other external cost drivers (eg, insurance costs, exchange rate movements), our proposal is that these be considered in setting future expenditure benchmarks (see next section). There would not be an adjustment to the existing expenditure benchmarks to reflect differences between outturn and expected levels of these drivers. Such adjustments could quickly become overly 'forensic', and may undermine the clarity of the efficiency carryover mechanism (and, hence, its potential impact on managers' incentives).

6.2.5. Efficiency carryover to be applied to the 1998-2002 period

In addition to determining the appropriate long-run efficiency carryover mechanism to be applied to SPI PowerNet, in making its Determination in relation to SPI PowerNet's revenue cap for 2003-2007 the ACCC will also need to make a decision as to the amount that should be included in SPI PowerNet's allowed revenue to reflect efficiency gains made in the 1998-2002 period.

There has not been a clear understanding of the carryover mechanism that will apply to SPI PowerNet in relation to the current regulatory period. It is important to note that the ACCC's decision as to the efficiency carryover mechanism to apply to the 1998-2002 period cannot influence SPI PowerNet's behaviour – given that the period is largely finished. As a result, the decision as to the appropriate carryover for the 1998-2002 period needs to be considered separately from the decision as to the appropriate long-run efficiency carryover mechanism to apply to SPI PowerNet.

Our proposal above applies to the long-run mechanism, and does not imply that the same approach is necessarily appropriate for the 1998-2002 period.

6.3. Proposed Approach to Setting Future Expenditure Benchmarks

In section 4 we considered the extent to which a mechanistic approach is appropriate for the setting of future expenditure benchmarks on the basis of outturn expenditure. In that section we set out two rules for the setting of expenditure benchmarks not to undermine the incentives of an efficiency carryover mechanism. In particular, we argued that in the absence of a 'last year' problem[25]:

- benchmark expenditures should be based on the best estimate of likely expenditure at the beginning of the regulatory period less any observed deferral of expenditure from the previous regulatory period; and
- benchmark expenditures should not extrapolate past trends in costs into the future – except to the extent that a portion of those trends can be identified as being driven by factors beyond the businesses control (such as factor cost changes and an ageing asset base)

[25] The last year problem is where accurate information on actual expenditure in the last year of the regulatory period is not available for calculation of the efficiency carryover to be applied at the beginning of the next regulatory period.

We also concluded that a mechanistic approach was unlikely to be consistent with the first of these principles, where costs exhibit lumpy or cyclical trends. This is generally the case with capital expenditure for regulated businesses. As discussed above, SPI PowerNet faces lumpy capital expenditure and, as such, an approach which takes the best estimate of future capital expenditure needs (as described in section 4.5) would be appropriate in establishing SPI PowerNet's future capital expenditure benchmarks. Such an approach would be consistent with the approach to the efficiency carryover described in the previous section for SPI PowerNet.

We also noted above that, in contrast to some other regulated businesses, SPI PowerNet faces cyclical and 'lumpy' operating and maintenance costs. As a result, we propose that the ACCC adopt either a bottom up or a top down approach to setting expenditure benchmarks. We note that both approaches, properly implemented, will give identical results.

The bottom up approach is consistent with the approach set out by the ESC and consists of:

- take as a starting point for establishing the next period's operating expenditure benchmarks outturn expenditure in the penultimate year of the current regulatory period;

- adjust this to take account of the differences between benchmark operating expenditure in the penultimate and final year of the current regulatory period;

- adjust this amount for changes to factors beyond the business's control since the end of the last regulatory period, eg, general factor price changes and changes in the average life of assets - the ESC does not explicitly state that future benchmarks should not anticipate any future efficiency savings due to the actions of the business. However, we consider that this is implicit in the ESC's claim that their efficiency carryover provides a sharing ratio for efficiency savings of 30/70 percent; but

- do not adjust this amount for any observations of efficiencies achieved in the final year of the last regulatory period (as doing this would implicitly deny the regulated business from an efficiency carryover associated with any such savings); and

- do not adjust this amount for any costs that will be incurred that represent deferral of expenditure already allowed for in previous regulatory periods.

The top down approach starts from the best estimates of future expenditures required over the next regulatory period and adjusts theses to:

- remove any observations of efficiencies achieved in the final year of the last regulatory period (as doing this would implicitly deny the regulated business from an efficiency carryover associated with any such savings); and

- remove any costs that will be incurred that represent deferral of expenditure already allowed for in previous regulatory periods.

The 'lumpy' and cyclical nature of SPI PowerNet's operating costs means that setting benchmarks will be necessarily more complex than for businesses which face a constant operating cost trend. In particular, the ACCC will need to consider:

- what operating expenditure in the penultimate year is not expected to be repeated in the next regulatory period, and, conversely, what expenditure is necessary in the next regulatory period which was not required in the earlier period – to address the 'lumpiness' of SPI PowerNet's operating costs;
- any trends in operating expenditure, as a result of ageing assets. Although the current part of the cycle is one with increasing operating costs, ultimately we would expect that costs will fall (and the cycle will start again), as older assets are replaced;
- the changes in business scope/obligations between the regulatory periods; and
- changes in other factors beyond SPI PowerNet's control, such as exchange rate changes and changes in insurance costs - these cost factors may be increasing or decreasing.

APPENDIX A. GENERALISED EFFICIENCY CARRYOVER FOR CAPITAL EXPENDITURE

Section 3.5 outlined why a building block approach to incentive regulation creates a potentially significant bias against capital expenditure savings and for operating expenditure savings. We also noted that the ESC's efficiency carryover mechanism potentially increases this bias. We suggested that an appropriate method for dealing with this bias may be to allow the business/regulator to show cause why they believe that a particular capital expenditure saving/over-spend will be ongoing in nature. If this case can be shown then an amount should be added/subtracted from the business's regulatory asset base to compensate/penalise the business for ongoing positive/negative efficiencies.

In this appendix we set out an alternative potential solution to the bias identified in Section 3.5. This solution has the advantage that it is general and does not require there to be an explicit decision concerning whether observed efficiencies would be ongoing. However, it has the disadvantage that future capital expenditure benchmarks must always be set on the basis that all past efficiencies are ongoing. For example, if a business makes a $20m saving against expenditure benchmarks in one regulatory period then assumptions used to set the next period's capital expenditure benchmarks must be altered to assume that the same level of efficiency will continue to be achieved.

This general approach is set out in the following five steps:

i. choose a sharing ratio for capital savings "S", eg, say the 33 percent associated with operating and maintenance savings;

ii. at the end of the regulatory period calculate the present value of all net capital expenditure savings on the assumption that these will be achieved in perpetuity;

iii. at the same time calculate the present value of the benefits already received by the firm within that regulatory period;

iv. increase the regulatory asset base at the beginning of the next regulatory period by S*(ii) less (iii) - ie, in addition to actual net capital expenditure during the last regulatory period include an amount that represents some fraction of saved capital expenditure; and

v. ensure that future benchmarks for capital expenditure are set consistently with the assumption that past capital expenditure savings will be maintained into the future.

The detailed formula for altering the regulatory asset base described in iv) above can be set out as Change in RAB:

$$=\left[S*\frac{X_t}{WACC}-X_t*WACC*\left(\frac{1}{WACC}-\frac{1}{WACC*(1+WACC)^{6-t}}\right)\right]*(1+WACC)^{6-t} \qquad \text{Eq A}$$

Where: Xt is the under/over spend relative to the (adjusted) benchmarks in period t
the adjusted benchmark in period z is the original benchmark for that period less the sum of Xt for t<Z
t=1 is the first year of the regulatory period;

The first term inside the square brackets is equal to S times the perpetuity value of total future benefits – assuming that X is maintained in perpetuity. The second term inside the square brackets is the annuity value of capital financing benefits already enjoyed by the business (as t approaches 6 this value approaches zero). The last term outside the square brackets simply carries these values forward from period t to the beginning of the next regulatory period.

A.1. Implementation issues

The approach set out above will provide neutral incentives for capital and operating cost savings/classifications (and for different types of capital savings). However, it relies critically on the implementation of step v). This step requires that future capital expenditure benchmarks assume outturn capital savings are perpetual – even if this is not expected to be the case. This is similar to the requirement of the ESC's operating expenditure efficiency carryover which requires that operating expenditure benchmarks are based on outturn operating expenditure in the second last year of the previous regulatory period – even if it is known that that outturn expenditure in that year was unrealistically low (say, due to deferral of operating expenditure in that year).

If step v) is not implemented properly then, just as is the case under the ESC efficiency carryover, if an under-spend of $X is achieved via deferral but the future benchmarks for capital expenditure include that $X then the business will benefit from that deferral by more than the true value of that deferral. Similarly, if a capital expenditure saving is 'one off' but is treated as perpetual in the efficiency carryover but not in the expenditure benchmarks, then the business will benefit by substantially more than the actual economic value of the saving.

This underlines the importance of maintaining consistency between an efficency carryover mechanism (eg, equation A) and the process for setting future benchmarks. The general approach outlined above could still be retained even if there is particular concern that the regulator will not be able to adhere to step v) outlined above (due, for example, to information asymmetry). In such a situation it may be appropriate to vary the steps i)-v) outlined above to reduce any risk/incentive for gaming. However, any such variations will inevitably retain some bias to swap capital for operating expenditure.

Examples of such variations would be reducing the sharing ratio for capital savings below the sharing ratio for operating and maintenance savings. Another example would be to assume that capital savings are not perpetual but instead are only expected to last for a given number of years. However, such approaches inevitably reduce the incentive for capital savings relative to operating savings.

SPI POWERNET

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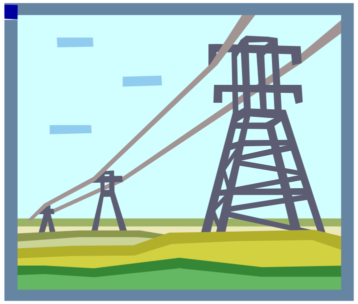
Appendix B
Re-optimisation

NERA
Economic Consulting

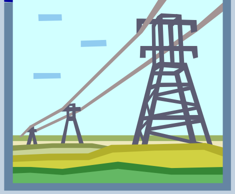


How Markets Work℠

Re-Optimisation

NERA

30 October 2002



Re-optimisation

- Some previously optimised SPI PowerNet assets are now in use.
- This requires their values to be re-optimised into the RAB.
- The Draft SORP states that:

  “Assets which are optimised out of the regulatory asset base will be carried forward at the rate of return. If they are optimised back into the regulatory asset base, their value will be the lesser of the carry forward value or depreciated replacement cost.

Re-optimisation

- SPI PowerNet has implemented this approach based on the assumption that:
  - “depreciated replacement cost” is equal to replacement cost less ‘competition’ depreciation.
- In its Draft Decision, the ACCC has argued that SPI PowerNet’s approach is inconsistent with the SORP. This appears to be based on the view that the SORP requires that:
  - “depreciated replacement cost” is equal to replacement cost less straight line depreciation.

Re-optimisation

- In this regard there is no doubt that the SORP envisions the use of competition depreciation. Proposed statement S5.5 is clear on this issue:

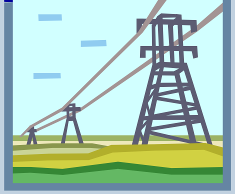
  "Changes in the regulatory asset value will be calculated according to the competition depreciation approach…"

- Page 47 of the SORP specifically addresses depreciation of replacement costs to derive DRC:

  However, in the Draft Regulatory Principles an alternative approach is taken to assessing depreciation which also needs to be reflected in any associated DORC valuations of the RAB. It is argued as a major feature of the Regulatory Principles that straight line depreciation fails to capture the important features of economic depreciation that are evident from the sale value of assets or the pricing of products over the life-cycle of productive assets.

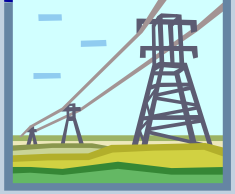
Re-optimisation

- The SORP defines ‘economic’ depreciation to be equivalent to competition depreciation.
  - We note that the ACCC in the SPI PowerNet building block model describes the difference between the CPI indexed opening and closing RAB as ‘economic depreciation.
- We also note that while the SORP envisaged the prescriptive use of competition depreciation in calculating building block depreciation this has not actually been adopted by the ACCC.
  - However, deviating from the SORP on building block depreciation is a very different issue deviating on re-optimisation values.
  - Unlike re-optimisation values, the level of building block depreciation does not affect the financial value of a business (assuming correct WACC is used).



Re-optimisation

- In addition to consistency with the SORP, it is important to ask what is the economically correct approach?
- The answer to this question is the approach that sets DRC equal to the value to customers/society of using the re-optimised asset rather than purchasing a new asset.



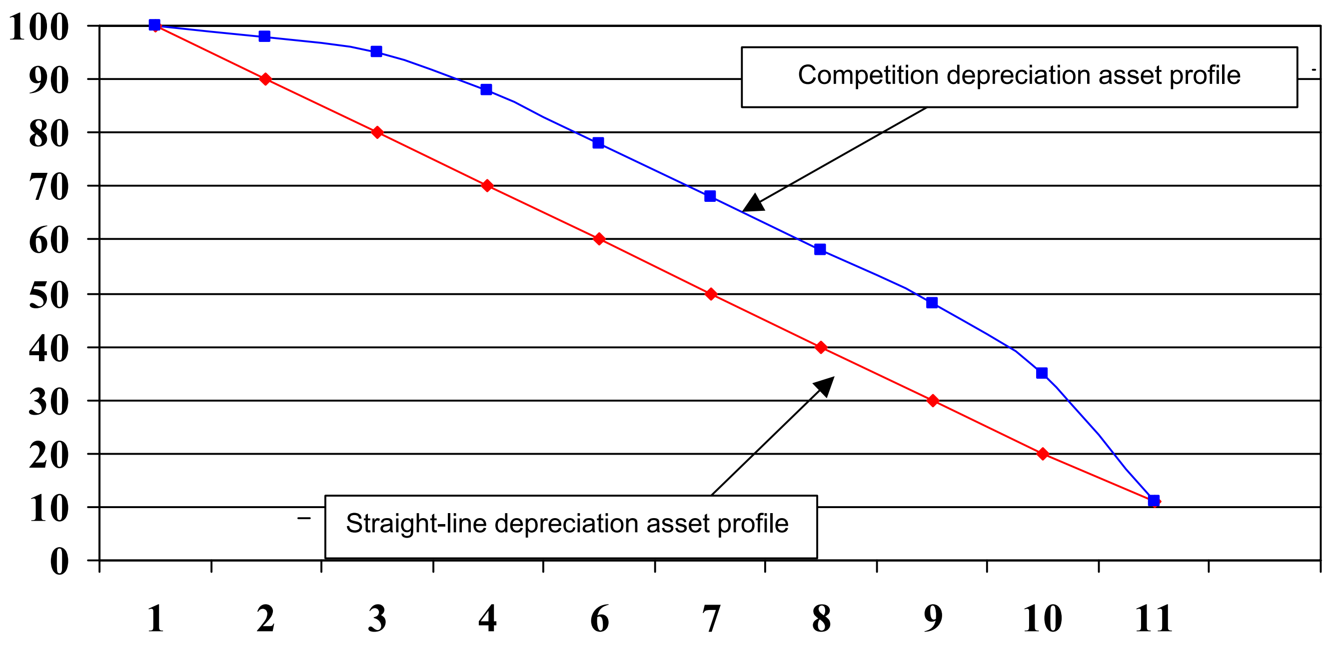
Re-optimisation

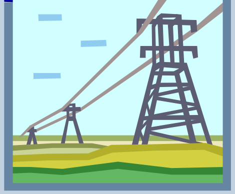
- The value of the re-optimised asset to customers is essentially the value of delay in the purchase of a new asset.
  - In other words it is the difference between the NPV of a new asset today and the NPV of a new asset at the end of the re-optimised asset’s life.
  - Other factors such as falling replacement costs and different maintenance costs can complicate the calculation.
- This is the approach taken by SPI PowerNet to calculating DRC.

Re-optimisation

It is also the approach taken by the SORP in figure A5.1 where the profiles of DRC under competition and straight line depreciation are compared

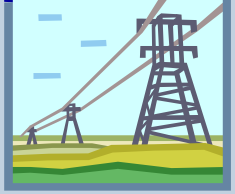
Real value of RAB ($m) at start of year





Re-optimisation

- What would using straight line depreciation do to incentives for efficient investment?
  - Lumpy assets and rising asset costs (eg, easements) can require a business to invest early in an asset even if it is not going to be used immediately
  - Efficiency requires that business invests early if the DRC (using competition depreciation) at the time it begins being used will be greater than the cost of investing now.
- Using straight line depreciation to determine DRC will mean businesses have an incentive not to invest early even if it is efficient to do so.



Re-optimisation

- What is fair to customers/businesses?
  - The economic benefit to customers of early investment is equal to the DRC (based on competition depreciation).
  - Providing less than this to the business penalises the business by more than any costs of early investment.
  - The flipside of this is that customers are more than compensated for early investment by the business
- This is not efficient and is arguably not fair.

Re-optimisation

- It is also important to note that the approach in the SORP already biases against efficient early investment.
- This is due to the re-optimisation at the *lesser* of carry forward or DRC
- This introduces an asymmetry meaning the business can only ever remain neutral (carry forward value) or lose (DRC) as a result of investing early.
- Calculating DRC inconsistently with the SORP (on the basis of straight line depreciation) would worsen this pre-existing bias.

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Re-Optimisation Methodology
A Presentation for SPI PowerNet
July 2002

Carol Osborne
Tom Hird

MMC Marsh & McLennan Companies

Purpose of Presentation

- SPI Powernet commissioned NERA to provide a briefing presentation on the reasonableness of the approach used to re-optimise assets in SPI Powernet's *Revenue Cap Application* for the period 1 January 2003 to 31 March 2008.

- In assessing the reasonableness and economic sense of the re-optimisation methodology, we have considered:
  - The ACCC's Draft *Statement of Regulatory Principles for the Regulation of Transmission Revenues*;
  - PB Associates report *Review of SPI Powernet Asset Base*;
  - Professor King's *Report on the Construction of DORC from ORC,* prepared for Agility Management; and
  - NERA's own analysis in the area of asset valuation.

Structure of Presentation

- **This presentation has the following structure:**
  - Background;
  - Examination of consistency between SPI's methodology for re-optimisation and the ACCC's SoRP; and
  - Examination of reasonableness of the SoRP's approach to re-optimisation (and the adoption of this approach implicit in SPI's methodology).

Background

Background

- SPI Powernet's regulatory asset base (RAB) was previously optimised in 1994 and had its valuation based on straight line depreciation.
- Changing network usage patterns and load growth in the interim mean it is now appropriate to reintroduce into the RAB some of the assets previously optimised.
- The issue for consideration is the appropriate valuation methodology for these reintroduced assets.

The ACCC's Statement of Regulatory Principles

- **In its draft *Statement of Regulatory Principles* (SORP), the ACCC has stated that:**

> *"Assets which are optimised out of the regulatory asset base will be carried forward at the rate of return. If they are optimised back into the regulatory asset base, their value will be the lesser of the carry forward value or depreciated replacement cost.*
>
> *Where assets are reinstated into the asset base the Commission will take into account past levels of recovery (that is, the written down value when removed from the regulatory asset base."*

SPI Powernet’s Proposed Methodology

- **SPI Powernet’s has proposed including re-optimised assets at the lesser of:**
  - Their written down value in 1994 (the value at which they were optimised out of the RAB), carried forward at the cost of capital (without depreciating the asset); or
  - The replacement cost of the assets less the present value of future replacement costs that would be incurred at the end of existing assets’ lives (assuming replacement costs are constant over time).
- **If the second dot point above is equal to ‘depreciated replacement cost’ as per the SoRP then SPI’s proposed methodology is identical to the ACCC’s.**

Consistency Between SPI and SoRP

(Defining ODRC)

Comparison of SPI Powernet's Proposal and SORP

- Both SPI and the SoRP advocate re-optimising assets at the carry forward value if this is less than the ODRC.

- Therefore consistency between these approaches requires that the definition of the ODRC adopted by SPI PowerNet is 'appropriate'.

- The SoRP does not provide guidance on how the ODRC should be calculated. Therefore, we focus in this presentation on how we consider the ODRC should be calculated.

NERA's View on ODRC

- We note that the SoRP refers to the depreciated replacement cost (DRC). In our analysis we refer to the optimised depreciated replacement cost (ODRC).
- Our view is that the ODRC should be calculated as the price a new entrant would be willing to pay for an existing asset rather than replicate it with a new asset.
- This price can be calculated as the price which equates the NPV of expected future costs associated with purchasing the existing asset with the costs of purchasing new assets, ie:

ODRC = NPV[(difference in capital costs) + (difference in non-capital costs)]

NERA's View on ODRC

- **SPI PowerNet's definition of ODRC captures only one of the cost advantages associated with using an existing asset rather than a new asset - namely the deferral of the need to invest in new assets.**

- **However it does not capture other potential cost advantages and cost disadvantages, specifically:**
  - If replacement costs are falling then there is a cost advantage associated with existing assets (greater benefits of deferral) that tends to increase the ODRC; and
  - If operating costs are lower with new assets than with existing assets then there is a cost disadvantage associated with existing assets that tends to reduce ODRC.
- **Whether or not incorporating these factors into SPI PowerNet's analysis would have a significant impact on the calculated ODRC is an empirical issue.**

NERA's View on ODRC

- **Resolution of this empirical issue would require specific analysis for each class of electricity asset being re-optimised of:**
  - rates of decline in replacement cost; and
  - differences associated with operating costs.

- **Depending on the assumptions used in relation to rates of change in replacement costs and operating costs, these factors have the *potential* to significantly impact the ODRC estimate.**

- **We note that the smaller are operating costs as a percentage of total costs the more likely it is that these considerations will increase the true ODRC above SPI PowerNet's estimate of the ODRC.**

Comparison of SPI Powernet's Proposal and SORP

- **Without making these adjustments SPI PowerNet's definition of the ODRC is comparable to using Professor King's ODRC construct.**
- **Professor King, in a paper for Agility Management, has structured an argument for ODRC which results in the valuation:**
    - ODRC = ORC[1-1/(1+WACC)^(remaining asset life)]
- **For the same reasons as already described we consider that this formula only captures one factor influencing the ODRC.**

Reasonableness of the SoRP on Re-optimisation

Reasonableness of the SoRP

- **We consider that the SoRP approach to re-optimisation, and SPI PowerNet's approach which follows the SoRP, is unreasonably harsh to investors.**

- **This is reflects the fact that both approaches introduce asymmetrical (downside) optimisation risk to businesses.**

- **Specifically, both approaches result in:**
  - inequitable/unfair outcomes to investors; and
  - inefficient investment incentives.

(Re)Optimisation and Incentives for Investment

- **To be encouraged to invest, firms must expect to earn a reasonable return on (and recovery of) their assets.**
- **Simplistic regulatory regimes that guarantee a return on and of *any* investment may give incentives for inefficient ('gold plating') investment.**
- **In an attempt to counter this incentive some regulators (including the ACCC) attempt to use the threat of optimisation if assets are not fully utilised in providing current services.**
- **However, an efficient and fair optimisation regime must not penalise a business for investing in an asset prior to it being fully utilised – when it is efficient to do so.**

When Should Investment Be Made Early

- **There are two situations when it is efficient for a firm to purchase assets ahead of the time they will be needed and therefore gain a return during the "holding" period:**

  - When there is a limited window within which to purchase the assets – for example, this might include land that will be required in the future but is likely to be developed and become unattainable if not purchased immediately; or

  - When the cost of purchasing the assets at the time they are required is expected to be higher than the costs of holding those assets – for example, in the case of large infrastructure assets for which capacity tends to be lumpy it could be sensible to build in extra capacity.

What Test Can Be Applied to Check This

- **It will have been "right"/efficient to purchase an asset ahead of time (in an ex post sense) if it was cheaper to have held the assets (charging a return on those assets during the holding period) than to replace those assets at today's prices.**

- **That is, the ex post efficiency test asks whether the carry forward cost is lower than the ODRC? The benefit to society from the firm investing early is equal to any difference between carry forward and ODRC.**

- **However, the ACCC and SPI PowerNet's methodology always value re-optimised assets at *the lesser* of carry forward or ODRC.**

- **This means that all the benefits of efficient early investments are captured by consumers and all the costs of inefficient early investments are borne by the business.**

Is This Methodology Appropriate for Valuation?

- **This in turn means that, unless a business is 100% certain that an early investment will be efficient (in an ex post sense) it will have an incentive not to undertake any such investments – even if they are expected to be efficient in an ex ante sense.**

- **For a network business with 'lumpy' investment this creates potentially highly inefficient incentives never to build excess capacity.**

- **Thus, a strong case could be put forward that the appropriate valuation is the ODRC – exposing the firm to both downside *and* upside risk, providing improved investment incentives and ensuring that the valuation is comparable with the competitive market paradigm.**
  - We understand that placing a "carryforward cap" reduces the re-optimised asset values by around 40 percent compared to simply using ODRC values.

Conclusions

- SPI Powernet's implicit formula of the ODRC does not capture all influences on the ODRC.

- Capturing these would require an empirical analysis of any likely falls in future replacement costs (which increase ODRC) and differences in operating costs between new and existing assets (which decrease ODRC).

- In addition, SPI PowerNet's approach to using the carry forward value to re-optimise assets (where this is less than the ODRC) is inappropriate. Equity and efficiency objectives are only satisfied by re-optimising assets at the ODRC. However, this would require diverging from the SORP.

- Given the magnitude of the impact of capping optimisation by carryforward values, it would appear likely that SPI PowerNet's approach to optimisation is unreasonably harsh on investors and is likely to result in too low a value, rather than too high, in the current context.

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Appendix C
Cost of Capital

A Weighted Average Cost of Capital for a Benchmark Australian Electricity Transmission Business

A Report for SPI PowerNet

R.R.Officer

20th October, 2002

Synopsis and Conclusions

In order to determine the required rate of return on the regulated asset base in SPI PowerNet's upcoming revenue cap review, a weighted average cost of capital (WACC) is needed. The appropriate WACC is a post tax nominal estimate of this required return using the "Vanilla" WACC equation.

Differences in the cost of capital or WACC, at any point in time, reflect differences in the risks associated with the cash flows being generated by the assets. In the context of capital market theory, only non-diversifiable or systematic risks are accounted for in the cost of capital estimates. This does not imply that diversifiable or non-systematic risks are not relevant to a valuation decision or the problem of determining revenue caps in a regulatory setting. Such diversifiable risks are, typically, accounted for in the net cash flows being generated by the assets. This paper outlines the procedures for taking account of such risk but it is beyond the mandate of the paper to do the calculations.

Ultimately, it is risk that determines the size of the cost of capital or WACC. The assessment of the cost of capital or the required return on the assets of the entity in this paper will be estimated using the capital asset pricing model (CAPM).

The CAPM has a number of parameters whose value will be estimated from the available evidence to arrive at the appropriate cost of capital. An important parameter is the beta risk; various sources for the estimates of beta or non-diversifiable risks are identified to arrive at an estimate. An examination is made of off-shore company betas, domestic sources for the estimation of beta including those provided by regulators and some separately calculated betas.

The determination of an appropriate beta for the asset class (electricity transmission) is not definitive and must be based on empirical evidence and inevitably subjective judgments about the weight to place on the evidence. The examination leads me to conclude that an ***asset beta of around 0.6*** *is justified and a point estimate of 0.58 would be realistic and consistent with the regulatory precedents on equity beta and the market evidence on debt beta.*

It should be noted that the WACC approach used in this paper means that the vanilla WACC can be estimated directly from the asset beta using the CAPM formula. In many regulatory decisions, this approach is not taken, apparently because the debt margins observed in the capital markets are assumed to relate partly to diversifiable (non-beta) risks. In view of this, the associated asset betas are not always directly comparable to those in this paper.

Estimating the required return to the assets also requires using a surrogate for a "risk-free" rate of return. The yield on the 10 year Commonwealth Government Bond is an appropriate surrogate. This is currently 5.6%.

Another important parameter of the CAPM is the estimation of the market risk premium. Evidence is presented to indicate that this is equal to 6% although there is considerable debate as to the value and arguments have been advanced that support both a higher estimate and a lower estimate. However, there is no compelling evidence in my opinion to change the estimate from 6%.

Adopting these estimated values for the parameters of the CAPM implies a ***post-tax nominal WACC of approximately 9.0%*** *(or more accurately 9.08% as at this date) or a real cost of capital of approximately 7.0% (or more accurately 7.08%).*

The asset cost of capital is the WACC. However, to the extent there may be a requirement to separately estimate components of the WACC, given the required return or cost of capital for the assets, implies a required return to equity (R_E) equal to 11.6% with a capital structure of 60% debt and 40% equity, and a required return to debt of 7.4% which reflects a debt margin of 1.80% (excluding debt raising costs). The 1.80% debt margin has been justified by examining the rates on corporate debt and the implied beta, assuming that the margin is predominantly due to systematic or non-diversifiable risk. The margin is consistent with what has been adopted by some regulators in hearings to date. Similarly, with the capital structure of 60% debt, this has been the capital structure adopted by most of the regulatory hearings in Australia to date for infrastructure projects and is broadly consistent with the empirical evidence.

Another feature of the mandate for the paper was to estimate the value of imputation tax credits. Taxes that are collected from the entity need adjustment for tax credits in order to accurately depict the company tax attributable to the entity. The basis of the WACC or cost of capital assessments is on an after company tax but before personal tax basis. Therefore, it is important to adjust taxes for any tax credits because these credits implicitly represent a collection of personal tax at the company level. The evidence suggests a value of these credits, on average, is equal to about 45% of their face value. The estimates can be quite variable and there is ongoing research being conducted by the author and a colleague that may cause an update to this estimate.

These results are summarized in the table below:

Parameter	Estimate
Nominal risk free rate (%)	5.60
Expected Inflation (%)	2.00
Real Risk Free Rate (%)	3.60
Market Risk Premium (%)	6.00
Asset beta	0.58
Equity beta	1.00
Debt beta	0.30
Debt margin (%)	1.80
Debt Cost of Capital	7.40
Gearing (Debt/Assets, %)	0.60
Equity Cost of Capital	11.6
Value of Imputation Credits	0.45
Vanilla WACC	**9.08**

Table of Contents

1. Introduction

As part of its revenue reset, SPI PowerNet has to develop and document a benchmark estimate of the Weighted Average Cost of Capital for the Company's regulated activities and a treatment for dividend imputation in the calculation of a tax allowance. To this end, SPI PowerNet commissioned this paper, which presents a review and analysis of current issues and the results from estimation of the various inputs – the current version of the paper is an update of a previous version that was lodged with the Commission in April 2002 as part of SPI PowerNet's revenue cap application. This current version of the paper reflects an update of figures and, to a lesser extent, argument.

Background

SPI PowerNet is the owner of Victoria's high voltage electricity transmission system. Privatised in 1997, the Company was recently sold to Singapore Power International by GPU International. The majority (95%) of the Company's revenue is regulated under a revenue capping arrangement put in place by the Victorian Government prior to privatisation. This arrangement expires on 31 December 2002 and will be replaced by a revenue capping regime administered by the Australian Competition and Consumer Commission (ACCC).

Operating pursuant to chapter 6 of the National Electricity Code, ACCC will set a new revenue cap with a minimum tenure of 5 years. ACCC's current approach to setting revenue caps is described as a post-tax nominal accrual building block. In essence, the revenue cap in year t of the control period is based on (noting that all items represent forecasts made at the time the revenue control is set):

$$R_t = OM_t + WACC * RAB_t + RD_t + (1-\gamma)Tax_t + GP_t \qquad (1)$$

where:

R_t is revenue in year t;

OM_t is operating and maintenance cost in year t;

WACC is the “vanilla” cost of capital;

RAB_t is the value of the Regulated Asset Base in year t – this is rolled forward from an initial valuation on a CPI-indexed basis, ie opening value plus capex plus indexation less deprecation;

RD_t is regulatory depreciation (net of the CPI indexation of the asset base);

γ is the dividend imputation factor representing the proportion of a company’s income tax that is eventually offset against its owners’ personal income tax;

Tax_t is a company income tax allowance calculated on a cash flow basis; and

GP_t is an incentive payment (glide path) for achieving greater than forecast cost savings in the previous regulatory period.

While this is the basis for setting the revenue caps, they are actually implemented as a CPI-X control. That is, the result of applying the building block approach in each year of the control period is reduced to a present value at the start of the period, then working from the total of these present values, an X factor is derived that delivers the same present value total when the revenue cap is projected forward on a CPI-X basis using a forecast of CPI consistent with other assumptions (most notably WACC).

SPI PowerNet understanding of the methodology for WACC and tax in 2003

SPI PowerNet has indicated that the post-tax nominal approach to determining revenue will most likely be used in the context of the 2003 reset. Consistent with this, the WACC used in the revenue calculation will be of the “vanilla” formulation.

$$WACC = R_e \frac{D}{V} + R_d \frac{E}{V} \qquad (2)$$

where:

R_d is the return on debt;

D/V is the debt to value ratio;

R_e is (post-tax) return on equity; and

E/V is the equity to value ratio.

In concert with this, the tax allowance will be determined (essentially) as:

$$Tax_t = \left(R_t - O_t - TD_t - RAB_t \frac{D}{V} R_d \right) T(1-\gamma) \quad (3)$$

where:

TD_t is tax depreciation in year t; and

T is the corporate tax rate.

In essence the task of this paper is to provide estimates for the "vanilla" WACC, ie.

$$WACC = R_d \frac{D}{V} + R_e \frac{E}{V}$$

and the value of the imputation tax credits, γ, and to discuss various issues that arise in the context of these estimations.

Organisation of the paper

The paper is organised as follows:

- section 2 sets out a framework (the Capital Asset Pricing Model) for analysing the risks relevant to the cost of capital, presents analysis of market data on equity, debt and asset betas and estimates a consistent set of betas for a benchmark Australian electricity transmission business;

- section 3 provides an analysis of tax and the value of imputation credits;
- section 4 reviews recent evidence on the market risk premium;
- section 5 considers issues relating to the definition and measurement of the risk free rate;
- section 6 discusses the estimation of expected inflation for use in the revenue determination;
- section 7 reviews the evidence on debt margin and gearing; and
- section 8 provides a summary of the estimates and my recommendations.

2. Risk

2.1 Non-Diversifiable (β) and Diversifiable (non-β) Risk

Non-diversifiable Risk

Non-diversifiable risk is also known as:

- systematic risk;
- market risk;
- covariance risk; and
- beta risk.

Because the risk β is non-diversifiable it commands a risk premium, known as the market risk premium (MRP), which is defined as [$E(R_m) - R_f$]. The MRP is the premium a market portfolio of assets or securities (R_m) is expected to earn above the risk-free rate (R_f).

The effect of non-diversifiable risk is captured through such models as the Capital Asset Pricing Model (CAPM):

$$\begin{aligned} R_j &= R_f + \beta_j \left[E(R_m) - R_f \right] \\ &= R_f + \beta_j MRP \end{aligned} \tag{4}$$

where:

R_j is the expected return on asset (security) j or its required return or cost of capital; and

βj is the non-diversifiable risk associated with asset j and because of the MRP this βj component of risk increases the discount rate or cost of capital in an NPV analysis.

The CAPM is the standard approach to estimate the required return (Cost of Capital) of equity (R_E) where unlike debt there is no contractual rate set for the return. The risk occurs as β in the above CAPM and this is non-diversifiable risk for which the capital market pays a market risk premium MRP.

In the case of debt, we typically use the yield on debt to estimate the cost of debt (R_D). Such a yield includes both non-diversifiable risk and diversifiable risk. The latter is usually included when estimating a company's WACC or asset cost of capital, although logically the diversifiable risk should not be included but for major companies it is so low the bias is judged to be not consequential.

The diversifiable risk is typically taken into account in the expected net cash flows that are to be discounted. It is discussed below.

Diversifiable Risk

Diversifiable risk is also known as:

- non-systematic risk;
- non-market risk;
- non β risk;
- idiosyncratic risk;
- residual risk; and
- insurable risk.

Diversifiable risk can be diversified away because it is uncorrelated with other risks or variations in net cash flows and as such it does not command a premium in the sense that non-diversifiable risk commands a premium. However, this does not mean that it has no effect on values or that it can be ignored in a discounted cash flow analysis.

As one of the names for it suggests, the cost of diversifiable risk is akin to an insurance premium, to the extent that insurance represents those events which can be diversified.

The "charge" against cash flows should be the actuarial estimate of the event, i.e. the product of the probability of the event occurring times the effect on net cash flows of the event[1]. Therefore, the standard (textbook) approach to handling risk in a valuation (NPV) problem is to account for non-diversifiable risk in the discount rate and diversifiable risk in the net cash flows.

An Example

Suppose we have a three period investment whose net cash flows are at the left of the column and the expected value is on the right of each column:

Probability		Period 1		Period 2		Period 3	
Event 1	0.3	$10m	$3m	$15m	$4.5m	$20m	$6m
Event 2	0.5	$40m	$20m	$50m	$25m	$50m	$25m
Event 3	0.2	$60m	$12m	$65m	$13m	$60m	$12m
		E($35m)		E($42.5m)		E($43m)	

The expected or actuarial flows for each period are respectively $35m, $42.5m and $43m. The "**normal**" cash flows are $40m, $50m and $50m – these relate to the outcomes of event 2 which represent the median outcome.

Applying a WACC of 10% to the expected net cash flows gives a value of *:*

$$\begin{aligned} NPV &= \frac{35}{1.1} + \frac{42.5}{(1.1)^2} + \frac{43}{(1.1)^3} \\ &= 99.25 \end{aligned} \qquad (5)$$

So much for the textbook approach for handling risk

[1] Another way of saying this is that the all potential costs should be estimated at their (statistical) expected value rather than at their median or typical year value.

The "business approach" is often different. Practitioners often take expected net cash flows to mean "normal" cash flows which is what they expect and not the actuarial expectation. The result is they adjust the discount rate for diversifiable risk as well as non-diversifiable risk.

Consider our previous example, "normal" cash flows per period are:

40, 50, 50

which when discounted by a 18.6% instead of 10% result in the same value for the project, i.e.

$$99.25 = \frac{40}{1.186} + \frac{50}{(1.186)^2} + \frac{50}{(1.186)^3}$$

The 18.6% includes an adjustment for both the non-diversifiable and the diversifiable risk.

The problem with the "business approach" is how to get a measure for the diversifiable risk contribution to the discount rate. It is usually an ad hoc adjustment unless we first solve for the value using the "textbook" approach and then plug in the "normal" net cash flows and solve for the internal rate of return to get an appropriate discount rate that incorporates both diversifiable and non-diversifiable risk.

In the approach I will be using and that which is adopted generally by regulators it is assumed that the WACC only reflects β or non-diversifiable risk. It is assumed that account will be taken of diversifiable risk in the estimates of net cash flows.

2.2 Betas for Electricity and Gas Companies

Australia has relatively few privatized electricity and gas companies. Moreover, nearly all of them have only been privatized in recent years. This means that there is a paucity of data on the risk characteristics of the companies and the industries. In such circumstances it would seem obvious to examine the risk characteristics of comparable companies and industries in countries that have been around for a much longer time, to supplement the limited observations on the Australian companies. However, such an approach is hazardous because of different economic and regulatory conditions in foreign countries. Nonetheless, providing caution is exercised in interpreting the relevance of the offshore results for Australia, some information can be usefully gleaned from such an examination.

The CAPM is the most popular procedure for estimating the required returns for assets or securities (equity) where there is no contractual right for a particular amount of return to the capital providers. The risk that is accounted for in the CAPM is non-diversifiable or beta-risk; it was described in the previous section. A domestic beta, i.e. the covariance risk of an asset or a company with its domestic share market, reflects the relative risk of that asset relative to the domestic market. A beta for an electricity company in the US or UK measures the risk of that company relative to those markets. Further, although such a beta may be indicative of the type of relative risk experienced by an Australian electricity company, certain conditions must apply before one can derive an Australian electricity beta from a US or UK beta.

As long as the component of the return on the Australian market that is uncorrelated with the return on the US market is also uncorrelated with the return on stock i[2], then it follows that:

$$\beta_{i,AUS} = \beta_{US,AUS} \times \beta_{i,US} \quad (6)$$

where:

$\beta_{i,Aus}$ is the domestic beta of an Australian company;

$\beta_{US,Aus}$ is the beta of the US index regressed against an Australian index;

---

[2] In effect, this component of a stock's return is idiosyncratic to the company, it does not related to returns of either markets.

$\beta_{i,US}$ is the domestic beta of the US company.

On the basis of data from Datastream the average beta ($\beta_{i,US}$) for US electricity companies is about 0.35. In addition, it is estimated that the beta $\beta_{US,Aus}$ over recent years is about 0.5. This implies an Australian $\beta_{i,Aus}$ of 0.18 – a very low number. A comparable analysis using UK electricity companies gave a $\beta_{i,UK}$ for UK electricity companies of about 0.4, a $\beta_{UK,Aus}$ of 1.19, which, using the relationship defined above, implies a $\beta_{i,Aus}$ of about 0.48 which is also a low but more realistic number.

The problem is that the assumption underlying the relationship between domestic and offshore betas implies that the respective capital markets are fully integrated, such that any idiosyncrasies of the Australian market reduce the β-risk for an offshore investor and accordingly make investment in an Australian electricity company look attractive. Also, measurement errors can make the domestic market look attractive from a β-risk perspective. In the circumstances, I believe it is unwise to simply adopt in the Australian context the β-risks implied by offshore companies at face value. Nonetheless, an examination of the consistency or otherwise of the β-risks amongst the different type of energy companies can be instructive. For this reason, the β-risks for offshore companies are shown below in Table 1.

Table 1
Estimates of Overseas Betas

Industry Name	Source	Number of Firms	Average Equity Beta	Market D/E Ratio	Asset Beta
US					
Electric Util. (Central)	DNYU	28	0.53	118.35%	0.29
Electric Utility (East)	DNYU	34	0.55	83.4%	0.35
Electric Utility (West)	DNYU	17	0.56	150.22%	0.27
Electricity Integrated	QCA	53	0.45 (0.26-0.9)	NA	0.32 (0.22-0.78)
Electricity Distributors	Datastream	12	0.27	NA	NA
Natural Gas (Distrib.)	DNYU	33	0.59	82.35	0.38
Natural Gas(Diversified	DNYU	37	0.72	45.95	0.54
Gas Distribution	Datastream	16	0.33	NA	NA
UK					
Electricity	QCA	4	0.68 (0.48-1.00)	NA	0.52 (0.41-0.72)
Electricity	ORG Bloomberg	5	0.32 (0.18-0.47)	32	0.29 (0.17-0.40)
Electricity	ORG Lond. Bus.S.	5	0.59 (0.51-0.65)	32	0.47 (0.34-0.56)
Electricity	Datastream	6	0.24	NA	NA
NZ					
Electricity	Datastream	4	0.54	NA	NA
Gas	Datastream	1	1.00	NA	NA

DNYU=http://www.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html)

An examination of the equity β-risks in the table indicate they are all relatively low, significantly lower than the equity β of the average investment, whose β=1.0. The asset betas have been calculated with the assumption of a debt beta of zero and often using a more conventional after tax WACC and not the "Vanilla" WACC assumption.

Betas are notoriously unstable. The beta of an individual company or entity is measured with a considerable amount of error and for this reason it is usually preferable to estimate groups of companies in the same risk or industry class in order to get an estimate of the β-risk appropriate for a company.

One of the features of any regression parameter that is estimated with error is that the parameter tends to mean revert over a number of separate measurements or observations. The mean reversions is caused by the errors on the high side in the next measurement will tend to be less next period and so the estimate will move downwards, and conversely errors on the low side. The net result will be mean reversion for the estimates of the parameter. Moreover, the mean of all companies is by definition, a beta of 1.0 and as a consequence the estimates of the equity betas over time tend to move towards that number. The first to note this was Marshall Blume in a paper in the Journal of Finance in 1975. Subsequent studies have confirmed some degrees of mean reversion for β estimates.

The consequence of this observation is that some of the measuring services such as Bloomberg provide estimates of beta that mean revert. The problem with this approach is that the mean reversion parameter is far from stable and what might be observed one period can be inappropriate for another period. Inevitably, the parameters used to mean revert tend to be ad hoc in these circumstances and hard to justify, particularly where estimates are based on significant numbers of companies or industry groups where the measurement errors are less.

A second problem causing instability in betas is "thin trading". "Thin trading" causes the beta parameter to be measured with error because the returns or price changes for the entity's shares being regressed against the market are not contemporaneous with the market. An attempt to overcome this problem is to use the Scholes-Williams estimators for beta. Unfortunately, in my experience, the Scholes-Williams estimates of beta tend to be more unstable than those measured under conventional ordinary least squares regression and I do not believe the use of such estimators improves the estimate of β.

As a consequence none of the beta estimates reported in this paper has been in modified.

2.3 Beta Estimates including the Effect of Gearing

The logic of the balance sheet applies to the derivation of asset betas from the betas of debt and equity. For example, the total assets of a company can be divided amongst the financial obligations as broad categories of debt and equity. The cash flows generated by the assets have to service the financial obligations of those providing capital (debt and equity). Further there is "natural conservation of risk" such that the risk of the cash flows generated by the assets have to be shared and totally accounted for amongst the risks attached to the returns of the providers of the capital (debt and equity). Therefore, the balance sheet logic compels the asset beta or the risk associated with the assets, to reflect the weighted average of the risks associated with the financial obligations (debt and equity). In effect, the weighted average cost of capital (WACC) is the cost of capital reflected in the assets and therefore the asset beta must be equal to a weighted sum of the debt and equity betas i.e.

$$\beta_a = \beta_e \frac{E}{V} + \beta_d \frac{D}{V} \qquad (7)$$

where:

β_a is the asset beta;

β_e is the equity beta;

β_d is the debt beta; and

E + D = V, the value (V) of the company's assets made up of equity (E) and debt (D).

The use of the WACC in SPI PowerNet's upcoming revenue determination is to allow for a return to the Regulated Asset Base (RAB), reflecting the opportunity cost of capital tied up in that base. In these circumstances, the appropriate WACC is the WACC indicated by the assets (and the corresponding asset beta). In effect, the knowledge of the asset beta would not require a further breakdown into debt and equity betas, and the CAPM could be used, with an asset beta, to determine the appropriate after-tax WACC for applying to the RAB. An after-tax WACC is appropriate because the form of the revenue determination is such that tax is compensated as a separate item, see Equation 1 above.

One of the advantages of using an after-tax definition of the WACC is that the parameter estimates can be taken directly from the capital market. Further, since these estimates are provided on an after-tax basis there is no requirement to modify the WACC equation for tax and the "simple or vanilla" formula of the WACC can be adopted.

It is not only measurement errors that may cause problems with estimation of appropriate betas. The assumptions explicitly or implicitly employed, using the CAPM, in relation to gearing and the beta of debt to estimate the cost of capital can also have a significant effect on the outcome.

Beta estimates are usually restricted to traded securities in deep and well informed capital markets. The trade in securities amongst the world capital markets is dominated by equities issued by companies and debt issued by governments, with some limited amount of corporate debt. This means that the beta estimates have to be derived from the equities of the companies that are operating in the same industry class or reflect the same asset composition of the company whose beta has to be estimated.

One of the variables causing differences in beta estimates for companies in the same industry class with the same assets is the differential gearing on average between companies. The greater the level of gearing, the greater the risk of both debt and equity, however over reasonable ranges, the risk of the total assets does not change. This is because the change in the weighting of capital from equity to debt maintains a constant risk level for the assets as a whole even though the beta measures of both debt and equity will increase.

To estimate the beta of a company from the betas of listed equities requires an adjustment for the gearing differential between the company whose beta is to be estimated and the beta of the companies providing the estimates. Further, insofar as the beta of the assets is made up of a weighted average of the beta of debt and equity, but the debt of companies is infrequently traded, means that some judgement is required in assessing debt betas before an overall asset beta can be estimated. An approach that can be adopted is to "reverse engineer" the CAPM such that with the knowledge of a return on debt, one can get an estimate of the implied beta consistent with this return. This assumes that all the risk compensation for the required return is systematic and not non-systematic; for major companies with high quality debt this is probably a reasonable assumption.

In the various regulatory hearings that are documented later in this paper in Table 8, the estimate of asset betas has been by this process of estimating an equity beta and then assuming a particular level of debt beta in order to derive the asset beta. However, in some of the decisions, the choice of an asset beta appears to have been somewhat subjective in that the equity beta, the level of gearing, and the debt beta are not exactly consistent with the asset beta that has been chosen.[3] The problem is further compounded when the regulatory body breaks the asset beta up into equity and debt in order to use it in a before-tax weighted average cost of capital.

Tables 3 to 8 below provide beta estimates from a range of sources and where an estimate has been made of the asset beta, two alternative assumptions have been made about the beta of debt. In the first instance following a number of the regulatory bodies a zero beta of debt has been assumed. However, in my opinion

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[3] In fact there is some indication that the wrong re-gearing formula has been used for the Vanilla WACC equation. See Appendix 4 *ACCC - Report on the Assessment of Telstra's Undertaking for the domestic PSTN originating and terminating access services, July 2000.* In this report reference is made to using the "Monkhouse" formula, this formula for re-gearing equity estimates is inconsistent with the Vanilla WACC.

this is unrealistic as most companies' debt securities are affected by the state of the market and reflect some market risk and, as a consequence, would be expected to have a positive beta. Private communications from investment bankers to SPI PowerNet (Westpac letter dated 14th October 2002 and National Bank letter dated 10th October, 2002, both included as an appendix to this report) and to ElectraNet SA (ANZ letter dated 3rd October, 2002, included in ElectraNet's response to ACCC's Draft Decision on SA revenue caps) provide indicative quotes of the debt margin for ten year debt issued by a typical utility company, rated BBB+[4]. In addition to the indicated margins in these letters there is the publicly available CBA Spectrum margin as of the 16th October. The following are the debt margins:

Table 2
Debt Margins

Bank	Debt Margin (basis points)
Westpac (14/10/02)	161 to 171
National (10/10/02)	184 to 189
ANZ (03/10/02)	190
CBA Spectrum (16/10/02)	169

The average of these debt margins is 176 to 180 basis points[5]. (Section 7 discusses this issue further).

Adopting the average debt margin suggested by the underwriters of 178 basis points implies a beta of about 0.30.

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[4] In the original version of this paper, a letter from UBS Warburg's credit research department to SPI PowerNet was attached that indicated that a "standard regulated transmission or distribution business would be rated around BBB+." This was based on a stand-alone business with an interest cover of 2.0 times and a debt/equity ratio of 60/40.

[5] This excludes debt raising costs such as placement fees and swap costs. Arguably, these are not driven by non-diversifiable risks and therefore are excluded from the cost of capital for the purposes of this paper.

Table 3 below presents estimates of equity and asset betas for various companies provided in the recent decision of the Queensland Competition Authority on Regulation of Electricity Distribution, May 2001. The asset beta of the companies listed averages around 0.62 for the reported asset betas and 0.68 if the debt beta in the WACC is assumed to be 0.30.

Table 3
Beta estimates from Queensland Electricity Distribution Price Review

Firm	Primary Business	Equity Beta	Leverage (%)	Asset Beta*	Asset Beta**
United Energy Ltd	Electricity distribution	0.84	53	0.42	0.55
Pacific Energy Limited	Electricity generation	2.03	29	1.42	1.53
Pacific Hydro Limited	Electricity generation	1.00	45	0.66	0.69
Energy Developments Ltd	Electricity generation	1.17	25	0.92	0.95
Allgas Energy Limited	Gas distribution and retailing	0.50	17	0.47	0.47
Australian Gas Light Ltd	Gas distribution and retailing	0.62	30	0.44	0.52
Envestra Ltd	Gas distribution and retailing	0.48	80	0.00	0.34
Simple Averages		**0.95**	**40**	**0.62**	**0.72**

* Asset beta as reported.
** Asset beta calculated with a debt beta of 0.30.
Source: Queensland Competition Authority, May 2001

Table 4 below sets out the estimates cited by the Victorian Office of the Regulator-General (ORG) in its decision for Electricity Distribution. The results give a consistently lower WACC than the QCA estimates which may simply reflect the time at which the estimates were made and indicate the variability of betas over time. It is worth noting that the ORG used a debt beta of 0.2 for its estimates of the appropriate WACC.

Table 4
Beta estimates from Victorian Electricity Distribution Price Review

Firm	Primary Business	Equity Beta	Leverage (%)	Asset Beta*	Asset Beta**
United Energy Ltd	Electricity distribution	0.46	54	0.32	0.37
AGL	Gas distribution and retailing	0.57	25	0.48	0.50
Envestra	Gas distribution and retailing	0.50	78	0.27	0.34

* Asset beta as reported
** Asset beta calculated with a debt beta of 0.30
Source: Office of Regulator General, Victoria, September 2000

The equity beta estimates in Table 5 are taken from Australian Graduate School of Management's (June 2002) Risk Measurement Service estimates. The results indicate an asset beta for the electricity distribution group of nearer 0.8 with a debt beta assumption of 0.30. The gas group has significantly lower estimates. It is not clear to me why the differences should be so great and probably demonstrates the unreliability of beta estimates for single or small groups of companies.

Table 5
AGSM beta estimates for electricity and gas, June 2002

Firm	Equity Beta	Leverage (%)	Asset Beta (Debt Beta=0)	Asset Beta (Debt Beta=0.2)	Asset Beta (Debt Beta=0.3)
Electricity distribution					
United Energy Ltd	0.25	47	0.13	0.23	0.27
Pacific Energy Limited	1.2	37	0.76	0.83	0.87
Pacific Hydro Limited	2.2	37	1.39	1.47	1.50
Energy Developments Ltd.	0.79	54	0.36	0.47	0.53
Average	**1.11**	**44**	**0.66**	**0.75**	**0.79**
Gas distribution and retailing					
Alintagas	0.1	58	0.04	0.16	0.22
Allgas Energy Limited	0.5	15	0.43	0.46	0.47
Australian Gas Light Ltd	0.36	53	0.17	0.27	0.33
Envestra Ltd	0.59	94	0.04	0.22	0.32
Average	**0.39**	**55**	**0.17**	**0.28**	**0.33**

Source: AGSM equity betas at June 2002

Independent estimates of equity betas were made and these are listed in Table 6.

The betas in Table 6 were calculated by regressing monthly total returns (from capital gains or losses plus dividends) against monthly total returns on the All Ordinaries Accumulation Index. The sixty months of data (ending May 2001) was used in this estimate, except where less than sixty months data was available, such as for more recent listings. This was done for all companies in the Infrastructure and Utilities index plus the Infrastructure and Utilities Accumulation Index itself. If less than 36 months data was available then the estimate was not formed as it would statistically be too unreliable.

As a generality, the results give a lower estimate of the equity betas than those in Table 4 which may reflect the different time interval over which the estimates were made.

Table 6
Infrastructure and utility betas estimated over a 60 month period

Company	Weight by Market Capitalisation	Listing Code	Equity Beta
Australian Gas Light	25.12%	AGL	0.514
Australian Infrastructure Trust	2.00%	AIX	0.765
AJ Lucas Group	0.27%	AJL	0.459
Energy Developments	7.96%	ENE	1.223
Envestra Ltd	2.60%	ENV	0.367
Environmental Solutions	0.34%	ESI	0.516
Hills Motorway Group	6.00%	HLY	0.290
Macquarie Infrastructure	18.01%	MIG	0.515
Origin Energy	11.18%	ORG	1.036
Pacific Hydro	3.72%	PHY	1.088
Renewable Energy	1.90%	REL	2.241
Transurban group	13.41%	TCL	0.476
United Energy	7.40%	UEL	0.717
Pacific Energy	0.08%	PEA	2.041
Average – weighted by market capitalisation	**100%**		**0.68**

Source: Estimated by the author from ASX data

In Table 7 the companies that are involved in electricity (those highlighted in Table 6) have been separated from those of Table 6 and the WACC estimated based on the equity betas shown in Table 6. The results are weighted by capitalisation. They indicate an increase in the equity beta, although it is slight for the value weighted estimate. Similarly, for the WACC there is a significant difference between the value weighted average WACC for the group compared to the simple average. In normal circumstances the value weighted average would be preferred but the large weight given to AGL means that it has a profound effect on the result and the company may not be as representative of an electricity transmission business as the other companies or indeed the infrastructure industry group as a whole.

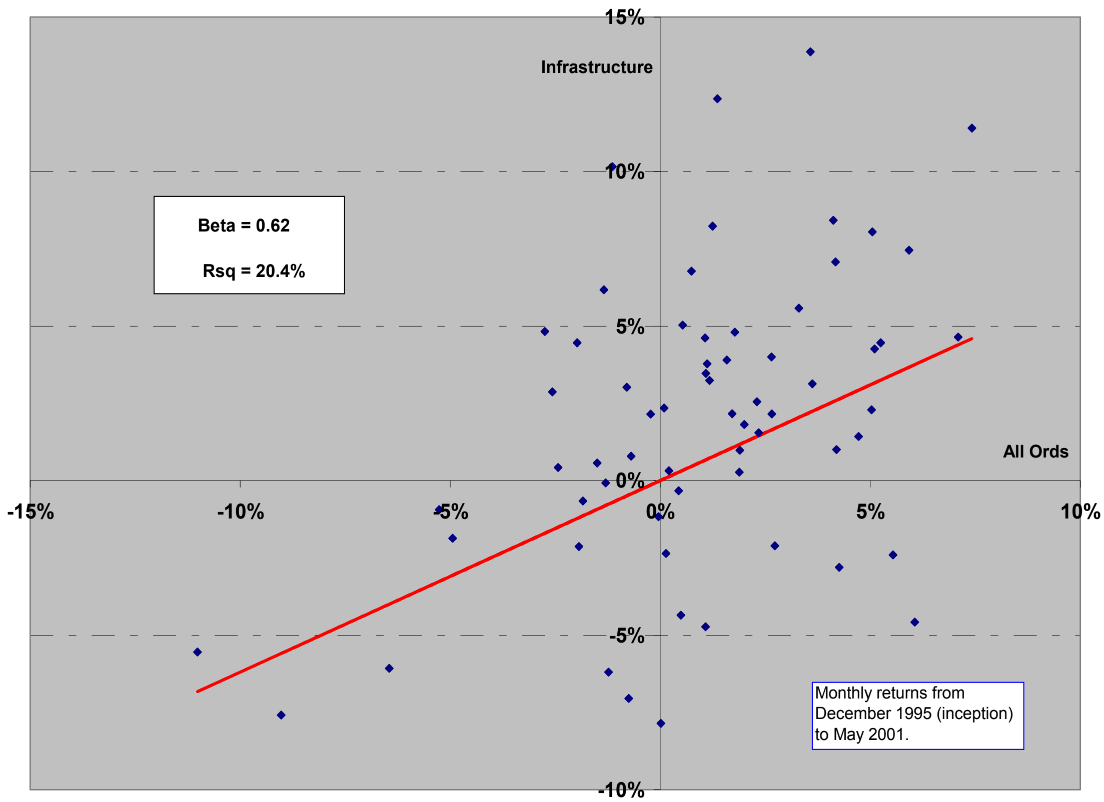
Table 7
Betas for electricity companies estimated over a 60 month period

	Adjusted weight by market capitalisation	Equity Beta	Leverage %	Asset Beta*	Asset Beta**
Australian Gas Light	0.54	0.514	53	0.24	0.41
Energy Developments	0.17	1.227	54	0.57	0.73
Envestra Ltd	0.06	0.367	94	0.02	0.31
Pacific Hydro	0.08	1.088	37	0.69	0.80
United Energy	0.16	0.717	47	0.38	0.53
Pacific Energy	0.00	2.041	37	1.29	1.40
Simple Average		0.99	54	0.53	0.70
Average – weighted by market capitalisation	**1.00**	**0.71**	**54**	**0.34**	**0.51**

* Asset beta calculated with debt beta of 0.0
** Asset beta calculated with a debt beta of 0.30
Source: Estimated by the author from ASX data

An example of the calculations for Tables 6 and 7 betas is demonstrated in the plot which demonstrates the estimation of the beta for the Infrastructure and Utilities index against the All Ordinaries index.

Figure 1
Infrastructure beta vs All Ordinaries



Source: Estimated by the author from ASX data

Table 8 summarises recent regulatory decisions in electricity and gas transmission and distribution. The results are consistent with those already discussed and the β estimates are no more definitive. The asset betas are between 0.4 and 0.6 (as reported) in the decisions but up to 0.79 in the case of the ACCC's decision with respect to the AGL pipeline if a debt beta of 0.30 is used. Overall, an estimate of 0.5 to 0.6 (based on a debt beta of between 0.20 and 0.30) appears to be most realistic.

Table 8
Recent regulatory decisions on betas for electricity and gas

Matter	Industry	Equity Beta	Leverage (%)	Asset Beta*	Asset Beta**
ORG, Price Determination	Electricity Distribution	1	60	0.4	0.58
ACCC, Snowy Mountains	Electricity Transmission	1	60	0.4	0.58
ACCC, NSW & ACT	Electricity Transmission	0.78-1.25	60	0.35-0.50	0.50-0.69
ACCC, Queensland	Electricity Transmission	1	60	0.4	0.58
IPART, Elect. DB's	Electricity Distribution	0.77-1.14	60	0.35-0.50	0.49-0.64
QCA, Price Determination	Electricity Distribution	0.71	60	0.45	0.46
ACCC, EAPL	Gas Pipeline	1.16	60	0.5	0.64
ACCC, AGL	Gas Pipeline	1.5	60	0.6	0.78

* Asset beta as reported
** Asset beta calculated with a debt beta of 0.30

It is difficult to find any conclusive evidence for a specific asset beta for electricity transmission. The regulators have opted for a number between 0.4 and 0.6 with most around 0.4 (based on asset betas as reported). Empirical evidence from the electricity distribution companies in Table 5 above would suggest an asset beta of at least 0.6 (based on a debt beta assumption of 0.30). A point estimate of 0.58 (combining the regulatory precedent of an equity beta of 1.0 with the market evidence for a debt beta of 0.30) is most realistic in my opinion. A debt beta of 0.2, allowing for considerable diversifiable risk in the debt yield, would imply an asset beta of 0.52.

3. Tax and the Value of Imputation Credits

The most appropriate definition for the WACC is after-company tax but before personal tax. Moreover the most suitable of the alternative formulae that are available is the simple or "vanilla" WACC which is also the definition of the WACC that is consistent with the revenue determination formula in the current matter. It is also the equation that has found most acceptance by the various regulatory authorities in Australia. The equation was defined above as Equation 2. One of the advantages of the "vanilla" WACC is that all the tax is accounted for in the cash flows, which in the context of a revenue determination requires separate compensation for tax (see Equation 1 above). This raises the issue of what is the company tax that is appropriate with the definition of the net cash flows and the WACC; it is not the net cash flows multiplied by the statutory tax rate.

The amount of tax paid by a company reflects the tax assessable income which is unlikely to coincide with the net cash flows, and the "effective" tax rate. Under an imputation tax system not all the tax collected from the company is really company tax. To the extent that part or all of the tax collected is redeemable against personal tax liabilities it represents personal tax. The company is collecting that proportion of the tax that is redeemable but it is tax that would otherwise be paid by the shareholder as personal tax. Therefore the "effective" tax rate for the company must take into account that amount of the tax paid by the company that is later redeemed by shareholders as a payment of personal tax. The issue is to assess what proportion of the tax collected from the company is not company tax but a pre-payment of personal tax.

There are two basic methods[6] of estimating the average amount of company tax that is redeemed as imputation tax credits against personal tax:

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[6] There is a third mechanism but it requires warrants to be listed on the shares which severely limits the sample of companies for which an estimate of the value of the credits can be assessed. This approach has been adopted in an unpublished paper by Cannavan, Finn and Gray (2000), Department of Commerce, University of Queensland.

- through the official tax statistics of the amount of company tax paid that is redeemed and
- dividend drop-off studies.

The most comprehensive study to date, using both methods, is by Hathaway and Officer. The work is currently being up-dated but the results, to date, are broadly consistent with earlier studies by the authors and others.

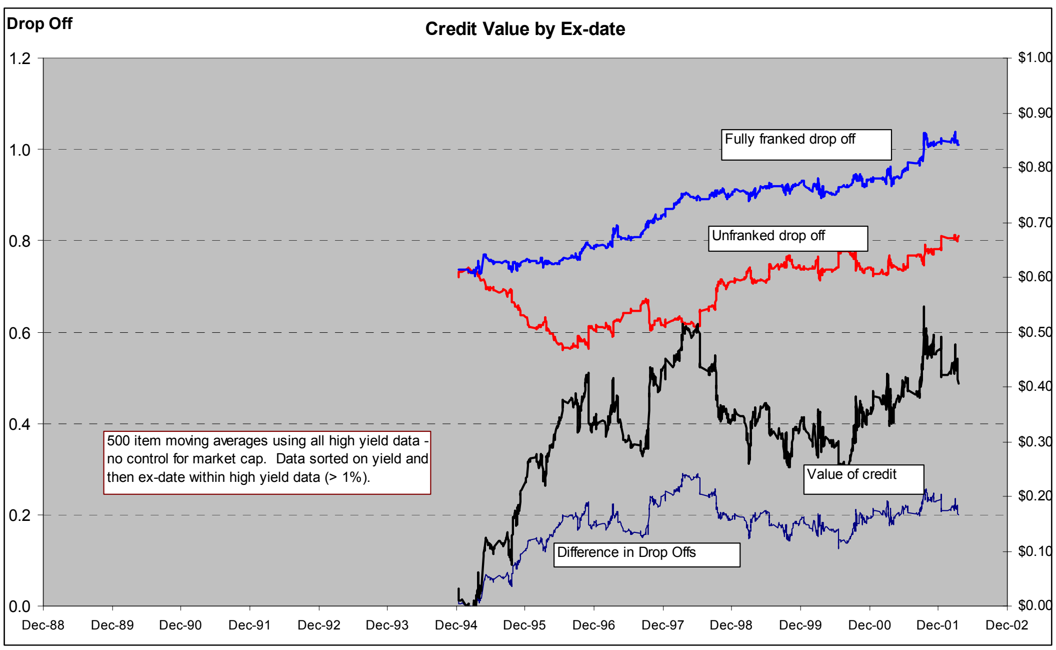
The introduction of imputation tax in July 1987 substantially reduced the previous position of double tax on company earnings; company tax followed by personal tax on dividends. Shareholders now pay personal tax on the gross of dividends and imputation tax (company tax) credits and obtain credit for the company tax paid. There are three milestones in the life of franking credits; they are created when company tax is paid, they are distributed along with dividends and they are redeemed when shareholders claim them against personal tax liabilities. Two issues thus arise; how many credits are issued (access) and how many of these distributed credits are redeemed (utilisation)? The study found that the access factor is 80% and increasing (an increasing amount of company tax is being distributed as credits) and about 60% of distributed credits are being redeemed. Overall, 48% of company tax is actually pre-payment of personal tax.

The study of official tax statistics indicate that a large proportion (48%) of the tax that "masquerades" as company tax is personal tax collected (withheld) at the company level. This means that the effective company tax rate in Australia during the period of the study was much closer to 18% than the statutory rate of 36%.

A company that pays a dividend, other-things-being-equal, is expected to drop in value by the value of the dividend being paid. By examining the amount of cash dividends and, separately, the amount of imputation credits we are able to assess the implied market value of the credits for the extent that the share price drops as the credit is being paid. The dividend drop-off study showed slightly greater value to the franking credits about 62% which may reflect the sample which was based on listed companies whereas the tax statistics include all companies. The main data set analysed consisted of all closing share prices for the period January 1 1985 to June 30 1995, although only a subset of this data was suitable for analysis.

However, there is ongoing research to update the period of the analysis and this may have some effect on the conclusion as to the average value of franking credits. The latest research results are shown below

Figure 2
Average value of franking credits, December 1994 to March 2002



Source:N.Hathaway, Invesco Ltd.

The above figure gives a moving average of the implied value of franking credits from an update of the dividend drop-off study. This study concludes in March 2002, although the graph's final point at March, 2002 reflects an average of dividends over the year March 2001 to March 2002 – the whole series are a moving average of typically a sample of 500 dividend payments with a minimum yield of greater than 1 %. The value of the credits is sensitive to the size of the dividend payment or yield and the size of the company issuing the dividend. The results of the graph below reflect, in part, sample differences to the previous study where in the current study there is a greater variation in the sample, particularly with respect to the size of the company.

On the basis of the most recent study a value of 40 cents per dollar of franking credits would appear to be more reasonable than the 50 cents implied by the previous study. However, there are differences in the sample of dividends between the two studies and the current study includes smaller companies which we would expect to lead to a greater variability in the estimate and a slightly lower estimate, other-things-being-equal. The possibility of significant "measurement errors" means that we could not be emphatic that there has been any change in the value of the credits, all we can be sure of is the credits have value and for large, higher dividend paying stock it is likely to average between 40 and 50 cents in the dollar. A compromise estimate would be 45 cents.

An example of the difficulty in arriving at a precise value for imputation credits is the limited sample of the Cannavan, Finn and Gray study, referred to in footnote 5 above. Their study indicates there is evidence that large companies that have a substantial overseas shareholding have seen the value of the credits dropping to around 25% with some around 0%. Further, the lowering of the capital gains tax rate makes it more attractive for investors to use companies as a tax shield so that companies will be encouraged to retain a greater proportion of earnings instead of paying franked dividends. This will reduce the value of the franking credits, other things being equal.

These results are in contrast to the arguments posed in a paper by Dr. Martin Lally, Associate Professor, in the School of Economics and Finance at the Victoria University of Wellington, New Zealand. The paper was commissioned by the ACCC and it was titled *The Cost of Capital under Dividend Imputation.* Lally argued that franking credits should be fully valued assuming that the Australian market was totally segmented from overseas investors. He argued that the use of a domestic CAPM (as distinct from an international CAPM) in the estimates of equity betas implies such segmentation. It is a legitimate argument but at odds with the facts.

Evidence indicates there are significant foreign investors in the Australian share market and, in these circumstances, it should be incumbent to take into account the effect of such foreign investors on the CAPM. The question, as recognized by Lally, is how to take into account foreign investors when the evidence would suggest that the Australian equity market and the international market are not completely integrated. The evidence is consistent with a partial integration of these markets in that foreign investors are well represented in the top 50 stocks listed on the Australian market but almost not at all represented in stocks outside of the leaders, hence one could argue for a partially segregated/integrated equity market. The problem is how to take this into account when such an approach really implies separate models depending on the nature of the company or equity being examined.

There appears to be no obvious solution to the quandary other than one of compromise. It would be a mistake to ignore the effect of foreigners investing in Australian equities, it is an equally an extreme decision to ignore Australian betas (betas from the domestic CAPM) and only rely on a betas estimated using the international CAPM. Lally could legitimately argue that it would be a mistake to believe that Australian investors were not influential and if we include the influence of foreigners to ignore the international CAPM.

A "solution" would be to ignore the quandary and treat the domestic betas as an approximation for their international counterparts and to continue to value the franking credits in the context of their average value in Australia i.e. around 45cents a dollar, reflecting the influence of both foreign and domestic investors. Even if the extreme version of the Lally recommendation was adopted that is to ignore foreigners, the value of the credits are likely to be significantly less than 1.0

to investors because of the significant proportion of current earnings that are not paid out as franked dividends and the fact that tax credits are a "wasting asset".

4. Market Risk Premium

The market risk premium (MRP) arises out of the capital asset pricing model (CAPM). The MRP is the stock market's price of risk relative to a risk-free rate of return such as the yield on 10-year Government bonds. The MRP is a real measure of risk as distinct from a nominal measure. The rationale for using historical data as a measure of the ex-ante MRP is that investors' expectations will be framed on the basis of their past experience. Historically, the MRP tends to be mean reverting but there have been 10-year periods when the returns from equities have been below the yield of 10-year bonds.

A figure of 6% is commonly used in Australia and the US by regulators and academics, although some market participants use more recent data and subjective measures to justify using a lower MRP figure.[7] When calculating ex-post MRP figures as a basis for determining the ex-ante MRP, the use of arithmetic average stock returns is favored over the geometric measure because arithmetic average returns are probably a closer proxy for what are expected by investors or how the expectations are framed by investors. The Australian historical MRP data has been reasonably consistent with that of the US, UK and New Zealand.

The graphs below demonstrate a justification for a MRP of 6%. The ten year moving average has a mean of about 6% although in any ten year period the

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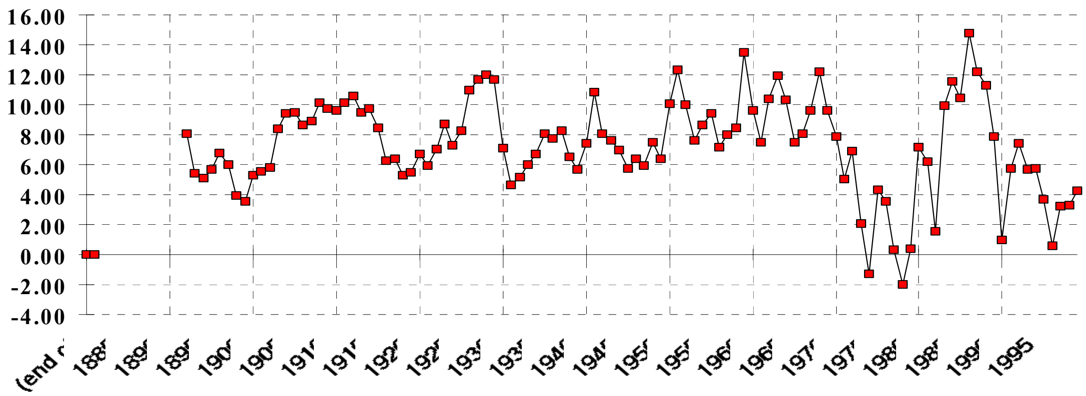
[7] For example, a report by Pareto Partners commissioned by BHP Billiton for the Gasnet Inquiry concluded that the ACCC should take more note of decisions of UK regulators who are using lower MRP's than those in Australia. However little evidence was produced to prove that these MRP estimates are based on any superior evidence or technology to that which is available to the Australian regulators.

A study by Mercer Investment Consulting commissioned by the Essential Services Commision of Victoria concluded that, based on Mercer's forecasts, the implied MRP should be much lower. However, there was no demonstration that Mercer have superior forecasting skills and the implied MRP will be a function of their forecast model.

average could be well below or above this average but this does not mean expectations will be framed on any one ten year period.

Figure 3
Ten year MRP

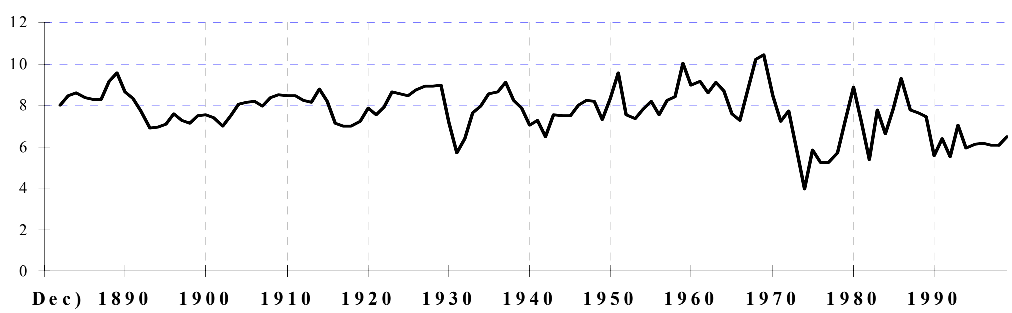


Source: Author's estimates

The Exponential Moving Series is also trending towards 6%, such a series places greater weight on more recent observations, the equation is defined as:

$$SMRP(t) = \alpha.MRP(t) + (1-\alpha). SMRP(t-1)$$

Figure 4
Simple exponential smoothing of the MRP, alpha=0.5



Source: Author's estimates

Table 9
Implied MRP from Brokers' Forecasts

Company	IRR perpetuity (%)	Start Date	Prices at this date ($)	Risk-free rate	Beta	(Rm-Rf) ($)	Implied MRP (%)
Southcorp	10.892	30/06/00	4.82	6.16	0.82	4.73	5.77
Adcorp	9.901	30/06/00	1.64	6.16	1	3.74	3.74
Amcor	9.919	30/06/00	5.84	6.16	1.29	3.76	2.91
Aristocrat	22.283	31/12/99	4.32	6.96	0.47	15.32	32.60
Baycorp	7.848	30/06/00	8.40	6.16	1	1.69	1.69
Brambles	7.017	30/06/00	51.34	6.16	0.82	0.86	1.04
Coles Myer	9.928	30/07/00	6.59	6.96	0.43	2.97	6.90
Cochlear	3.740	30/06/00	28.76	6.16	0.63	-2.42	-3.84
Computershare	15.641	30/06/00	8.59	6.16	1.73	9.48	5.48
CSL	8.042	30/06/00	33.03	6.16	0.55	1.88	3.42
Ci Technologies	6.540	31/12/99	8.10	6.96	1.12	-0.42	-0.37
Data Advantage	8.269	30/06/00	4.58	6.16	1.79	2.11	1.18
Energy Developments	10.197	30/06/00	9.75	6.16	1.57	4.04	2.57
Foster's	7.069	30/06/00	4.70	6.16	0.6	0.91	1.52
Hansen Technologies	5.480	30/06/00	1.80	6.16	1	-0.68	-0.68
Harvey Norman	16.258	30/06/00	3.76	6.16	0.95	10.10	10.63
MYOB	24.856	31/12/99	3.22	6.96	1	17.90	17.90
News Corp	7.362	30/06/00	23.00	6.16	0.86	1.20	1.40
Seven	8.774	30/06/00	7.09	6.16	0.95	2.61	2.75
Sonic Healthcare	11.779	30/06/00	6.88	6.16	1.13	5.62	4.97
Howard Smith	13.107	30/06/00	8.16	6.16	1.16	6.95	5.99
Tabcorp	11.850	30/06/00	9.60	6.16	1	5.69	5.69
Wesfarmers	8.183	30/06/00	13.30	6.16	0.95	2.02	2.13
Woolworths	7.187	30/06/00	6.16	6.16	0.25	1.03	4.11
Westfield Holdings	5.996	30/06/00	11.48	6.16	1.2	-0.16	-0.14
Cable&Wireless	5.459	30/06/00	4.98	6.16	1	-0.70	-0.70
Frucor	20.384	30/06/00	1.71	6.16	1	14.22	14.22
Telstra	7.591	30/06/00	6.78	6.16	1.05	1.43	1.36
BHP	11.280	30/05/00	19.75	6.27	1.2	5.01	4.18
MIM	32.041	30/06/00	0.90	6.16	1.95	25.88	13.27
North Broken Hill	12.005	30/06/00	3.95	6.16	2.25	5.84	2.60
Rio Tinto	18.232	31/12/99	32.72	6.96	1.77	11.27	6.37
Western Mining	10.592	31/12/99	8.40	6.96	1.7	3.63	2.14
Woodside	9.231	31/12/99	11.25	6.96	0.9	2.27	2.52
Qantas	14.913	30/06/00	3.38	6.16	0.23	8.75	38.06
TOTALS	**399.849**			**221.31**		**178.54**	**203.38**
AVERAGES	**11.42**			**6.32**		**5.10**	**5.81**

Source: JF Capital Partners, Trinity Best Practices Committee.

A Jardine Fleming Capital Partners survey of professional market participants' MRP expectations found that on average these participants thought the historic MRP for Australia was 5.87%. Their expectation for the future MRP is about 1% below this figure. However, there was a high co-efficient of variation in these expectations reflecting a significant amount of uncertainty.

Also, a survey of brokers' forecasts of stocks' future earnings related to their current share price showed an implied MRP of about 6% - see the table above.

Finally, The Millennium Book: A Century of Investment Returns, shows in the table below that the Australian results are consistent with countries such as the US, UK and Canada whose capital markets are very similar to Australia. The arithmetic rates are more likely to be reflected in investors' expectations than the geometric rates, which over the period represent 10 year rates, whereas the arithmetic represent annual rates.

Table 10
Market Risk Premium

Equity Premium	Arithmetic Mean (%)	Geometric Mean (%)
Australia	7.6	5.9
Canada	6.1	4.6
Denmark (from 1915)	3.6	2.5
France	7.0	5.0
Germany (ex1922/3)	10.1	6.9
Italy	8.5	5.0
Japan (from 1914)	10.9	6.4
Netherlands	6.8	4.8
Sweden	8.0	5.8
Switzerland (from 1911)	4.3	2.8
USA	7.2	5.3
UK	5.8	4.6

Source: The Millennium Book: A Century of Investment Returns

5. The Risk-Free Rate

There has been some debate about what is the appropriate risk free rate to use in the CAPM. The debate has not concerned the source of the surrogate "risk free" rate which is a Commonwealth Government Issued security. The debate, to the extent that it exists, concerns the duration or term of such a security together with the sampling method used for determining an estimate.

The CAPM is a single period model of no fixed duration and various governments securities from government bills to long term government bonds have been used as a surrogate rate. In the context of CAPM theory there is no reason to pick one duration over another. However, ideally the duration of the CAPM should be the duration of the planning period for which the CAPM is to be used to estimate an expected or required return. This means that if the planning horizon is a long term investment then a long term government bond is the appropriate duration to use.

Further, it has been conventional in Australia to use 10 year Commonwealth Bond Yields as the proxy of the risk free rate as it is a highly liquid security which provides a good reflection of the expected yield on a long term government security. The data bases that have been assembled typically use such a bond as the surrogate risk free rate and, therefore, measures of market risk premium and the like are more readily available where a 10 year Commonwealth bond rate has been used. To the extent that a shorter rate has been used in electricity regulation (refer to Table 11), it has only been by ACCC, to my knowledge, in relation to Snowy Mountains and Powerlink, and more recently the draft decisions on SPI PowerNet and ElectraNet SA. The ACCC's Draft Regulatory Principles also foreshadow this treatment. In these decisions a 5 year rate was used on the grounds that this was consistent with the period of the regulatory decision.

Table 11
Risk-free rate parameters adopted in regulatory decisions

Entity/Author	Industry	Benchmark bond	Estimation factor
QCA (2001)	Electricity distribution	10 year Commonwealth	20-day average
ORG (2000a)	Electricity distribution	10-year inflation indexed Commonwealth	20-day average
ACCC (1999a)	Electricity transmission	5-year Commonwealth	40-day average
ACCC (2000a)	Electricity transmission	10-year Commonwealth	40-day average
IPART (1999c)	Electricity distribution	10-year Commonwealth	20-day average
IPART (1999d)	Electricity distribution	10-year Commonwealth	20-day average
OTTER (1999)	Electricity distribution	10-year Commonwealth	12-month average
OFGEM (1999)	Electricity distribution	(UK) A range, with particular weight on the 10-year Gilt	A range, on the 10 year Gilt
ACCC/ORG (1998)	Gas transmission	10-year Commonwealth	12-month range
ORG (1998b)	Gas distribution	10-year Commonwealth	2-month average
IPART (1999b)	Gas distribution	10-year Commonwealth	20-day average

Source: Queensland Competition Authority, Electricity Distribution Decision, May 2001, page 78

However, even in these circumstances, if the planning period of the company is longer than the periods between regulatory decisions, it is a mistake to use the 5 year rate as distinct from a longer term rate such as the 10 year rate. The longer term will better reflect the investment horizon of the company which is the relevant term and not that of the regulators. A moving 10 year rate should be used if regulatory periods are considerably shorter than the 10 year period. In short, there is no sound justification for the use of a five year rate.

The argument for a term consistent with the regulatory period would be correct if the entity, at the time they purchased the assets, were guaranteed that they would get compensation for the required return based on a five year benchmarked fixed interest security and at the end of the five years, if they choose to walk away from the asset, they would be fully compensated. In these circumstances, from the perspective of the owner of the asset, it is a five year asset even though its economic life might be greater.

Electricity companies are not in this position. When a company commits funds to purchase an asset, it is typically long-term, for infrastructure assets probably considerably longer than the term of the ten year Government Bond that is used for a surrogate risk-free rate that I and others advocate as an appropriate benchmark. When it makes the purchase, it has to consider making the purchase of that asset or the opportunity cost of investing in other assets of comparable risk and duration, or where the risk and duration has adequate compensation for the alternative investments. Even though it knows that the allowed rate of return on the asset will be reset at regular periods, it does not have the luxury of having those rates prescribed to it at the time of the purchase of the asset. Nor does it have the luxury of knowing that it can walk away from the asset if it finds such compensation unsatisfactory. The risk to the infrastructure owner is the risk faced by the purchaser of a long-term asset. The nature of the risk may be affected by the regulatory regime but nonetheless it is still committed to the asset unless offered full compensation should it choose to walk away or sell the asset. For these purposes a full compensation implies at least the replacement cost of the asset or its optimal deprival value under the same set of conditions i.e., the same regulatory regime that was expected at the time the asset was purchased.

The ACCC commissioned a separate paper on this subject by Dr.Martin Lally. However, the examples that Lally uses in his paper to demonstrate the argument for using a five year bond rate are equally applicable to using the changes in the ten year rate at each regulatory period. To use a rate with a time span equal to the regulatory period requires showing the assets of the company are not at risk, they will be totally protected or "insured" by the regulator. Moreover, this five year rate is inconsistent with the MRP and therefore inconsistent with the CAPM. Although the difference in the market risk premium estimated using five year rates relative to ten year rates would not have a profound influence on the ultimate value, it misses the point. The rate used has to be consistent with the assets' cost of capital and because the assets are long lived the ten year rate is likely to be more consistent with the cost of capital than a five year rate. Also, the longer term investment will show a greater premium because of the normal shape of the yield curve than a shorter term investment.

Further support for using a ten year rate is that the market is much deeper in ten year risk free securities issued by government than five year securities and therefore the estimates are more reliable. Moreover, all the estimates of the MRP generally have used ten year bond yields to estimate the MRP and to re-estimate for the five year premium would require a great deal more work than has been done to date on that particular premium.

Another issue that has been contentious is at what point should the redemption yield on a government security be used. Typically regulators have used an average rate running from 12 months down to 20 days. The argument is that these averages remove potential “spikes” which may reflected in the rates due to some short term uncertainty. Where an average of bond yields is used to estimate the risk free the resulting number will have lower variance than simply using the last observed rate. However, the average will also contain more historical and less relevant information i.e. it will be a poorer forecast of future rates than the last prevailing rate. The tradeoff is between a lower variability and less information and higher variability and greater information in such an estimate.

It is subjective but in my opinion averaging over five days would not be a significant compromise to the information effect, whereas averaging over a month or longer, which has been previously proposed, I believe could compromise to a much greater extent the information contained in the rate.

6. Expected Inflation.

The expected level of inflation comes into a regulatory decision on prices when an inflation adjustment is required for forecasting net cash flows. It is important in such circumstances that the inflation adjustment made with respect to net cash flows is consistent with the implied rate of inflation embedded in the cost of capital. The CAPM takes account of expected inflation in the risk free rate and, to the extent that this is a 10 year bond, then the embedded inflation is the expected annual geometric mean inflation over the 10 years of the bond. An alternative approach would be to estimate the risk free rate in real terms. In this circumstance a 10 year capital indexed bond rate would be appropriate. The rates then would require simply forecasting net cash flows at current prices and then adjusting for any inflation forecast.

There are basically two methods by which an estimate of inflation can be made.

- The difference between a Commonwealth Government capital index bond and a Commonwealth Government nominal index bond of the same duration, will reflect the expected inflation over the period of the duration.
- There are regular forecasts by economists of expected inflation rates for, typically 12 month periods, which could be used as a measure of expected inflation for the period of the forecast.

I would recommend using the difference between a capital indexed bond and the government bond of the same duration to estimate expected inflation over the period of the chosen duration. This would mean the other parameters of the model including the cost of capital would need to be estimated in real terms in the first instance and then adjusted for the expected inflation over the duration of the regulatory decision. Over a ten year period the current expected annual inflation is approximately 2.0%, on the basis of the difference in yields between indexed bonds and nominal bonds for the last five days of September, 2002[8].

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[8] Reserve Bank of Australia.

7. Debt Margin and Gearing (Leverage)

The difference between the interest rate or yield on debt issued by the entity and the comparable yield on the Commonwealth government issued security of the same term is called the debt margin. This margin will reflect the risk of the entity's debt relative to the Commonwealth debt's security. The risk of the security can be divided up into diversifiable and non-diversifiable risk both of which will reflect the default risk of the entity or borrower.

Clearly, the risk of the entity's debt will be a function of the amount of asset backing to the debt or equivalently the degree of leverage or gearing that the entity has. The greater the debt to value or debt to equity ratio of the entity, other things being equal, the greater the risk and therefore the greater the required return or debt margin. Similarly, the cost of equity will increase as the proportion of debt in the capital structure increases but this does not imply the cost of capital for the entity's assets changes. The change in proportion of equity to debt can offset the relative increase in equity and debt costs such that the WACC or asset cost of capital remains unchanged – this is an illustration of the Modigliani Miller (MM) Proposition that "a company's value is invariant with changes in its capital structure". As a practical proposition the so called MM hypothesis is valid within reasonable ranges of debt/equity for most entities. The consequences are that in setting a debt margin, we are implicitly setting a level of gearing. If the observed equity beta is used together with a debt beta to derive an asset beta the assumptions employed will imply a particular level of gearing.

In the estimates of beta above (section 2.3) a recommended beta for debt was 0.30 which implies a debt margin of about 1.80%. However, this implies that the total debt margin is due to non-diversifiable or systematic risk and there is no margin for the diversifiable or idiosyncratic risk of the entity. I believe this is not an unrealistic assumption, in the context of default risk for a major entity, i.e. it is unlikely that the default of a major entity's debt will not be associated with the significant external market conditions. The capital structure implied for this debt margin is between 50 and 60% debt as a proportion of the total assets of the entity.

Table 12 below, taken from the Queensland Competition Authority's Final Determination in the context of electricity distribution, shows that the debt margins used in regulatory decisions are typically around 1 to 1.5 percent with an average of approximately 1.2. The significant difference between these decisions and the debt margin recommended here is due in large part to the implied assumptions made in the decisions about debt financing together with the state of the debt markets at the time that market data was sampled. Although not always explicit, many decisions appear to have assumed that the relevant benchmark for debt financing is based on the term of the regulatory period. As discussed in section 2.3, the long planning horizon for infrastructure necessitates using a long term financing basis (ie 10 year duration or greater).

Table 12
Cost of debt parameters adopted in regulatory decisions

Entity/Author	Industry	Margin above the risk-free rate (%)
QCA (2001)	Electricity distribution	1.65
ORG (2000a)	Electricity distribution	1.5
ACCC (1999a)	Electricity transmission	1.0
ACCC (2000a)	Electricity transmission	1.0
IPART (1999c)	Electricity distribution	1.0
IPART (1999d)	Electricity distribution	0.8-1.0
OFGEM (1999)	Electricity distribution	1.4 (UK)
ACCC/ORG (1998)	Gas transmission	1.2
ORG (1998b)	Gas distribution	1.2

Source: Queensland Competition Authority, Electricity Distribution Decision, May 2001

The capital structure or proportion of debt to the total assets of the company is referred in the tables above as leverage or gearing. As I have indicated above, the capital structure can have a significant bearing on, not only the debt margin, but also the required return on equity although within "reasonable" bounds it is unlikely to affect the asset cost of capital or the WACC.

Table 13 below indicates that the typical capital structure assumed by regulators has been 60% debt as a proportion of total assets. In theory, within the range of 40% to 70% the asset cost of capital should be stable providing appropriate adjustments are made to debt and equity costs to reflect the change in gearing. However, to the extent that the equity cost of capital is the prime determinant of the asset cost of capital one has to be cognisant of the capital structure of the companies determining the equity cost of capital in selecting an appropriate leverage or gearing. In Table 6, the sample average leverage of the companies listed is 54% when the averages were simple or value weighted.

In the circumstances, it would appear that a leverage of between 50 and 60% is a reasonable benchmark. Given that most regulators have adopted a gearing of 60%, which is consistent with this benchmark, there is little compelling reason to vary from this assumption.

Table 13
Gearing levels adopted in regulatory decisions

Entity/Author	**Industry**	**Debt/ Debt+Equity (%)**
QCA (2001)	Electricity distribution	*60*
ORG (2000a)	Electricity distribution	60
ACCC (2000a)	Electricity transmission	60
IPART (1999c)	Electricity distribution	60
IPART (1999d)	Electricity distribution	60
OTTER (1999)	Electricity distribution	50-70
Ofgem (1999)	Electricity distribution(UK)	50
ACCC/ORG (1998)	Gas transmission	60
ORG (1998b)	Gas distribution	60
IPART (1999b)	Gas distribution	60

Source: Queensland Competition Authority, Electricity Distribution Decision, May 2001

8. Estimations and Recommendations

In the context of the upcoming SPI PowerNet revenue determination, my opinion is that the WACC and dividend imputation factor should be set having regard to the following recommendations.

- The WACC should be formulated as the simple or "vanilla" WACC (see equation 2).
- The WACC only captures the required compensation for bearing non-diversifiable risks. Consequently, compensation for the actuarial value of all diversifiable risks should be included as a separate item in SPI PowerNet's revenue allowance.
- The parameter estimates (MRP, asset beta, equity beta, debt beta/debt margin, gearing and gamma) for the WACC and tax allowances should be as set out in Table 14 below.
- While these parameter estimates are expected to be stable over the period to the end of 2002, the estimates for the risk free rate and inflation are variable in nature. Hence, when the revenue determination is made, the estimates need to be refreshed at that time. The risk free rate should be determined as the Commonwealth Government 10 year nominal index bond as an average of the last five days preceding the day of the determination. The inflation estimate should be derived consistent with this with respect to the difference between the Commonwealth Government 10 year nominal index bond and the Commonwealth Government 10 capital index bond.
- As at 18th Ocober 2002 the combination of these parameters and variables yields an estimate of the vanilla WACC for SPI PowerNet of 9.08%.

Table 14
Estimate of WACC and dividend imputation factor

Parameter	Estimate
Nominal risk free rate (%)	5.60
Expected Inflation (%)	2.00
Real Risk Free Rate (%)	3.60
Market Risk Premium (%)	6.00
Asset beta	0.58
Equity beta	1.00
Debt beta	0.30
Debt margin (%)	1.80
Debt Cost of Capital	7.40
Gearing (Debt/Assets, %)	0.60
Equity Cost of Capital	11.6
Value of Imputation Credits	0.45
Vanilla WACC	9.08

Source: Author's estimates and http://www.rba.gov.au/Statistics/indicative.html

Westpac Institutional Bank

Corporate Securities
Level 5, 255 Elizabeth Street
Sydney NSW 2000
Telephone: (612) 9284 9437
Facsimile: (612) 9284 8270
Email: jbrien@westpac.com.au

14 October 2002

EMAIL

Ms Karen Smith
Treasury Manager
SPI PowerNet Australia
Level 17, 452 Flinders Street
Melbourne VIC 3000

Dear Karen,

As discussed, please find below indicative pricing for a new issue (as at 14 October 2002).

Assumptions:	
Rating:	BBB+
Maturity:	10 Years
(1) Issuance Margin to swap:	+1.30 / 1.40% per annum
(2) Bond / Swap Spread:	+0.31%
(3) Spread to 10 Year CGS (1+2):	+1.61 / 1.71% per annum
Other Costs:	
(4) Dealer Placement Fees:	+0.08% per annum
(5) Swap Credit/Risk Charge:	+0.06% per annum
Total Funding Costs:	
All-In (Per Annum) Margin to swap (1+4+5):	+1.44/ 1.54% per annum
All-In (Per Annum) Margin to CGS (3+4+5):	+1.75 / 1.85% per annum

Note: The margin between Commonwealth Bonds and swap has historically traded at an average rate in the 40 to 50 basis point range, and only recently has traded in to the low 30s range.

The 'Other Costs' are a non-variable element in the total costs. Irrespective of the volume or margins achieved in final pricing, the Dealer Placement Fee and Swap Credit/Risk Charge must be paid on the full volume of funds raised. Both are per annum fees.

Please let me know if I can provide any further information.

Yours sincerely,

....

Jennifer Brien
Associate Director, Corporate Securities

National

10 October 2002

Wholesale Financial Services

Telephone (03) 8641 2769
Facsimile (03) 8641 4194

Level 32
500 Bourke Street
MELBOURNE VIC 3000

www.nabmarkets.com

Karen Smith
Senior Treasury Dealer
SPI PowerNet
Level 17
452 Flinders Stree
Melbourne VIC 3000

Dear Karen

Debt Capital Markets Pricing

I am pleased to provide you with indicative pricing for a medium term note ("MTN") issue by a notional regulated utility with a credit rating of BBB+ (Standard & Poor's) for an issue size of between A$100 million to A$250 million. Pricing is subject to market conditions at the time of issuance. Increased volumes of issuance may require wider issuance spreads.

Maturity	10 years
Benchmark CGS*	6.25% May 2013
Re-offer Spread to Benchmark	+184 – 189 bps
Re-offer Spread to Swap	+152 – 157 bps
Issuance Fees - see below (p.a.)	+8 bps
All-in Spread to Benchmark	+192 – 197 bps
All-in Spread to Swap	+160 – 165 bps

**CGS is Commonwealth Government Security*

Issuance Fees

The following fees are payable:

- MTN Placement (Dealer) Fees - for a 'BBB+' issuer MTN placement fees are typically 0.07% p.a. of the issue amount over the life of the bond
- Legal documentation and Austraclear Fees - total fees of 0.01% p.a. – 0.015% p.a. are payable by the Issuer for legal work and to register the MTNs in Austraclear

Market Overview

- The corporate bond market has experienced a widening in credit spreads for most corporates as a result of the recent equity market volatility.
- Issuance of 'BBB' rated credit in 2002 has dimished significantly from the previous 3 years as a result of investors adopting a more risk adverse investment strategy given the volatile market conditions.

Yours sincerely

George Polites
Director
Debt Capital Markets

COMMENTS ON LALLY:
DETERMINING THE RISK FREE RATE FOR REGULATED COMPANIES

R.R. OFFICER

30th September 2002

The Appropriate Term for the Risk Free Rate

The numerical illustration used by Lally to argue that the term of the regulatory decision was the appropriate term is perfectly consistent with using a non regulatory term for the period of the risk free rate. The Lally example is a basic illustration of the following proposition: If the entity's cost of capital is reset at each regulatory period then by definition the value of the asset will not change and the initial investment will be recovered. This example is no different to pointing out that a floating rate note will maintain its value because their interest rates rise or fall and the coupon provided by the note rises and falls along with interest rates so that the value of the note is maintained.

The real issue, in the context of the current matter, is whether it is the company's cost of capital is the one being applied by the regulators and changed at each regulatory period, as distinct from some other rate. Moreover, in this context, the issue is whether it is the yield on a five year government bond or a ten year government bond when used in CAPM estimate gives the best estimate of the entity's cost of capital.

The CAPM and the Consistency with the Term of the Risk Free Rate with the MRP.

Lally correctly points out that the CAPM model is a single period model where theory does not indicate any particular term or duration for the model. The argument for using a ten year bond rate rather than a bill rate, which is occasionally used (particularly in the US), is that the bond rate better represents an investment's duration and therefore implied period for the risk free rate is one of a long duration as distinct from a bill rate which better represents a trader's duration. Therefore, by implication, the risk free rate in the CAPM should a long duration such as a ten year government security.

"*The claim that the risk free rate used to determine the market by them must be consistently applied throughout the CAPM valuation formula is false*." (Lally, page 12). Once again the illustration used by Lally to support this claim does not prove his point because if we used the same example with an annualized and then a two year period for the CAPM using a ten year risk free rate, we would get the same result.

By proposing a five year risk free rate with the MRP based on a ten year risk free rate what Lally is proposing is a different model to the CAPM. While we can derive a market risk premium taken from the difference between the return on the market and a ten year government bond yields and then use as the risk free rate the (R_f) rate on a government five year bond yield but this is not the CAPM model.

In short, all of Lally's examples for using a five year bond rate are equally applicable to using the changes in the ten year rate of each regulatory period and yet this rate is the rate consistent with the MRP and therefore consistent with the CAPM. The Lally approach is not consistent with the CAPM and although the difference in the market risk premium estimated using five year rates relative to ten year rates would not have a profound influence on the ultimate value, it misses the point. The longer term investment will show a greater premium because of the normal shape of the yield curve than a shorter term investment.

Further support for using a ten year rate is that the market is much deeper in ten year risk free securities issued by government than five year securities and therefore the estimates are more reliable. Moreover, all the estimates of the MRP generally have used ten year bond yields to estimate the MRP and to re-estimate for the five year premium would require a great deal more work than has been done to date on that particular premium.

Averaging the Yields to Estimate the Risk Free Rate.

Where an average of bond yields is used to estimate the risk free rate the resulting number will have lower variance than simply using the last observed rate. However, the average will also contain more historical and less relevant information i.e. it will be a poorer forecast of future rates than the last prevailing rate. The tradeoff is between a lower variability and less information and higher variability and greater information in such an estimate.

It is subjective but in my opinion averaging over five days would not be a significant compromise to the information effect, whereas averaging over a month or longer, which has been previously proposed, I believe could compromise to a much greater extent the information contained in the rate.

COMMENTS ON LALLY: "THE COST OF CAPITAL UNDER DIVIDEND IMPUTATION"

R.R. OFFICER

24th September, 2002

A large number of interesting and complex issues are raised by Lally in this paper. A substantial piece of work would be required to address all of them in a satisfactory manner and, clearly, this is well beyond any current task. Instead, my intention is simply address those issues raised by Lally which gives rise to different parameter estimates in his analysis from those parameters used in calculating the weighted average cost of capital (WACC) in my paper *A Weighted Average Cost of Capital for a Benchmark Australian Electricity Transmission Business A Report for SPI PowerNet*. R.R.Officer 28 February, 2002.

Lally refers to the "Officer" approach; there are several different aspects of this approach which Lally criticizes and comments on and it is instructive to clearly separate them in order to understand the extent to which his criticisms are valid.

The Value of Imputation Tax Credits.

Lally refers to the apparent "ambiguity in definitions" (Lally p. 6) in the Officer approach to the different ways tax and the effect of tax can be treated in valuation. The ambiguity or more accurately the chance of error is significantly reduced if the so called "Vanilla WACC" equation as the WACC equation. The ACCC has recognized the benefits of using the approach that incorporates this equation and its associated definition of net cash flows. Adopting this approach to valuation, all corporate tax and its effects (such as any relevant differential between capital and income taxes) are taken into account in the cash flows and these can vary period by period to reflect the tax status of the company. Moreover, the Vanilla WACC equation can also be estimated and varied on a period by period basis. It is this property of the Vanilla WACC approach which enables gamma to vary period by period in the estimate of the net cash flows as distinct from the WACC.

Lally (p.8) distinguishes the value of the tax credits (γ) into 1. the "utilization rate" and 2. the "ratio of imputation credits assigned to company tax paid". There are, in fact, three stages in the "life" or value of a tax credit and not two as implied by Lally.. The most recent version of the Hathaway and Officer paper (an earlier version of the paper is referred to by Lally as Hathaway and Officer (1995)) discusses the three stages in the life of an imputation tax credit. They are:

1. when it is generated as company taxes are paid;
2. when it is distributed to shareholders in the form of franking credits attached to a franked divided; and
3. when the tax credits are claimed by the investor against their tax liabilities.

The estimate of gamma is taken into account in the net cash flows when these cash flows are generated by the company (stage 1) but the value of γ is not released until stage 3. The time delay between stages 1 and 3 can significantly reduce the value of the franking credits. Franking credits are a wasting asset in that they cannot be invested and compounded at the cost of capital as the retained earnings of a company can be. If there is a delay between the time the tax credit is generated (stage 1) and the time that the credit is redeemed (stage 3) then the present value of the credit when it is generated is less than its face value because of the opportunity cost of the taxes being credited against personal tax liabilities.

The company that pays no dividends and never pays a franking credit will have no value in their imputation tax credits but clearly the company will still have value because of the retained earnings and the associated assets of the company. This of course an extreme example. However, for example, if a company typically has a dividend payout ratio of 60% and a cost of equity capital of 12% then the value of the tax credits as they are generated will be about 83cents in the dollar.[1] The lower the payout ratio and the higher

[1] Let $D_{1.}\alpha$ = a franking credit at time 1, E_1 earnings and k the dividend payout ratio and α=t/(1-t).
Then the present value of a dollar of franking credits generated at time 0 is

the cost of equity capital this number would be further reduced, with the recent change in the differential between capital gains tax and income tax in Australia resulting in an expectation that companies will have a much lower divided payout ratio in the future than historically because of the tax shield afforded by the lower capital gains tax relative to income tax.

Evidence indicates there are significant foreign investors in the Australian share market and in these circumstances it should be incumbent to take into account the effect of such foreign investors on the CAPM. The question, as recognized by Lally, is how to take into account foreign investors when the evidence would suggest that the Australian equity market and the international market are not completely integrated. The evidence is consistent with a partial integration of these markets in that foreign investors are well represented in the top 50 stocks listed on the Australian market but almost not at all represented in stocks outside of the leaders, hence one could argue for a partially segregated/integrated equity market. The problem is how to take this into account when such an approach, which really implies separate models depending on the nature of the company or equity, is being examined.

Lally assumes a completely segregated market and therefore no foreign investors and he argues that the franking credits can be fully utilized by domestic investors. But I have pointed out above this fails to take into account the wasting nature of a tax credit and the failure of companies to pay out all their taxable earnings in the period that the tax is paid on them.

The quandary involves assuming only domestic investors and therefore a domestic CAPM or a fully integrated market with foreigners and therefore an international CAPM. At an empirical level, as I indicated above the market is probably only partially

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$$PV = k.\alpha \sum_{i=1}^{n} \frac{E_1(1-k)^i}{(1+r)^i}$$

And let n $\rightarrow \infty$,

Then PV=k.α/(r+k).

So that setting, k=0.6, r=0.12, t=0.3, and let α=1.0 (a dollar of franking credit) then PV=0.83.

segregated/integrated. The betas of Australian stocks estimated using a domestic CAPM typically will be higher than those of betas estimated using an international CAPM.

Whether to recognize the presence of foreign investors and the associated inability of them to get significant value from franking credits is probably incumbent on us to re-estimate the betas of such firms or industries in the context of a “more integrated” CAPM.

There appears to be no obvious solution to the quandary other than one of compromise. It would be a mistake to ignore the effect of foreigners investing in Australian equities, it is an equally an extreme decision to ignore Australian betas (betas from the domestic CAPM) and only rely on a betas estimated using the international CAPM. Lally could legitimately argue that it would be a mistake to believe that Australian investors were not influential and if we include the influence of foreigners to ignore the international CAPM.

A “solution” would be to ignore the quandary and treat the domestic betas as an approximation for their international counterparts and to continue to value the franking credits in the context of their average value in Australia i.e. around 50cents a dollar, reflecting the influence of both foreign and domestic investors. Even if the extreme version of the Lally recommendation was adopted that is to ignore foreigners, as I have already pointed out, valuing the franking credits. Even ignoring foreigners, the value of the credits are likely to be significantly less than 1.0 to investors because of the significant proportion of current earnings that are not paid out as franked dividends.