The Allen Consulting Group

Methodology for updating the regulatory value of electricity transmission assets

Final report

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Report to the Australian Competition and Consumer Commission

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Executive summary

The Australian Competition and Consumer Commission ('the Commission') has requested The Allen Consulting Group to report on the relative merits of two alternative options for updating the regulatory values of the regulated electricity transmission assets at future reviews, namely:

- revalue the relevant network assets at an estimate of the valuation derived using the optimised depreciated replacement cost (ODRC) valuation methodology (and, implicitly, continue to revalue the network using the same methodology at subsequent price reviews); or to
- commence with the previous regulatory asset base for the regulated assets, and adjust for capital expenditure, depreciation, disposals and inflation during the previous regulatory period.

The change in the regulatory value from the start of one regulatory period to the next reflects the change in future income that a provider will expect arising out of the actions or events that took place during the proceeding period. Thus, to the extent that the provider had invested in renewals to the network over that period, or expanded to meet the growth in demand, the change in the regulatory value would reflect the incremental income the provider would expect from making those investments, and hence its incentive to invest.

The most important of the distinctions between the two methodologies relates to the strength of the incentive provided to transmission network service providers to minimise cost and – determined simultaneously – the level of risk borne by transmission providers over the ability to recover costs incurred.

The first of these methodologies – the ODRC revaluation methodology – would have the effect of setting prices for the use of transmission assets at the commencement of each regulatory period at a level that is (approximately) consistent with the cost structure of a hypothetical (efficient) new entrant. That is, regulated charges would be independent the costs actually incurred (that is, capital costs and operating costs) in providing transmission services.

In contrast, the second of these methodologies – the rolling forward methodology – would imply updating the regulatory asset base for a regulated transmission entity to reflect the actual outcomes for the regulated entity over the previous regulatory period. That is, the updated regulatory asset base would reflect the level of capital expenditure undertaken and return of funds (regulatory depreciation and disposals) received over the period. The practice of fixing prices independent of cost for a regulatory period – and coupling this with a carry-over of some of the benefits arising from efficiency gains into the next period – would provide a commercial incentive to reduce cost, notwithstanding the updating of the regulatory asset base to reflect actual cost.

The ODRC revaluation methodology represents the polar case along a spectrum of trade-offs relating to the strength of incentives to reduce cost, and the degree of certainty over the recovery of costs. The rolling-forward methodology, in contrast, provides a degree of certainty over the recovery of costs incurred – with the degree of certainty (and strength of the incentive to minimise cost) determined by the length of the regulatory period selected.

We do not consider that the setting of prices completely independent of cost is feasible for regulated electricity transmission businesses in the short term. The application of the ODRC revaluation approach would require significant refinement to the methodology for estimating ODRC values to the methodology used to set regulated charges – which would require a substantial investment by the Commission.

Moreover, we do not consider that the application of such a methodology is desirable in the longer term. Whether a transmission business would expect to recover the cost of continuing to provide the service – or expected to earn returns much larger than that required to justify its continued financing of the business – would depend upon the accuracy of the estimated ODRC value, for which substantial statistical uncertainty will be inevitable. Given the risks associated with estimation errors, it is difficult to see how the Commission could commit credibly to adhere to such a regulatory regime over the long term.[1] As a consequence, we do not consider the ODRC revaluation methodology to be appropriate.

Whether the balance between the strength of the incentive to reduce cost, certainty over cost recovery under the use of a five year regulatory period and efficiency carry is the most efficient balance is a matter that the Commission should keep under review. It is noted, however, that where price cap is used (which is consistent with the roll-forward methodology), the strength of the incentive to reduce cost can be increased by lengthening the regulatory period – which is a straightforward task. One means of making longer price control periods more credible would be to improve the methods used to set the rate of change of prices over the period, in particular, to place less emphasis on the use of internally generated forecasts and more on external estimates of productivity growth. We consider that work in this area would be a more productive use of the Commission's scarce resources than the refinement of ODRC estimates.

Another point of distinction between the valuation methods is the level of prices expected at each point in time in the future. The ODRC level would maintain average prices at (approximately) the level consistent with those of the hypothetical (efficient) new entrant, whereas under the roll-forward approach, average prices could be higher or lower. It is noted that the structure – rather than the average level – of charges is more important for efficiency. It is also noted that the time profile of charges of an efficient new entrant may not be the most efficient charges – and that the roll-forward methodology may permit the more efficient time profile of charges.

[1] The use of an ODRC valuation methodology equates to what was referred to as an 'engineering economic analysis' in the recent report to the Utilities Regulators Forum on different regulatory approaches (Farrier Swier Consulting, Comparison of Building Blocks and Index-Based Approaches, Report to the Utility Regulators Forum, June 2002, p.33). Farrier Swier Consulting appeared to reject the 'economic engineering approach' as one that could potentially be applied as the primary approach in Australia, although did not set out clearly the reasons for rejecting the approach (Farrier Swier Consulting, op cit, p.35).

Another relevant matter in the selection between the two methodologies is the administrative costs and simplicity of the two approaches. The application of the ODRC revaluation methodology would require a substantial refinement to the current practice, which would require a commensurate investment by the Commission and interested parties. The continued application of the methodology is also likely to be difficult, given that substantial windfall gains or losses may result (for example, from an error in the depreciation allowance). While the application of price cap regulation (and the roll-forward approach) is not cost free, it is noted that the greater use of incentive arrangements to assist the regulatory task offers scope for reducing the cost of regulation. More objective methods of setting future price paths – such as greater reliance on estimates of productivity trends rather than internally generated forecasts – would also reduce administrative costs.

A positive effect of revaluing assets at their ODRC value is that this may provide regulated entities with the incentive to have regard to events beyond the current price control period, including the most appropriate means of meeting increasing demand. ODRC valuations would ensure that the regulated entity would have an incentive to take account of the value of a flexible response.

The importance of such an incentive is an empirical matter, and is something that declines as the length of the regulatory period is extended, and would need to be traded off against the adverse effects of increased risk from the ODRC revaluation method. However, for electricity transmission, such an incentive is likely to be of little practical relevance because the provider has no incentive over the structure of tariffs, and because the regulatory test already provides a 'screen' over the efficiency of the response to demand growth.

It is noted that the references to concepts like optimal deprival value and the associated current replacement cost concepts derived from a desire in the 1980s to improve the measures of the financial performance of government business enterprises. This approximately coincided with the debate about the most appropriate measure of income for financial accounting purposes, relating to the debate between financial capital maintenance and operating (or physical) capability maintenance.

It is noted that revaluing assets at their ODRC value has similarities to concepts from the financial accounting field, such as Optimised Deprival Value and the valuation methods consistent with the operating capital maintenance concept. The regulatory asset base in regulation has a specific purpose, which is to reflect the value of the regulated assets in the eyes of the regulator at each point in time, and the test for the appropriateness of any method for updating of the regulatory asset base has a specific objective – which is to ensure that the change in the regulatory value provides incentives for efficiency, including to minimise cost but to continue to investment where it is efficient to do so. Accordingly, it need not follow that accounting conventions developed for other purposes – such as measuring the financial performance of government businesses or to derive better estimates of economic income – are appropriate for this task.

Having regard to the merits of the ODRC methodology relative to rolling forward the asset base, we do not consider revaluations based on ODRC to be feasible in the short-term nor does it provide appropriate incentives for regulated transmission providers over the long term. A preferred approach is for the regulatory asset base to reflect the level of capital expenditure undertaken and return of funds received over the regulatory period – that is, the rolling forward methodology.

Chapter 1
Introduction

1.1 The brief

The Australian Competition and Consumer Commission ('the Commission') has requested The Allen Consulting Group to report on the relative merits of two alternative options for updating the regulatory values of the regulated electricity transmission assets at future reviews, namely:

- revalue the relevant network assets at an estimate of the valuation derived using the optimised depreciated replacement cost (ODRC) valuation methodology (and, implicitly, continue to revalue the network using the same methodology at subsequent price reviews); or to
- commence with the previous regulatory asset base for the regulated assets, and adjust for capital expenditure, depreciation, disposals and inflation during the previous regulatory period.

In undertaking this project, the Commission has requested that regard be had to:

- allocative efficiency issues, including the rate of technological change, the level of demand, and the market characteristics such as the age of the networks and potential augmentations in the future;
- incentives for efficient investment in regulated assets; and
- approaches that are robust, transparent, and simple.

The Commission has also noted that the report will need to consider the key issues in a manner suitable for public release and discussion. Further, reference would be made to the approaches adopted in other Australian industries and jurisdictions, and to relevant contributions in the economics literature.

1.2 Background

The regulatory asset base that is assigned to a transmission provider's assets is an important input in the assessment of regulated charges. The regulatory asset base at a point in time can be interpreted as the net present value of income that the regulatory regime would be expected to provide over the remaining economic life of those assets, at least in the eyes of the regulator.[2] Thus, the objective of the regulator when setting regulated charges can be expressed as setting charges such that regulated revenue stream has a present value equal to the regulatory asset base, given the regulator's assumptions about matters such as expenditure requirements and the cost of capital associated with the regulated activities.[3]

[2] This statement assumes that the regulatory WACC is equal to the cost of capital for the regulated activities, and that expenditure on operating and capital items is exactly that assumed by the regulator for the purpose of determining regulated charges. If the regulated business outperforms against these benchmarks (ie spends less than the benchmark), while not compromising service performance, or the regulatory WACC is higher than the cost of capital associated with the regulated activity, then the expected net present value of income to the existing assets will exceed the regulatory asset base. In addition, a regulator may also include a reward for past efficiency gains in regulated charges in order to provide a continuous incentive for efficiency, which would also imply that the net present value of future

The Commission released its draft *Statement of Regulatory Principles for the Regulation of Transmission Revenues* (DRP) in May 1999, which set out the Commission's views on all the methodology it would adopt to determine the revenue caps for the regulated electricity transmission network service providers, including the methodology for setting a regulatory value for the assets that are used to provide the regulated services.[4]

In that draft statement, the Commission expressed its intention to set the regulatory value of the regulated transmission assets at an estimate of the Optimised Depreciated Replacement Cost of the relevant network when the Commission first had the opportunity to reassess the value of those assets under the National Electricity Code. It also signalled its intention to reset the regulatory value for the regulated transmission assets at an estimate of the ODRC value of the relevant network at future reviews (although not necessarily every five years).

The Commission has now set the 'first round' revenue caps for five regulated transmission providers (TransGrid, Powerlink, the Snowy Mountains Hydro-electric Authority, SPI PowerNet and ElectraNet) and is in the process of setting the revenue cap for a sixth, which will complete the revenue caps for the transmission providers covered by the National Electricity Markets. However, under the relevant provisions of the National Electricity Code,[5] the Commission's decisions over the regulatory values for the regulated transmission providers when setting the 'first round' revenue caps were constrained to the values set by a jurisdictional regulator or at values consistent with the jurisdictional valuation if one existed. Accordingly, it is assumed in this report that the Commission will reset the value for the regulated transmission assets at an estimate of their ODRC value when setting the 'second round' revenue caps for the regulated entities.

The issue that is addressed in this report is whether the Commission should continue to reset the regulatory value of regulated transmission assets at an estimate of their ODRC value into the future, either at each periodic revenue cap review or at longer intervals. The alternative approach to updating regulatory values based on ODRC estimates is to merely to adjust the previous regulatory value to reflect capital expenditure, depreciation and disposals over the period, that is, in the same manner as book values of assets are carried forward in Australia for financial accounting purposes.

income would exceed the regulatory asset base. The form of incentives arrangements that a regulator may adopt are discussed in chapter 2.

3 This statement is subject to the same caveats set out in footnote 2.

4 More precisely, the Commission determines revenue caps (referred to as the Maximum Allowable Revenue, or MAR) for the prescribed services provided by the transmission network service providers that are registered as such pursuant to the National Electricity Code. All references to regulated services and regulated transmission entities throughout this report are references to this specific class of services and entities, and references to regulated transmission assets are references to the assets required to provide prescribed services.

5 National Electricity Code, Ch.6.

Setting an *initial* regulatory value with reference to cost for the assets that are already exist at the time those assets become regulated formally has been one of the most contentious issues for Australian regulators. It is a matter for which economic principles do not provide an unambiguous answer. The assumption in this report that the Commission will reset the regulatory values of the regulated transmission assets at an estimate of their ODRC values implies that the selection between the methodologies for updating the regulatory asset bases should not be expected (*ex ante*) to lead to a windfall gain or loss to the regulated transmission providers.[6]

1.3 Structure of this Report

The remainder of this report is set out as follows.

Chapter 2 describes the analytical framework that is adopted for assessing the alternative asset valuation methodologies, and, in particular, the implications of economic efficiency for price regulation, and the regulatory tools that exist for encouraging the various facets of economic efficiency. It also discusses some of the ‘regulatory tools’ that are either embedded in the National Electricity Code – or implicitly ruled out by the Code.

Chapter 3 describes the two options for updating the regulatory value of regulated transmission assets in detail. A key message of the discussion is that a fair comparison between the options for updating asset values needs to consider the *complete package of measures* that could accompany the selected methodology. The practicalities associated with each methodology also need to be considered.

Chapter 4 assesses the relative merits of the alternative methodologies for updating the regulated values of regulated transmission assets, focussing on the key distinctions between the methodologies identified in Chapter 3 and pursuant to the framework for analysis set out in Chapter 2.

Chapter 5 summarises the practice on asset re-valuation in other industries and jurisdictions, the gas industry in Australia and energy regulation in the US and UK and places in context the use of the two methodologies.

6 A further implicit assumption of this report is that the Commission would have decided how it intends to update the value of the regulated transmission assets prior to setting the ‘second round’ revenue caps, and that – should it elect to reset regulatory values at ODRC in the future – those revenue caps are set in a manner that is consistent with that asset revaluation methodology. Chapter 3 discusses the requirements for consistency if regulatory values are to be reset at their ODRC over time.

Chapter 2

Framework for Analysis

2.1 Introduction

It is assumed that the relevant objective for the Commission when setting revenue caps for electricity transmission businesses is to ensure that economic efficiency is maximised. Accordingly, this chapter first provides an overview of the implications of *economic efficiency* for this task.[7]

One of the important regulatory innovations in the last two decades has been the development of techniques to overcome the lack of incentive that regulated entities may have for minimising cost under more traditional regulatory arrangements. The two asset revaluation methodologies assessed in this report effectively imply the selection of one of either two schools of thought as to how best to encourage efficient production. Accordingly, the costs and benefits of each of these approaches are discussed below.

As well as innovative measures to encourage cost minimisation, the last two decades has witnessed the development of forms of regulation that harness regulated entities' commercial incentives to deliver other socially beneficial outcomes. The other outcomes that may be relevant to the relative merits of the alternative asset valuation methodologies are the setting of efficient prices and the decision to invest in the most appropriate technology and at the most appropriate time. Accordingly, the approaches to these issues are also discussed below.

The provisions of the National Electricity Code embody a regulatory tool for achieving some of the objectives discussed above – namely, the 'regulatory test', and also preclude the use of one of the tools – namely, using incentives to encourage efficient pricing. Accordingly, the relevant provisions of the Code, and their implications of the relative merits of the two asset revaluation methodologies are also discussed below.

2.2 Objectives of Price Regulation – Economic Efficiency

Economic efficiency, in general terms, refers to a condition under which society's limited resources are used such that the benefit to society is maximised, for a given distribution of wealth. While the conditions for economic efficiency can be expressed in terms of three general outcomes,[8] the more relevant (interrelated) implications of economic efficiency for the matter at hand include the following:

[7] It is noted that Chapter 6 of the National Electricity Code – and the Code Objectives set out in Chapter 1.4 – may imply that considerations other than economic efficiency may also be relevant. However, consistent with the brief, this report addresses only the efficiency-related issues associated with the different methodologies for updating regulatory asset values.

[8] The more general conditions for economic efficiency are:

- the mix of goods and services that an economy produces reflects the relative value that society places on those goods and services given the extent of society's resources required to produce the respective goods and services (allocative efficiency);
- firms produce the goods and services for the minimum cost, which implies that the lowest-cost combination of society's resources (typically defined generically as land, labour and capital) is used, and the best technology is employed (productive or technical efficiency); and

- *Efficient pricing* – prices signal to customers the relative scarcity of 'resources' used to provide network services (including prices reflecting cost-efficient provision of service). This condition ensures customers' decisions about whether to connect to the network or to use the system at a particular time are also socially optimal decisions;
- *Efficient investment* – investors must have the incentive to invest in long-lived assets that will be required to ensure that the service continues to be provided at the desired service levels over the long term; and
- *Efficient production* – the service delivered by the network (ie energy of a particular reliability at a particular point) is produced in the least cost manner. This requires the selection of the cost-minimising technology for providing the service given all of the available options, and the construction and ongoing operation and maintenance of the asset in a least-cost manner.

The *first condition* implies that the regulatory regime should minimise the opportunity for the provider to set unnecessarily high prices (and making unnecessarily high returns) that may otherwise arise from its market power. Thus this condition effectively places an upper bound on earnings. It also has implications for the structure of tariffs. As electricity transmission is characterised by economies of scale and scope, setting prices at the efficient level may not permit the recovery of all costs, and so additional cost recovery may be required. Given the need to allow all costs to be recovered (resulting from the second condition, and discussed further below), efficiency requires that tariffs be structured to recover the residual in a manner that has the least impact on the pattern of demand.

The derivation of the most efficient prices is a demanding task, and one for which regulators are not well equipped. A more recent innovation in regulatory practice has been to provide regulated entities with the flexibility to set charges, and to design regulatory arrangements to encourage efficient price setting. This issue is discussed in section 2.4. However, the National Electricity Code limits the applicability of such arrangements for transmission pricing – as discussed in section 2.5.

The *second condition* requires that investors expect to make sufficient returns from the regulated business to recover the costs – including the opportunity cost of the funds tied up in the business, adjusted for risk – from investing in the regulated business, and so effectively places a lower bound on earnings. Taken together, the first and second conditions would be met from a set of regulatory arrangements that provide investors with an expectation of making a reasonable (risk adjusted) return on their investments and a return of that investment over the life of the relevant assets.

While the outcome implied by the *third condition* – ensuring that the regulated services are provided at least-cost – is straightforward in principle, achieving such an outcome in practice is complex. The selection between the two asset revaluation methodologies effectively implies a choice between the different approaches that exist for encouraging cost efficiency. Accordingly, the two methods are discussed next.

- the mix of goods and services produced, and the production processes employed by firms, change over time in response to changes in tastes, technology and other factors – that is, so that allocative and productive efficiency is maintained at each point in time (dynamic efficiency).

2.3 Encouraging Efficient Production

It is now widely understood that regulatory arrangements that provide a high degree of certainty over the recovery of costs incurred – consistent with the second condition discussed above – also provide less incentive for the firm to seek to minimise costs and, indeed, can provide the perverse incentive to over-spend. The US system of ‘rate of return regulation’ is the most obvious example of regulatory arrangements that provide poor incentives to minimise cost. The US institutional arrangements have generally allowed firms or the regulator to seek adjustments to prices whenever costs or revenues move such that the allowed rate of return is breached.

It is also widely accepted that the regulator is in a poor position to judge whether a particular project or technology or organisational structure and associated staffing levels represent efficient production. The regulated entity’s knowledge of such matters outweighs vastly that of the regulator, and so attempts by a regulator to disallow perceived inefficiencies are unlikely to be effective.

The presence of both information asymmetry between the regulated entity and the regulator over what is efficient practice, coupled with the poor incentive properties of regulatory arrangements that promise a high degree of certainty of cost recovery, has lead to the development of alternative forms of regulation that overcome these deficiencies. The two different forms that are relevant to this report are *price cap regulation* and *external benchmark regulation*, which are discussed in turn below.

Price Cap Regulation

Price cap regulation is one of the manifestations of incentive regulation, the essence of which is that the regulatory regime is designed to provide firms with incentives that align its private interests with social interests – that is, to act efficiently. Given these incentives, the firm’s actual behaviour can be assumed to be efficient – or at least to converge towards efficiency over time – implying that observations of the firm’s actual behaviour can provide information that can be relied upon for regulatory purposes.

Thus, the underlying philosophy of incentive regulation is – in effect – to bribe the regulated entity to act in a manner that is efficient and so reveal this to the regulator, and then to use the information gained to improve the efficiency of the regulatory process.

With respect to achieving cost efficiency, the most common method for aligning interests is through the use of a price cap. Under a price cap, prices are set independently of cost for a period, which implies that the regulated entity can increase its returns by reducing its expenditure (including by meeting its service obligations using a different technology).[9] A more recent innovation in the use of price cap regulation is the introduction of a carry-over of some of the benefit from efficiency gains made in one regulatory period to the next. If properly designed, the carry-over of efficiency benefits can eliminate any reduction in the incentive to pursue efficiencies that may otherwise exist towards the end of a regulatory period.[10] The potential rewards from the pursuit of efficiency gains under price cap / efficiency carry-over regulation – and hence the strength of the incentive to make such gains – is then a function of the length of the period between price reviews.

There are two methods that can be used to set the rate of change of prices over the regulatory period. The first method – and one used in the UK and in Australia – is to forecast expenses and demand growth over the period, and set the price path such that the expected revenue under the price control equates with the expected cost of providing the services (both in discounted terms). The second method – and which is widely used in US price cap plans – is to set the rate of change in prices with reference to a proxy for expected future productivity increase for the industry, for which long term historical productivity growth is generally used as the proxy.

Over time, it would be expected that such incentives would lead to the firms' expenditure levels reflecting efficient levels, and reflecting new technologies and techniques as they become available. The use of such incentive arrangements have a number of benefits for all parties involved in the regulatory process.

- The presence of the incentive arrangements would permit the *regulator* to infer that a firm's actual expenditure level at the end of a regulatory period is efficient, and to use that expenditure level as a starting point when setting price caps for the next regulatory period. Accordingly, the regulator could satisfy it statutory obligations without the need to second-guess a firm's operational decisions – over which the regulated entity has substantial informational advantages relative to the regulator.
- The use of incentive arrangements should encourage efficiency gains that otherwise would not have been achieved. *Customers* would benefit as these gains are passed through into lower prices over the medium term.
- *Regulated entities* have the opportunity to make additional returns from above-expected performance. The regulator's use of incentive arrangements to generate outcomes like cost-efficiency would also avoid the potential need for the regulated entity to justify specific operational decisions to the regulator.

An important question to be addressed when designing the price cap regime is the strength or power of the incentive for cost reductions that is created. The importance of this issue derives from the fact that as the strength of the incentive to minimise cost rises, the level of certainty over the recovery of costs incurred – or the level of insurance provided by the regulatory regime – falls.

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9 It was also recognised that prices could more credibly be set independent of cost for a period if prices where adjusted for inflation (thus removing a substantial risk to investors in times of inflation uncertainty) and if an offset were made for expected future productivity gains (the X factor). Accordingly, price cap regulation is also commonly referred to as CPI-X regulation.

10 The design of such an efficiency carry-over mechanism is described in some detail in: ESC 2002, *Review of Gas Access Arrangements: Final Decision*, October.

Price cap regulation works by exposing regulated entities to the profit consequences caused by differences between their actual cost incurred in providing the regulated services and the cost assumed in the price cap *for a period*. It is inevitable that a firm's actual cost will diverge from that assumed in the price cap. The higher the strength of the incentive, the longer the period of time that the provider would either retain the benefit – or bear the shortfall – associated with a difference between its actual cost and that assumed in the price cap. Thus, stronger incentives provided to reduce costs, the greater the risk that either the entity is unable to continue to finance its activities (thus violating condition two above), or that profits reach an unacceptably high level.[11]

Accordingly, the combination of the need to secure an adequate level of investment in long-lived assets and also to ensure that customers are protected from monopoly pricing is likely to impose a constraint on the strength of the incentives for cost-efficiency that reasonably (and credibly) can be imposed.

External Benchmark Regulation

An alternative approach to using a price cap to overcome asymmetric information and incentive problems is to attempt to use a model to predict the efficient cost of undertaking the relevant activity. External benchmarking uses cost information from a large number of regulated entities, together with the information about each of the networks to adjust for factors that may cause costs to differ across networks. The outcome of such a methodology is that the regulated price (or at least the starting price) is predicted, based solely upon information that is external to the regulated entity (or at least in principle).

Numerous techniques exist for attempting to predict the efficient cost of providing regulated services; the categories identified in the recent paper to the Utility Regulators Forum were as follows:[12]

- Frontier methods – which included Data Envelopment Analysis and Stochastic Frontier Analysis;
- Econometric Benchmarking; and
- Engineering economic analysis.

Continuously updating the regulatory value of the electricity transmission assets to an estimate of their ODRC value corresponds to the latter methodology – the engineering economic analysis.

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11 While it is possible to exclude the regulated entity from some of the events that may affect future profitability through the use of pass-through clauses or a specific correction factor in a price cap, these mechanisms could only apply to a very narrow class of events. This is because many of the events (or the consequences thereof) that may cause cost to change are likely to be partly within the control of the regulated entity, and so seeking to insulate the provider from this risk would undermine the incentives for efficiency that the price cap regime was intended to generate in the first place. Extending pass throughs to a broader class of events will expand the cost of administering the price cap plan.

12 Farrier Swier Consulting, Comparison of Building Blocks and Index-Based Approaches, Report to the Utility Regulators Forum, June 2002, pp.32-33.

The ability to use external benchmark models to set regulated charges is dependent upon a comprehensive and reliable set of information on the costs and relevant cost-related conditions of networks and a model that can predict costs to a level of accuracy that would make the methodology credible. In practice, however, it may be necessary to 'fit' a model to a particular regulated, which may imply that it may not be possible for the regulated charges to be completely independent of the decisions of the regulated entity. This is a particular issue for the 'engineering economic analysis' method, and is discussed further in section 3.1.

While not normally explicit in the use of external benchmark regulation, it would be open for the rate of change in the regulated prices over the regulatory period to reflect a proxy for industry-wide productivity growth.

Regarding the power or strength of the incentive to reduce cost (and level of insurance), the use of an external benchmark model to predict the total cost of an activity would imply a 'no cost insurance' model.

Regulatory Methods Compared

There are a number of distinguishing features between the use of a price cap methodology and external benchmark model.

- First, the price cap method uses actual costs as a starting point for the future price path, whereas the external benchmark approach bases the initial prices on predicted efficient cost.
- Secondly, the price cap method permits a selection of the strength of incentives to reduce cost (or degree of 'cost insurance'), which is choses through the selection of the length of the regulatory period. In contrast, prices under the external benchmark model would not insulate the provider from any changes in cost.

For both methods, prices over the term of a regulatory period could be set using a proxy for expected future industry-wide productivity growth if desired.

2.4 Other Incentive Arrangements

The use of price caps to encourage cost efficiency is just one of the regulatory tools falling under the heading of incentive regulation that can be used to align a regulated entity's private interests with the social interests, and so improve the outcomes from regulation. An outline of some of the other measures is as follows.

Efficient Tariff Structures and efficient response to demand growth

Given the existence of economies of scale and scope in electricity transmission, a residual amount of costs in excess of the marginal cost of providing the service needs to be recovered from customers. Efficiency requires that this residual be recovered in a manner that least distorts usage patterns. However, the derivation of an efficient price requires account to be taken of the demand sensitivities of different customers and to different methods of charging. Unfortunately, the regulator is not well positioned to undertake this assessment.

A recent trend in regulation is to delegate the decision over the structure of prices to the regulated entity (within an overall cap), and to provide incentives for the entity to set efficient prices. Within a regulatory period, the specific form of the control over prices affects the payoffs that may be associated with tariff rebalancing, and hence is the mechanism through which the incentive to set efficient prices can be provided.

Similarly, the form of price control also determines the incremental revenue that a provider will receive from additional load growth (as well as the loss it suffers from a loss of existing load), and so will affect the provider's decisions in relation to expansions to the system to meet new load growth. An important choice for the network provider may be how to respond to a possible growth in demand, there is a high degree of uncertainty about that future growth. Typically, there are a range of means to meet that growth, from purchasing demand management, to installing different types of transmission assets. In the presence of such uncertainty, responses that provide a degree of flexibility to respond to changes in future demand (such as demand management options, or the construction of a smaller capacity upgrade) are likely to have an additional benefit to the regulatory regime,[13] which implies that a simple comparison of the discounted cost (or net benefits) of the alternatives may not deliver the most efficient choice of response. Ideally, the incentive arrangements should lead the provider also taking account of the value of flexibility when selecting between the alternative means of responding to demand growth.

The choice of revaluation methodology may also have an impact on the incentives both to set efficient prices and to select the most efficient means of responding to demand growth. Under a price cap approach, the provider is only exposed to the consequences of events that occur during the price control period, and hence would only be expected to take account of such events when designing price structures and selecting between different means of meeting demand growth. In contrast, revaluing assets at a level consistent with that required to meet outturn demand (ie the ODRC revaluation methodology) would have the effect of exposing the regulated entity to the consequences of such events in all future periods.

The practical importance of providing such an incentive is an empirical issue. In addition, its relevance depends centrally on the length of the regulatory period – the longer the period, the more events the provider would be expected to take into account when making decisions. Thus again, better incentives to take account of future events would be provided by extending the length of price control periods.

However, we do not think that the objectives of providing an incentive to set efficient prices and to select the most efficient means of responding to uncertain demand growth are of central importance for electricity given the other regulatory tools and constraints in the National Electricity Code, which are discussed next.

[13] The characteristic of a project to allow the cost incurred to be varied to reflect observed demand (or other factors) is often terms a real option.

2.5 Implications of the National Electricity Code

The National Electricity Code contains two mechanisms that may reduce the requirements for additional tools to achieve the objectives set out above, and hence reduce the range of issues for which the choice of the asset revaluation methodology is relevant. These two mechanisms are the 'regulatory test' and the determination of price structures.

Regulatory Test

The National Electricity Code requires that new regulated investment satisfy an up-front 'regulatory test' to ensure that the benefits of undertaking the investment outweigh the costs. The 'regulatory test' is applied at a time prior to investment being undertaken (and expenditure sunk), and has as its objective the ranking of the desirability of a particular project against possible alternatives (including the alternative of doing nothing, or doing the same thing at a different time). The Commission has a role in determining any disputes about the application of the test.

The existence of the requirement for the regulatory test implies that a new project would already have to satisfy a formal test of whether it is the most efficient means of meeting demand growth. Given the existence of such regulatory requirement, the importance of incentive arrangements for delivering efficient project choices is lessened.

Price Control and Tariff Structure

The National Electricity Code specifies in detail the approach to cost allocation and tariff design for the pricing of transmission services. The implication is that regulated transmission businesses have practically no discretion over the setting of tariffs.

The existence of a prescribed methodology for cost allocation and tariff design implies that incentive arrangements to encourage efficient price setting would not have a role to play.

Chapter 3

Asset Valuation Methodologies to be Assessed

3.1 The Optimised Depreciation Replacement Cost Valuation Methodology

Introduction

Updating the regulatory asset base of regulated transmission assets to a new estimate of the ODRC value over time would imply that the regulated charges – or tariffs charges – would be set independently of actual costs incurred over the previous or any other regulatory period. In order to assess the relative merits of such an approach, the issues associated with its application are:

- the conceptual underpinnings of the ODRC valuation;
- the theoretical limitations to the continued reapplication of a properly-calculated ODRC value;
- the practical application of the ODRC valuation methodology to date;
- areas where the estimation of ODRC valuations may need to be refined if assets are to be re-valued at ODRC over time; and
- the implications of ODRC valuations for the other inputs required to set regulated charges.

Conceptually-Correct ODRC Value

The objective of an ODRC valuation is to estimate the maximum price that a person would be willing to pay for an existing asset, given the alternative of constructing a new asset.[14] In effect, it is an estimate of the price that an asset would sell for if that asset was traded in a liquid second-hand market (like used cars). In such a market, the value for the existing asset would reflect the cost of a new – and optimum – asset, but would also reflect all of the differences in the forward-looking service potential and costs of associated with the existing asset, compared to the new asset (all discounted to a present value or cost).

- It is important to understand that an ODRC valuation seeks to replicate the second-hand value of assets, *on the assumption that such a market existed*. In practice, the presence of substantial sunk costs and economies of scale and scope implies that such a market does not exist – indeed, if a liquid second hand market for regulated assets did exist, then there would be no rationale for regulation. Moreover, the reference to the service potential is a reference to the potential generated for society, rather than the service potential that necessarily could be captured by the asset owner. The degree of structural separation in the Australian electricity industry implies that it is not always possible for the provider of an asset to capture all of the benefits created.

[14] The Commission has discussed the theoretical foundations of the ODRC valuation in similar terms: Australian Competition and Consumer Commission, Draft Statement of Principles for the Regulation of Transmission Revenues, May 1999, pp.39-40.

A straightforward implication is that the ODRC value provides an estimate of the value that existing assets (that is, those that are inputs to production) would have in a market where the price was set at the level consistent with the price that would be charged by a hypothetical (efficient) new entrant (that is, assuming a perfectly contestable market). The logic for this is follows.

- The hypothetical (efficient) new entrant would be expected to set a price that recovered – over the life of its asset – the cost of providing the service with the new, optimum asset (including a competitive, or normal, return on its investment).
- Taking this price as given, the value of the existing asset would be given by its discounted future cash flows – which must deliver a value equal to the cost of the new, optimum asset, but adjusted for any differences in the forward-looking costs and/or service potential associated with the existing asset compared to and new, optimum asset.[15]

It also follows that prices in (long run) competitive equilibrium should be consistent with providing a reasonable return on the cost of the efficient new entrant. Given the relationship between the new entrant's costs and ODRC discussed above, prices in a (long tun) competitive equilibrium will also be consistent with providing a reasonable return on the ODRC value of existing assets.

The conceptually-correct ODRC value has a number of important implications for matters like the impact of excess (or inadequate) service potential on the value.

- Where the existing asset is considered to be overbuilt (ie contains excess capacity), the optimal asset may be sized to meet a lower level of demand. In this case, the old asset may be able to meet the future growth in demand for little or no additional cost, whereas the new 'optimal' asset may require substantial augmentation. The present value of the cost savings of meeting the future growth in demand with the existing asset would be reflected (as a positive addition) to the estimated ODRC value.
- Where an existing asset is considered to have service potential that would not be reflected in the optimal asset, the existing asset may deliver benefits in excess of its optimal replacement. Again, this excess service potential would be reflected (as a positive addition) to the estimated ODRC value.[16]

The steps in the computation – and the inputs – required to derive such an estimate are straightforward, and are as follows:

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15 The price that is expected to be charged by the hypothetical (efficient) new entrant may itself be used to assess the extent to which current pricing practices diverge from those consistent with a contestable market, and hence test whether there is evidence of monopolistic pricing practices. A critical assumption in the estimate of the hypothetical (efficient) new entrant price is the rate at which the entrant would expect to have its capital returned (for a good discussion of the application of the hypothetical new entrant test, see: NERA, The Hypothetical New Entrant Test in the Context of Assessing the Moomba to Sydney Pipeline Prices, A Report to the ACCC, September 2002). However, an assumption about the depreciation rate for the hypothetical (efficient) new entrant is not required to estimate the ODRC value – as knowledge of the present value of the future revenue stream rather than its time profile is all that is required. However, the continued application of the ODRC methodology over time effectively requires the same information, and the issue of the rate of regulatory depreciation that is consistent with the continued use of the ODRC methodology is discussed below.

16 Considered in terms of the hypothetical (efficient) new entrant, if the service offered by the incumbent offers a higher level of service potential than that of the new entrant, then the incumbent should be able to set higher prices than the new entrant, up to the level where the higher prices extracted the additional value that customers obtained from the service.

- First, to identify the asset that would be the optimum replacement (providing the optimum level of service) for the asset in place, taking into account all feasible means of providing the service, and to estimate the (full) cost of construction.
- Secondly, to identify the differences in the forward-looking service potential and costs associated with the existing asset compared to the new (optimal) asset.
- Thirdly, to adjust the estimated cost of the optimal asset to deduct (or add on) the present value of the reduced (or increased) service potential associated with the existing asset, and to deduct (or add on) the present cost of the higher (or lower) forward-looking costs associated with the existing asset compared to the optimal asset.

In analytical terms, the derivation of an ODRC value is then calculated as follows:

$$ODRC_0 = ORC_0 - \sum_{t=1} \frac{Serv_{New,t} - Serv_{Existing,t}}{(1+r)^t} - \sum \frac{Cost_{Existing,t} - Cost_{New,t}}{(1+r)^t}$$

where *ORC* is the cost of the optimal replacement of the existing asset, *r* is the discount rate, *Serv* is the value of the service potential of the relevant asset, and *Cost* is the forward-looking cost (operating and capital) associated with the relevant asset, and it is assumed for simplicity that all costs and benefits are received at the end of each year.

- Implicit in this formulation is that the role of the 'depreciation' step is to adjust for the differences in the forward-looking cost of operating, maintaining and renewing the existing asset compared to the optimal asset, and to adjust for differences in the value of the level of service provided by the existing asset compared to the optimal asset. Thus, the appropriate rate of depreciation is not a simple scaling down of the value to reflect the expired portion of the asset's life.
- Implicit also in this formula is that the use of an ODRC methodology would imply that regulated charges would depend only on the assumed operating expenditure for the optimal asset (that is, charges would be independent of the forecast of the entity's actual operating expenditure). This is because any change in the forecast of the entity's own operating expenditure would be translated into downward adjustment to the estimated ODRC value by an amount that would offset precisely the rise in forecast operating expenditure.

It is clear, however, that the application of the ODRC methodology – if done in a manner consistent with its theoretical underpinnings – requires substantial information, including:

- the optimum replacement for the existing system, which should include consideration of the most efficient means of providing the service given the existing sources of supply and demand, which should include consideration of alternative routes or technologies for providing the optimum level of service;

- an estimate of the cost of replacing the whole system, with this cost estimate taking account of all of the factors that may affect the efficient cost of constructing the relevant system across the whole of the system (for example, typographical factors, and environmental approval requirements);
- a forecast of the future operating and capital cost associated with providing the service using the new asset over the indefinite future, and again with this cost estimate taking account of all of the factors that would affect the efficient cost of providing the service using the optimal system across the whole of the system;
- a forecast of the future operating and capital cost associated with providing the service using the existing asset over the indefinite future; and
- an estimate of the value associated with any differences in the service potential between the existing and optimal asset.

In practice, the application of the ODRC methodology in Australia has fallen well short of the theoretical ideal, and has also involved a number of highly simplifying assumptions, which are discussed below.

First, however, some additional implications of economic principles to the feasibility of a regulatory model that requires the continued reapplication of a conceptually-correct ODRC methodology are discussed.

Theoretical Feasibility of the ODRC Methodology

The discussion above of the conceptually-correct ODRC methodology is the correct means of deriving a regulatory asset base that would be consistent with the market value of a business' assets in a market that is characterised by perfect contestability *at a point in time*, making it impossible in practice to allow for the movement from one optimally configured system to another. Rather, the efficient configuration of an actual system will reflect the fact that it would have been efficient for the networks to be configured to meet demand growth as it had occurred over time. Moreover, the cost associated with providing the level of capacity at any point in time will reflect the fact that actual systems are generally constructed to meet a forecast of future demand growth, rather than just existing demand.

The implications of the *incremental expansion* of the system and *efficient pre-building* – and the possible responses – are discussed in turn below, and then some comments are made on the practicality of the responses to these issues.

Level of Optimisation

As discussed in section 2.3, the incentive for the regulated entity to continue to expand its system to meet the efficient growth in the market relies upon changing the regulatory asset base to reflect the efficient cost of expanding the system to meet that growth in demand. As the transmission networks are generally characterised by economies of scale, scope and/or density, the incremental cost of expanding the actual system from one level of demand to a higher level would always exceed the change in the cost of the optimally configured system.

The implication of re-setting the regulatory asset base at an estimate of its ODRC value is that the provider would always suffer a financial shortfall from meeting growth in demand. One response would be to allow a faster rate of regulatory depreciation – in effect, allowing the provider to recover the difference between the forecast of the actual cost of meeting growth and that reflected in the change in ODRC values from customers in that period. This approach, however, has a number of shortcomings.

- First, the provider's incentive to not meet – or even to actively dissuade – system growth would remain as it would still gain financially *at the margin* by not expanding its system.
- Secondly, the amount of 'new network' that may have to be written off and recovered from customers in the period could be substantial. Moreover, the fact that it would be recovered from existing customers rather than the new customers served may be seen as unreasonable.

The alternative response would be to depart from the hypothetical (efficient) new entrant standard and to factor in an assumption of *incremental expansion* to the configuration of the system. The implication of this is that the optimisation step would be constrained (or, alternatively, that the replacement network would be sub-optimal). The appropriate degree of incremental expansion would be the level that aligned as closely as possible the change in the estimated ODRC value with the incremental cost of expanding the actual system.

The Level of Demand Assumed

The level of demand that the system should be configured to serve when the hypothetical (efficient) new entrant test is applied is straightforward – it is the *current level of demand*.

- If the hypothetical (efficient) new entrant attempted to set prices that recovered the cost associated with meeting a higher level of demand that was expected in the future, then another hypothetical (efficient) new entrant would be able to set lower prices by only seeking to recover the cost associated with serving current demand.
- Likewise, if the hypothetical (efficient) new entrant attempted to set prices that recovered the cost of capacity that had been built some years before to meet current demand, then again another hypothetical (efficient) new entrant would be able to set lower prices by only seeking to recover the cost associated with serving current demand.

However, in practice, transmission investment comes in lumps of capacity – and is generally characterised by economies of scale, scope and density – and it would seldom be efficient to install assets that are configured to meet just the current level of demand. Two observations flow from the need to pre-build capacity.

- First, even if the configuration of the actual system by chance corresponded to the configuration of the optimal system, the assets in the actual system would have needed to be having been built some years before (and so would have a higher cost than the hypothetical optimal system).
- Secondly, if it were assumed that the system could be optimally reconfigured today – but never reconfigured again – the optimal system would be one that was configured to meet future demand.

It follows from both of these observations that using the conceptually-correct ODRC as the regulatory asset base at each point in time would systematically understate the cost of actually providing the service. The two possible responses to this problem would be either to inflate the cost of constructing the optimal system at each point in time to recognise a level of pre-building, or to determine the optimised system as one that is optimal over a normal planning horizon. The latter of these would appear more practicable.

Practicality of the Adjusted-ODRC

The issues discussed above imply that it would be infeasible to reset the regulatory asset base for the electricity transmission assets at a conceptually-correct estimate of their ODRC value (ie the value consistent with the hypothetical (efficient) new entrant) as such a methodology would be expected systematically to understate the cost of providing the transmission services. Rather, two adjustments were proposed, which were:

- to assume a sub-optimal network when estimating the ODRC value to reflect an extent of *incremental construction* in the network; and
- to assume a degree of *pre-building of the network* at any point in time.

Both of these adjustments require further methodological decisions or assumptions. In particular, the adjusted ODRC requires information and decisions on:

- *incremental construction* – a model that generates the efficient *incrementally-expanded system* given the history of the relevant network is required, as well as information on the relevant history; and
- *pre-building* – a decision of the appropriate planning horizon for the purpose of setting an ODRC value is required, as well as the relevant forecasts of demand and sources of supply over that forecast period.

Moreover, at a conceptual level, the adjustment to reflect an incrementally constructed network inevitably implies determining the cost of a network that resembles closely the actual network in existence. A consequence is that the extent to which the regulatory asset base is independent of the decisions of the transmission provider would be reduced.

Practical Application of the ODRC Methodology

The application of the ODRC methodology for electricity transmission in Australia to date has fallen well short of the hypothetical (efficient) new entrant standard and has involved a number of highly simplifying assumptions. However, some of the departures from the hypothetical (efficient) new entrant standard would appear to be responses to the theoretical concerns discussed above with resetting the regulatory asset base at an estimate of its ODRC periodically.

This section provides an overview of the practical application of the ODRC valuation methodology to date, and the refinements that would be required to use ODRC as the basis for continued revaluation of transmission assets. It also comments on the asymmetric information problem inherent in ODRC valuation. Lastly, it discusses a methodologically simpler (but equivalent) approach for re-setting prices based upon the hypothetical (efficient) new entrant standard – which is the use of ORC rather than ODRC as the basis for valuation.

Assumptions adopted in current ODRC Valuations

Regarding the *level of optimisation*, Sinclair Knight Mertz has summarised what it considers to be the standard approach to ODRC valuations for transmission assets in Australia in the following terms.[17]

> Optimisation is a notional exercise. The objective is to determine the optimised transmission system that gives ‘industry best practice’ levels of service, or the same level of service as the existing system, whichever is the lower.
>
> “Brownfield” optimisation follows an incremental approach and not a greenfields approach. With incremental optimisation the existing network is reviewed and configurations, ratings and designs assessed to identify excess redundancy, over-capacity and over-design. It is based on there being no changes to points of supply (generating stations), location of loads, transmission line or cable routes, easements or substation sites. However, existing substations or lines can be amended in layout, or rating, or design, or deleted as appropriate. With greenfields optimisation the entire network would be completely redesigned and all lines and substations re-engineered and potentially relocated.
>
> Incremental optimisation places a limiting constraint on the extent of optimisation. It recognises that there will always be some degree of sub-optimality and reflects to some extent the historical development of the network. It takes a position between a pure economic (greenfield) approach that would lead to significant optimisations and a historical approach (and acceptance of staged construction of assets where economically justified) that would result in virtually no optimisation.
>
> An incremental optimisation methodology has in general been followed for previous electricity asset valuations, thus establishing a precedence for this methodology. Incremental optimisation is considered pragmatic, and has been adopted for this optimisation assessment.

That is, the optimisation step is typically undertaken subject to two constraints:

- *Routes* – that the sources of supply (generators), the delivery point for the transmissions (terminal stations) and the route of each transmission line is fixed at that which exists in practice; and
- *Incremental development* – an assumption is made that the system was expanded in an incremental manner.

In addition, it is also understood that the optimal system is also assumed to be designed to meet forecast demand growth, with a planning horizon of between 10 and 15 years commonly assumed.[18]

Regarding the *depreciation step*, the common method for depreciating the ORC value has been to use standard financial accounting approaches, that is, to scale down the cost of the new asset to take account of the expired age of the asset in place. This contrasts with the required adjustment, which is to adjust the ORC value upwards or downwards to reflect the difference between the forward-looking cost of continuing to run the old and new asset, and upwards or downwards to reflect the difference between the service potential of the old and new asset.

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17 Sinclair Knight Mertz 2002, *Optimisation Assessment for the SPI PowerNet Network*, April, p 12.

18 It should be noted that, while the assumption of a degree of ‘sub-optimisation’ and pre-building is relevant where the regulatory value of assets is continually reset to the ODRC value, these assumptions would be invalid for the application of a hypothetical (efficient) new entrant test.

Lastly, the estimates of the *cost of the replacement network* typically have been provided by engineering companies from their own databases, although some estimates of the ODRC value have used previous estimates adjusted for assumed cost inflation, or supplemented with benchmarks drawn from other regulatory decisions or recent examples of actual construction costs. The ODRC estimates that have been undertaken to date would suggest that there is a large degree of statistical uncertainty in the estimates of the cost of replacement assets, a view that often has been expressed as a caveat to independent reviews of ODRC valuations. By way of example, in its report to the Commission on the estimate of the ODRC value for PowerLink, PB Associates commented as follows:[19]

> It should be noted that cost estimating is not an exact science and that costs are different in different areas. Hence results of comparison [when estimating the replacement cost of assets] should be taken as indicative rather than definitive.

Issues for the Continued Application of the ODRC Methodology

If the Commission were to reset the regulatory asset base for transmission providers at an estimate of the ODRC value at defined periods, then it would be necessary for the Commission to provide detailed guidance on the methodology to be adopted to conduct such a valuation. In doing so, the Commission would also need to address any deficiencies in the standard approach to ODRC estimation described above. The criterion against which the application of the methodology should be tested is whether the estimated ODRC value would be likely to provide an unbiased estimate of the cost of providing the regulated transmission service, both over the long term and within each sub-period.

There would appear to be a number of aspects with the current approach that the Commission would need to assess carefully, as well as deficiencies in the standard approach.[20]

First, with respect to the degree of 'sub-optimisation' that is assumed when estimating the ODRC values, the Commission would need to assess whether the methods currently applied are likely to align the change in the ODRC value of a growing system with the efficient cost of expanding the actual systems. The Commission would also need to form a view as to the extent of pre-building that would be considered the efficient level of pre-building. If the ODRC method were to be used for asset revaluation purposes, the methodology and models used to derive the (sub-optimal) network should be made transparent and open to public scrutiny and debate.

19 PB Associates 2001 *PowerLink Network Asset Valuation Review prepared for ACCC*, April, p 14.

20 The derivation of robust methodology for reapplying the ODRC method over time would be worthy of several reports in itself. Accordingly, only a number of general observations on the issues to be addressed are offered in this report.

Secondly, the sources and method that is used to estimate the cost of constructing the replacement network and the cost of operating that network would also need to be refined and open to public scrutiny and debate. To be sufficiently robust for asset revaluation purposes, the model used to estimate the replacement or operating costs would need to take account of all of the factors that may affect the cost of constructing or operating the optimal system, and be demonstrated to deliver these cost estimates with sufficient degree of precision. To date, there has been little or no public scrutiny of – and hence little informed debate about – the models used by the various engineering firms for estimating the replacement cost of transmission networks and the cost of the operation the networks. Accordingly, it is difficult to conclude that the methodologies currently used are sufficiently reliable to be used to set regulated charges independent of cost.

Thirdly, while it may be possible to continue to adopt the simple approach to the depreciation step – that is, the use of a financial accounting approach to depreciation – the Commission would need to be careful as to how it determined the new operating expenditure forecasts.[21] In particular, if the capital-related element of cost is set according to an external benchmark but operating expenses are set with reference to the firm's actual operating expenditure, then the firm would have two obvious incentives, which are to:

- skew its choice of technology towards high operating cost / capital cost equipment, the most obvious example of which would be to keep old assets in service longer than would be efficient; and
- to seek to classify as much expenditure as possible as operating expenditure rather than capital expenditure (which is a bias that would be consistent with financial accounting guidelines).

The only practicable response to both of these concerns with the operating expenditure forecasts would be to also use an external benchmark to determine operating expenditure forecasts – although the external benchmark should reflect the network actually in place. However, if an external benchmark for operating expenditure is required regardless, the simple financial accounting method for the depreciation step would appear to offer no advantages – it would appear more sensible to derive the external benchmark for operating expenditure to be consistent with the replacement asset, and to make the correct adjustment for depreciation.

Lastly, there are a number of difficult issues that the Commission would need to settle in order for an ODRC revaluation methodology to be applied, such as how it would deal with matters such as changing environmental standards.

The resolution of the issues discussed above and development of a sufficiently robust methodology would be expected to be a substantial task for the Commission.

Asymmetric Information Problem

A further consideration for the Commission when assessing the relative merits of the two methodologies for updating assets over time is the extent to which the application of the relevant methodology is dependent upon information that is held by the regulated entity.

[21] It is not completely clear whether the use of the financial accounting approach to depreciation would be sustainable over time in the face of changing operating expenditure requirements.

As discussed in Chapter 2, the development of external benchmark models – like engineering cost estimation models – was driven by a concern to overcome the asymmetry of information between the regulator and regulated entity. However, the practical application of the ODRC methodology as discussed above implies that the Commission would be dependent upon information that is held by the regulated entity. Some of these examples are as follows.

- First, the design of the replacement system would require load flow studies for the relevant system, which in turn requires assumptions about current and future (normalised) flows into and out of the relevant network. For most of the regulated transmission entities, the cost-effective gathering and analysis of this information could be undertaken only by the transmission entity.
- Secondly, the estimation of the cost of constructing the replacement network requires knowledge and adjustments for location network conditions. While in theory anyone could 'walk the route', the transmission entity would have an advantage in gathering and analysing this information.

To date, the estimates of the ODRC value of regulated assets in both the electricity and gas industries have been produced by the owners of the regulated assets (or their representatives), and the regulators' analyses typically has been limited to a desk-top analysis of the main assumptions reflected in those estimates. If regulatory values for regulated electricity transmission assets are to be reset at their estimated ODRC value over time, it would be expected that the Commission would need to take on a more active role in the derivation of the ODRC estimates.

An Alternative Methodology – ORC-Based Prices

To the extent that the Commission intended to use the engineering cost model approach to determine regulated charges into the future, a preferable approach may be to set charges based upon a model that sets charges with reference to the optimised replacement cost of the system (referred to below as the ORC approach), rather than with reference to the depreciated value. Such an approach would mirror the approach that is used to set access charges in telecommunications.

If applied correctly and consistently, both the ORC and the ODRC methodologies would deliver the same regulated charges.[22] However, the ORC methodology may offer a number of practical advantages. First, the use of the ORC methodology would obviate the need to forecast the costs of continuing to operate the existing system – and make it obvious that the assumptions about the forward-looking cost of operating and renewing the old asset would not have an impact on regulated charges if the ODRC methodology is applied correctly. More importantly, if the ORC approach is applied, regulators would be able to draw upon the body of knowledge with respect to the methodological issues associated with reapplying an engineering cost-based asset valuation over time that has developed in the telecommunications context.

[22] The equality between the ORC and ODRC methodologies requires the depreciation step of the ODRC valuation to adjust for the differences in the forward-looking cost of operating the old and replacement assets. If a financial accounting approach to depreciation is undertaken, one of the methodologies may provide higher regulated charges – although it is an empirical question as to which would be higher.

Consistency Requirements for the Application of the ODRC Methodology

The objective of setting regulated charges that provide an opportunity to recover efficient cost (as discussed in Chapter 2) has two important implications for the other inputs that are used with an ODRC value.

First, the assumptions for operating and capital expenditure and the useful lives of assets would need to reflect those consistent with the old (or existing) asset. This reflects the fact that the depreciation step in the ODRC valuation would already have reduced the value of the regulatory asset base on account of the higher forward-looking cost of operating and renewing the existing asset and shorter useful lives of existing assets.[23]

Secondly, the regulatory depreciation allowance would need to reflect an unbiased estimate of the forecast change in the ODRC value for the network over the regulatory period less the capital expenditure forecast for the period. This is necessary to ensure that the expected present value of future cash flow equates to the regulatory asset base at the commencement of the regulatory period. That is, the regulatory depreciation allowance would need to be calculated as:

$$\sum_{t=1}^{T} Reg\ Dep_t = \left(ODRC_T - ODRC_0\right) - \sum_{t=1}^{T} Capex_t$$

where the regulatory period is T years in length.

The calculation of the appropriate regulatory depreciation allowance, therefore, requires all of the assumptions required to derive the ODRC value at the commencement of the period, but projected out to the end of the regulatory period. Important assumptions include the trend in the cost of replacing the relevant assets, and assumptions about the likelihood of parts of the system becoming redundant over the period.

An implication of the ODRC revaluation methodology is that future regulated charges would be constrained to follow a unique time profile – in effect, (almost) mirroring the prices that would be charged by an efficient new entrant. A second implication is that the derivation of the regulatory depreciation allowance is likely to be controversial as any errors in its estimation would imply a windfall gain or loss to the regulated entity.

23 As discussed already above, the assumptions about the cost of operating, maintaining and renewing the existing asset should have no affect on regulated charges if the ODRC value is estimated correctly. This reflects the fact that a rise in the cost of operating, maintaining and renewing the old asset compared to the new would imply a commensurate reduction in the ODRC value.

3.2 The Roll-Forward Methodology

Introduction

Under the roll-forward methodology, the regulatory asset base at the commencement of a regulatory period would be calculated as the opening regulatory asset base at the commencement of the previous regulatory period, plus the actual capital expenditure over the period, less regulatory depreciation (and disposals). As the regulatory asset base is adjusted for actual capital expenditure and actual funds returned to investors implies that the future prices would be based upon the actual cost incurred in providing the service.

In contrast to the application of the ODRC revaluation methodology, the application of the roll-forward methodology is relatively straightforward. However, for completeness, the main features of the methodology are summarised below. First, the formula for updating the methodology is discussed, followed by a discussion of the model's consistency with the use of price cap regulation. Lastly, the implications of the roll-forward model for the other inputs required to set regulated charges is noted.

Application of the Roll-Forward Methodology

Under a price cap regulatory regime, the regulatory asset base need only be calculated at the commencement of each regulatory period, which is assumed in the discussion below.

The formula for deriving the opening regulatory asset base is as follows:

$$RAB_{Opening,T+1} = RAB_{Opening,0} + \sum_{t=1}^{T} Capex_t - \sum_{t=1}^{T} Deprec_t$$

where the previous regulatory period was T years in length. If the return on assets that was assumed in regulated charges for the previous period was defined in real terms, then this formula holds if the values are set in constant price terms.

The opening regulatory asset base at the commencement of the previous period (year 1) would have been settled in the previous regulatory period, and the capital expenditure for each year except for the last year of the regulatory period would be observable from the company's regulatory accounts. The capital expenditure for the last year would not be observable if prices are set in advance of the next regulatory period, as the final decision would be made part way through the last year.

Accordingly, the only matters upon which a decision is required is:

- how depreciation should be measured; and
- the assumption about the last year of the previous regulatory period.

Regarding depreciation, there are two possible options, which are to:

- use the depreciation methodology and lives assumed in the previous regulatory period to derive the depreciation allowance, reflecting the actual mix of capital expenditure over the period; or

- use the dollar allowance (adjusted for inflation) that was included in regulated charges for the previous period.

The application of either methodology is feasible, although some regulators have relied upon the latter approach because of its simplicity and greater consistency with the 'financial maintenance concept' (which is discussed in section 4.5).[24]

Regarding the assumption to be made about capital expenditure in the last year, again a range of simple assumptions are possible. However, it has been noted that merely assuming that the outturn capital expenditure is equal to the original forecast would have the most desirable incentive properties if a carry-over of part of the benefits of efficiency gains in the previous period is provided.[25]

Use of Price Cap Regulation

As discussed in section 2.3, if prices were changed to reflect changes in the costs incurred in providing the regulated service frequently (or able to be reset to reflect cost as soon as a discrepancy between price and cost had occurred), the regulated entity would have little incentive to minimise cost. This is because the consequences of inefficiency would be largely borne by customers. The roll-forward methodology would be a feature of such a regulatory regime.

However, price cap regulation is also compatible with the roll-forward revaluation methodology. In particular, by setting prices independent of cost for a period, the provider would retain the benefits from reducing costs (or minimising any increase in cost) for the period of the price cap. Moreover, the price cap could be combined with a carry-over of part of the efficiency gains made during the regulatory period in order to ensure that the benefits from making cost reductions is constant throughout the regulatory period.

Under price cap regulation, the rolled-forward regulatory asset base would be used to set prices at the commencement of a new regulatory period, but then have no effect on price levels until prices were reset at the next periodic price review. As also noted in section 2.3, the size of the incentive to reduce costs would be determined by the length of time between such periodic price reviews.

Administrative Costs

The setting of regulated charges inevitably will be administratively costly for both regulators and regulated entities.

However, with the greater use of incentive arrangements discussed in Chapter 2, the administrative costs of updating a regulatory asset base to the start of a new regulatory period can be reduced substantially – to merely ensuring that reliable information on actual costs incurred is kept (which would be required for any methodology).

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24 See, for example, Essential Services Commission (Victoria), Review of Gas Access Arrangement – Final Decision, October 2002, p.132.

25 Essential Services Commission (SA), Electricity Distribution Price Review: Efficiency Carryover Mechanism, Working Conclusions, April 2003, p.30.

Establishing the new price path (or X factor) under the current approach in Australian of basing this on internally generated forecasts can bring with it significant administrative costs, arising in large part because the regulated entities stand to make windfall gains if the forecasts are biased towards setting higher prices. However, it would be open to the Commission over time to make more use of external productivity estimates (rather than internally generated forecasts) to set the trajectory of price paths between regulatory periods. The greater use of objective measures to set price paths would be likely to reduce the administrative costs of implementing price cap regulation.

Consistency Requirements for the Application of the Rolled-Forward Approach

The use of the roll-forward methodology would permit a range of approaches to be used to determine the opening regulatory asset base for a network in existence, and not be limited to valuing the assets using the ODRC methodology, the only constraint being that the value of existing assets be rolled-forward mechanically thereafter. In addition, to the extent that the Commission considered it appropriate to value pre-existing assets at a value equivalent with the price that would be charged by a hypothetical (efficient) new entrant, this valuation would be feasible. Moreover, the adjustments to the conceptually-correct ODRC estimate (ie assumption of incremental construction and pre-building) discussed in section 3.1 are only required if assets are to be reset at an externally estimated value over time. If the value is to be set once and then rolled-forward, the unadjusted-ODRC value would be feasible.

The only constraint on regulatory depreciation is that the regulated entity have its capital returned at a sufficiently fast rate that it is expected to have returned (through regulatory depreciation) the whole of the value of its investment over the life of the asset, taking into account such matters as possible competition in the future. Subject to this lower bound, any regulatory depreciation profile is feasible.

Lastly, as with the ODRC methodology, the operating and capital expenditure assumptions that are used to derive revenue benchmarks should reflect the cost of operating the system in place (that is, the existing asset rather than any notional optimal asset).

3.3 Key Differences Between the Options

The discussion above has identified the following matters upon which the two asset valuation methodologies differ:

- the strength of incentives provided to reduce cost and, related to this, the level of certainty over the recovery of costs incurred;
- the level of average prices over the period and the permitted time profiles for tariffs; and
- level of administrative costs expected from applying each of the methodologies.

The assessment of these different factors is set out in Chapter 4. First, however, the differences between the separate concepts of ODRC revaluation and ‘regulatory stranding’ and ‘prudence tests’ are discussed.

3.4 Related Measures – 'Regulatory Stranding' and 'Prudence Tests'

There are two other regulatory tools that have featured in discussions of the methodology for updating a regulatory asset base, which will be referred to in this report as 'regulatory stranding' and undertaking a 'prudence test'. In order to avoid confusion, the differences between each of these regulatory tools and updating a regulatory value at its estimated ODRC value are discussed in this section. It should be noted that both of these measures are incompatible with an approach whereby the regulatory asset base is reset at its estimated ODRC value periodically, but may be used as a complement if the regulatory value is updated (or rolled-forward) to reflect actual events over the regulatory period.

Regulatory Stranding

'Regulatory stranding' is taken as asking whether any of the elements of a network have turned out to be excess to requirements, and adjusting the regulatory values for the specific assets downward, if the regulator is not compensating for the reduction in asset value through an increased regulatory depreciation allowance (and regulated charges).[26] It would be expected that 'stranded assets' may be readmitted to the regulatory asset base at some time in the future if they subsequently become used; however, the loss of income over the intervening period would be borne by the provider.

Some of the distinguishing features of 'regulatory stranding' assumed in this report are that:[27]

- the assessment of whether an asset should be 'stranded' would be made on the basis of a measure of utilisation of the asset – asset values would not be adjusted downwards to reflect a reduction in the cost of replacing the relevant asset;
- the judgment of the need for an asset would be expected to be made for either individual network elements or sub-networks, rather than comparing the system in place to the system that would be constructed by the hypothetical (efficient) new entrant;
- the assessment of whether an asset should be 'stranded' is an *ex post* test, that is, a judgment on the efficiency of a network element in light of outturn market outcomes; and
- the financial implications of asset stranding for the regulated entity would be asymmetric, that is, assets either would remain at their (implicit) regulatory value, or be re-valued downwards.

[26] 'Regulatory stranding' can be distinguished from what may be termed economic redundancy, the latter of which would occur where the existence of competing energy sources and/or a decline in demand may imply that the provider is unable to set prices that recover its revenue requirement. While such a form of stranding would not be imposed at the time by the regulator, the potential for economic redundancy should be anticipated in decisions, in particular, about the rate of regulatory depreciation that is permitted. The issues associated with the optimal rate of regulatory depreciation are discussed in section 4.3.

[27] This definition of 'regulatory stranding' is broadly consistent with what the National Gas Code refers to as 'redundant capital' (National Third Party Access Code for Natural Gas Pipeline Systems, sections 8.27-8.29).

Clearly, the implementation of a policy on 'regulatory stranding' would require a number of conceptual issues to be resolved, which include how the need for a particular network element is to be determined (and whether a form of threshold is required to be crossed before an asset is declared to be stranded), the extent of the value of an asset that is removed, and how what may be efficient pre-building of assets is to be treated.

Prudence Test

In contrast, what will be referred to as a 'prudence test' is taken to mean that the regulator would undertake its own assessment of the appropriateness of investment, and exclude assets from the regulatory asset base that did not pass the test. While the term 'prudence' is used, it is envisaged that the regulator would assess the efficiency of the relevant project or projects, potentially assessing such matters as:

- whether it was efficient for the relevant service potential to be created (that is, valued by its customers at more than its cost);
- whether the project was the optimal means of providing the service potential, given alternative technologies for providing the service; and
- whether the project was constructed in a least-cost manner.

The Commission's Regulatory Test (discussed in section 2.5) effectively requires a 'prudence test' as described above with respect to new augmentation projects, and is included for all projects (ie renewal and augmentations) in the Commission's existing Draft Regulatory Principles.[28] This description of the 'prudence test' is also broadly consistent with the tests required for capital and operating expenditure in the National Gas Code.[29]

A variety of administrative approaches to applying such a test could be adopted, ranging from undertaking an audit of the systems and procedures adopted by the relevant utility, to assessing the efficiency of individual projects (in turn, for which a range of different approaches could be adopted). Some of the distinguishing features of 'prudence' assessments assumed in this report include following:

- the test would be undertaken at the time when capital expenditure is first considered for being rolled-in to the provider's regulatory asset base (ie the next price review) and not at some time in the future; and
- the test would take account only of information available at the time that the project took place – and so utilise only information that was available to the provider.

Regulatory Tools Compared

Following from the discussion above, the key differences between the concepts of resetting the regulatory asset base at an estimate of its ODRC value, regulatory stranding and prudence tests are as follows:

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28 Australian Competition and Consumer Commission, Draft Statement of Principles for the Regulation of Transmission Revenues, May 1999, pp.56-57.

29 National Third Party Access Code for Natural Gas Pipeline Systems, sections 8.16, 8.37.

- *Level of optimisation* – the new ODRC value should reflect (in principle) the cost of a fully optimised system at any point in time, that is, taking into account different routes for transmission lines, siting of terminal stations, etc. In contrast, 'regulatory stranding' merely asks whether the asset that has been installed is has turned out to be excess to requirements, whereas the prudence test asks whether the asset to be installed is considered (ex ante) to be excess to requirements.

- *Financial effect* – re-setting a regulatory asset base at an estimate of its ODRC value could have a positive or negative impact on the provider, with the direction of the impact depending on whether the forecast of the period-end ODRC value that was assumed in existing tariffs over or understated the value. In contrast, 'regulatory stranding' could have only a negative effect on a provider. In particular, even though an asset could be readmitted into the regulatory asset base if it subsequently became sufficiently utilised, the opportunity cost of funds associated with that investment would have been foregone over the intervening period. Similarly, the effect of a prudence test could only be negative, although the fact that the test is an ex ante test – that is, relying on only the information available to the provider at the time of making the investment – implies that it would be reasonable to expect that the vast majority of projects would pass the test.

Chapter 4
Assessment

4.1 Introduction

This chapter considers the relative merits of the alternative asset revaluation methodologies, focussing on the distinguishing features of the two methodologies, namely:

- the strength of incentives provided to reduce cost and, related to this, the level of certainty over the recovery of costs incurred;
- the level of average prices over the period and the permitted time profiles for tariffs; and
- level of administrative costs expected from applying each of the methodologies.

The chapter also comments on the relevance of accounting conventions developed for other purposes for the approach to asset revaluation, and provides some comments on a related issue of the appropriate role of 'regulatory stranding' and 'prudence tests' when updating the regulatory asset base for a regulated transmission entity.

4.2 Strength of the incentive to minimise cost / certainty about cost recovery

The discussion of the relative merits of the ODRC revaluation methodology is divided into two periods, the short term and the longer term.

Most appropriate methodology in the short term

We do not consider that the setting of prices completely independent of cost is feasible for regulated electricity transmission businesses in the short term.

The discussion in section 3.1 has identified a number of complex methodological issues that would need to be addressed in order for the ODRC revaluation approach to be applied. We are also concerned that, to date, there has been very little wider debate and analysis of the actual estimation of ODRC values, with no disclosure and independent analysis of the robustness of the sources of information and statistical techniques that have been used to produce ODRC estimates. To date, the substantial variation in ODRC estimates for the same assets over short periods of time – and the large range of error often quoted by firms commenting on ODRC estimates – does not lend weight to the proposition that current ODRC practice of estimating ODRC values is sufficiently robust to be used to set regulated charges.

Most appropriate methodology over the longer term

We also do not consider that the application of the ODRC revaluation methodology would provide for the most appropriate set of incentives for the regulated transmission providers over the longer term.

Whether a transmission business would expect to recover the cost of continuing to provide the service – or expected to earn returns much larger than that required to justify its continued financing of the business – would depend upon the accuracy of the estimated ODRC value, for which substantial statistical uncertainty will be inevitable. The inevitable error reflects the level of uncertainty inherent in each of the steps undertaken to estimate an ODRC value – including, amongst other things, the appropriate extent of optimisation and pre-building of the network, the cost of constructing the hypothetical assets given the unique characteristics of each network, the cost of purchasing equipment which may fluctuate substantially over time, and the prediction of the future cost of operating, maintaining and renewing the optimal asset.

The lack of public debate to date on the accuracy of engineering models for predicting the efficient cost of electricity transmission makes it difficult to make strong conclusions about the likely bounds of uncertainty for these cost predictions. However, a comparison with the models employed in telecommunications – which are subject to substantial debate – do not provide much room for optimism over the accuracy of models for predicting electricity transmission costs. Indeed, a comparison of the output provided by the two most popular models for estimating 'proxy costs' for telecommunications network elements showed an average difference of 50 per cent.[30] The author's conclusion on the appropriateness of cost-prediction models for setting telecommunications access charges was as follows:[31]

> Thus, I strongly suggest that regulators around the world learn from the US experience and avoid the use of cost proxy models in setting prices on interconnection and unbundled network elements.

Given the risks associated with the inevitable error associated with the prediction of efficient cost, it is difficult to see how the Commission credibly could commit to adhere to such a regulatory regime over the long term. It is noted that in the recent report to the Utilities Regulators Forum on different regulatory approaches, Farrier Swier Consulting appeared to reject the 'economic engineering approach' – of which the ODRC revaluation approach is an example – as one that could potentially be applied as the primary approach in Australia.[32]

That said, it is considered that the Commission should keep under consideration the question of whether the use of a five year regulatory period and efficiency carry would be expected to provide the most appropriate set of incentives for regulated entities. It may well be appropriate for Australian regulators to consider lengthening the time between price reviews in order to increase the strength of incentives on regulated entities to reduce cost.

30 Dippon, C 2001, 'Local Loop Unbundling: Flaws of the Cost Proxy Model', *Info*, Vol 3, No 2, April, p.165.

31 Dippon, C, 'Local Loop Unbundling: Flaws of the Cost Proxy Model', *Info*, Vol 3, No 2, April 2001, p.171.

32 The use of an ODRC valuation methodology equates to what was referred to as an 'engineering economic analysis' in the recent report to the Utilities Regulators Forum on different regulatory approaches (Farrier Swier Consulting, Comparison of Building Blocks and Index-Based Approaches, Report to the Utility Regulators Forum, June 2002, p.33). Farrier Swier Consulting appeared to reject the 'economic engineering approach' as one that could potentially be applied as the primary approach in Australia, although did not set out clearly the reasons for rejecting the approach (Farrier Swier Consulting, op cit, p.35).

However, it is considered that a lengthening of the time between reviews would require improvements in the way in which the trajectory of prices over the regulatory period is set in order to reduce the scope for regulated entities to use their asymmetric information to ensure that the price path is likely to generate windfall gains. A productive way forward for the Commission would be to use methods that place less emphasis on internally generated forecasts of matters like expenditure and demand over the period and more emphasis on external estimates of trends in partial or total factor productivity growth.

4.3 ODRC and Efficient Prices

Introduction

As discussed above, one of the objectives of regulation is to produce prices that reflect the 'scarcity' of the resources consumed in providing the regulated service. Such a price will ensure that users of the system face a signal that reflects the cost of providing the regulated service. In turn, this should lead to consumers making decisions that reduce the cost of providing the regulated service overall – for example, locating a generator closer to the source of demand, or turning off equipment when the network that would supply into an area is constrained.

What is an Efficient Price at a Point in Time?

The correct price signal for the scarcity of the resources consumed by a particular user is the marginal cost of providing that customer's service. The marginal cost is the change in the forward-looking cost associated with providing the last unit of service.

However, as electricity transmission networks are generally characterised by economies of scale and scope, both short run and long run marginal cost will generally sit below the average cost of providing supply. This is just the well-known problem of natural monopoly, where setting prices consistent with (forward-looking) change in costs caused by any particular customer would fail to permit recovery of the whole of the cost of providing the service.

Given that all of the cost of providing the regulated transmission services needs to be recovered from customers,[33] the shortfall in cost needs to be recovered from customers. Given this constraint, the prescription for efficient pricing becomes one of recovering the remaining costs in a manner that has the least impact on usage and investment decisions compared to the decisions that would have been made had customers faced the efficient prices. In turn, this implies recovering the remaining costs through charging components that have the least impact on demand, which would be expected to involve some form of non-linear pricing (such as multi-part tariffs with different types of fixed components, a usage charge that varies with the level of usage, etc).

[33] An option that is normally discussed in text book analyses is that the residual cost component be subsidised by the government through taxes, which may generate a lower deadweight loss than raising the price of electricity. This option is assumed not to exist in this report.

An implication of the discussion above is that it is the structure of prices – rather than the average level – that is more important for efficiency at a point in time.[34] Moreover, there is no reason to consider that prices determined to reflect the price that a the hypothetical (efficient) new entrant would charge at any point in time have a claim to being the most efficient charge – as a mark-up or extra charge in addition to efficient charge would be required to recover costs. Rather, given that a residual amount needs to be recovered from customers over the life of the relevant asset – while at the same time not distorting their usage of the system – the relevant question becomes what is the *optimal rate of recovery of costs over time*, and whether there is a distinction between the two valuation methodologies on this basis.

The question of the optimal rate of recovery of costs over time is a question of the most efficient rate or profile of depreciation for regulatory purposes, which is addressed next.

Efficient Prices over Time – Regulatory Depreciation

The regulatory depreciation allowance is the return of capital to investors over the life of the asset. Provided that prices are expected to deliver a present value of future cash flow equal to the original cost of an asset, the sum of the regulatory depreciation allowance over time will equate to the original cost of the asset.[35] In parallel, the profile of the regulatory depreciation allowances over time will determine the time profile of charges to customers over the life of the asset – and equally, the time profile of charges will imply a regulatory depreciation profile (provided that the set of prices is expected to deliver a present value of future cash flow equal to the original cost of the asset).[36]

As discussed in section 3.1, re-setting the regulatory asset base at the ODRC value at each price review implies that a unique time profile of charges over time would be established. The time profile would reflect the prices that would be charged by the hypothetical (efficient) new entrant at any point in time – which in turn would imply a unique profile of regulatory depreciation allowances.

In contrast, if the regulatory asset base is rolled-forward, flexibility exists in relation to the time profile of regulated charges (and regulatory depreciation). Subject to the rate of regulatory depreciation being sufficiently fast that the provider would always expect to be able to set prices that recover its revenue requirement given the actual (rather than hypothetical) threat of future competition, any regulatory depreciation profile can provide a stream of income that has a present value that equates with the regulatory asset base.

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[34] A constraint is that the average prices (or revenue cap) be sufficiently high that it permits charges that reflect marginal cost. Such an outcome would be consistent with an efficient rate of regulatory depreciation, which is discussed below.

[35] If a nominal return is provided, then the sum of regulatory depreciation allowances expressed in 'money of the day' terms will equate to the original cost of the asset. If a real return is provided, then the sum of regulatory depreciation allowances expressed in constant price terms will equate to the original cost of the asset.

[36] It is important to note that the profile of regulatory depreciation and the profile of prices will not (at least not necessarily) be the *same* – but just that there is a necessary relationship between the two.

Comparing the two asset valuation methodologies, it is noted that the roll-forward methodology would permit the same regulatory depreciation profile (and hence time profile of regulated charges) as that implied by prices reset at the level consistent with the hypothetical (efficient) new entrant, but would permit other profiles of depreciation (and prices) to be selected. The only constraint on the profile of regulatory depreciation under the rolled-forward methodology would be the minimum rate necessary to ensure that the provider is always able to set charges that will recover the revenue requirement in the future, given potential future actual competition. Thus, the rolled-forward asset valuation methodology would appear to have the advantage of providing greater flexibility over the methodology where the regulatory asset base were re-set to an estimate of the ODRC value.

The greater flexibility offered by the rolled-forward methodology then raises the question of whether the use of the re-ODRC methodology may rule out a more efficient time profile of prices (and regulatory depreciation allowances).

In most applications in financial economics, the appropriate measure of depreciation is the rate of economic depreciation. Economic depreciation can be defined as the change in the market value of an asset between two points in time (adjusted for cash flows into or distributions from the relevant financial asset over that period).

However, where monopoly assets are regulated, there is a degree of circularity in attempting to use economic depreciation, as the rate of economic depreciation will reflect the depreciation methodology that is selected by the regulator. This reflects the fact that the selected regulatory depreciation profile determines the profile of prices over time, and hence affects the time profile of revenue – thus determining the change in the value of the asset. The one caveat to this conclusion is that the asset owner must expect to recover the whole of the value of the regulatory asset base over its economic life. This latter constraint implies that regard must be had to the price at which the service may be subject to actual competition in the future (in turn, depending on matters like the rate of technological improvement), and sets a lower bound to the rate of regulatory depreciation.[37] Within this bound, any regulatory depreciation schedule is consistent with economic depreciation.[38]

[37] The impact of future competition on the permissible regulatory depreciation profiles was analysed in: Crew, M and Kleindorfer, P (1992), Economic Depreciation and the Regulated Firm under Competition and Technological Change', *Journal of Regulatory Economics*, Vol 4, pp.51-61.

[38] This latter general proposition has been demonstrated by, amongst others, Schmalensee, R (1989), 'An Expository Note on Depreciation and Profitability Under Rate-of-Return Regulation', *Journal of Regulatory Economics*, Vol 1, pp.293-298.

The concept of economic efficiency provides further insights for the rate of regulatory depreciation than specifying a lower bound, however. As discussed above, the presence of economies of scale and scope in electricity transmission imply that a component in excess of the efficient price will have to be recovered from customers. As the economic distortion associated with the recovery of the residual costs may be affected by the amount that is to be recovered in each particular period, the efficient rate of regulatory depreciation can be defined as the is the rate that minimises the impact on usage of the regulated asset from recovering the residual cost of providing the service discussed above over time, provided always that this depreciation profile would ensure that the asset owner would expect to recover the whole of the value of the regulatory asset base over the economic life of the asset.[39]

The derivation of such a rate of depreciation is a complex task, however. In principle, it requires a view on the profile of marginal cost over time, as well as any change in the likely demand responsiveness of customers between periods. It also requires a view on all other factors that would affect price levels over time, such as trends in operating and capital expenditure, and demand. However, some of the implications that follow from simple models include the following:

- increasing operating costs over time as assets age would imply that the optimal cost recovery would be more *front-ended*, all else constant;
- falling replacement costs over time would imply that optimal cost recovery would be *back-ended*, all else constant falling ; and
- where demand is increasing over time, the optimal rate of recovery would be *back ended* (and vice versa if demand is expected to decrease), all else constant.

While the time profile implied by pegging prices to those that would be charged by the hypothetical (efficient) new entrant would also be affected by these factors, the rate of economic depreciation implied by the hypothetical (efficient) new entrant asset valuation may be expected to depart from the efficient rate, for the following reasons:

- Under the hypothetical new entrant valuation, changes in the replacement cost of assets would be assumed to flow directly into the assumed hypothetical new entrant price, and hence imply a faster rate of regulatory depreciation. In contrast, as noted above, the efficient rate of regulatory depreciation would be expected to imply a back-ending of depreciation (ie a slower recovery) where the replacement cost of assets is expected to fall (subject to the ability for the regulated entity to set prices that recover its revenue requirement).
- Under the hypothetical new entrant valuation, the full (average) cost of providing service in each period would be reflected in prices for that period. Thus, where demand is expected to rise – and there are strong economies of scale and scope in the provision of the service – prices would be high in the early years and fall over time. In contrast, the optimal rate of recovery of costs would imply a *deferral* in the recovery of the residual cost if there is expected to be a greater number of customers – over whom the residual costs can be – spread in the future.

[39] Baumol, W (1971), 'Optimal Depreciation Policy: Pricing the Products of Durable Assets', *The Bell Journal Economics and Management Science*, Vol 2, pp.638-656.

In the absence of actual contestability of a service, there is no compelling reason to fix the time profile of cost recovery to the outcome that would be expected to be observed in such a market if it existed. Moreover, the discussion above suggests that the time profile of charges implied by the hypothetical (efficient) new entrant standard may depart materially from the profile that would be economically efficient in some cases – for example, where replacement costs are expected to fall at a fast rate (subject to the ability to recover all cost) or demand is expected to grow over time. Accordingly, the additional flexibility for regulatory depreciation implied by the roll-forward approach may permit a more efficient time profile of regulated charges to be adopted.

The UK Office of Telecommunications Regulation, in explaining its approach to modelling economic depreciation for regulated mobile termination calls, reached a similar conclusion:[40]

> 20 One way to specify the competitor constraint would be the contestable market approach. It could be assumed for the purposes of the analysis (even if this represents a departure from reality) that entrants never experience a type (i) difference compared to incumbents. In a contestable market entrants face no barriers to entry and so would always be able to achieve the same utilisation as the incumbent(s) in any calendar year. So, for illustration, assume that the incumbent invested three years ago and achieved 50% utilisation in its first year of operation and 75% in its second year before reaching 100% in the current year. The contestable market approach would mean that the entrant in the current year would be assumed to achieve 100% in the current year, its first year of operation (and so has greater type (ii) efficiency than the incumbent).
>
> 21 Competition from potential entrants to a contestable market would be sufficient to ensure the removal of super-normal profit (whatever the number of incumbents or the nature of competition among them). The incumbent would be unable to defer depreciation when utilisation is low. If input costs (MEA price and operating expenses) were constant, then the economic depreciation profile under contestability would be a constant annual cost recovery (in £) each year. The unit cost (or price) would be inversely proportional to utilisation.
>
> 22 Although contestability provides a feasible answer to the specification of the competitor constraint, the price/unit cost profile that it implies seems unattractive. When utilisation is very low, the price/unit cost is very high and vice versa. It also involves an assumption about new entrants that seems very unrealistic.

It follows that the roll forward methodology may permit a more efficient spreading of costs over time than one where prices are reset periodically at the level that would be charged by a hypothetical (efficient) new entrant.

4.4 Administrative Costs and Complexity associated with the Different Options

One of the factors upon which the Commission has sought comment is the administrative costs and complexity associated with the different options. However, in the absence of a fully specified and road-tested ODRC methodology, it is difficult to be definitive about the relative administrative costs of the different valuation approaches. Notwithstanding, some observations on the potential administrative costs are set out below.

[40] Oftel, Calls to Mobiles: Economic Depreciation, undated (available at: http://www.oftel.gov.uk/publications/mobile/depr0901.htm)

As discussed already, a significant point of difference between the two methodologies is the upfront 'investment' required to implement each. While the roll-forward methodology is used already – and has widespread experience of use in other jurisdictions[41] – a substantial refinement to the estimation of ODRC values for electricity transmission networks would be needed before this could be considered as a feasible option in Australia.[42] Moreover, there is little or no precedent for the use of ODRC as the basis for revaluing electricity (or even energy) networks in other jurisdictions from which to learn.

Once estimated, the relative costs and complexity of administering the respective methodologies is likely to depend upon the difficulty of obtaining the information necessary to implement the approach – and the scope and incentive for the provider to contest the application of the methodology.

The range of assumptions required for the estimation of an ODRC value – and the fact that the provider would stand to make windfall gains (or losses) if the value is estimated incorrectly – would suggest that the derivation of an ODRC value is likely to require substantial resources from the regulator as well as the regulated entity. In contrast, updating the regulatory asset base using the roll-forward method requires only information on what has actually been spent over the previous period, which is reasonably straightforward to obtain. Moreover, any cost-prediction model is likely also to require information on actual expenditures undertaken by utilities – and potentially on a more disaggregated basis and for more companies than that required simply to roll-forward regulatory values.

One matter that could require substantial resources under the roll-forward model is testing for the efficiency of investments (and operating expenditure) undertaken during the previous regulatory period. However, as discussed in section 2.2, the use of incentive regulation to encourage regulated entities to undertake only efficient expenditure offers the opportunity for regulators place less emphasis on second-guessing the efficiency of investment decisions.

A further significant point of difference between the two methodologies is the level of analysis required to determine the allowance for regulatory depreciation. As noted in section 3.1, under the ODRC method, the regulated entity would make a windfall gain or loss if the regulatory depreciation factored into regulated charges differed from the change in the ODRC valuation over the regulatory period (adjusted for additions). Accordingly, the entity would have a strong incentive to attempt to inflate the allowance made for regulatory depreciation – and for which the correct value would be very difficult to calculate – implying that this input is likely to require substantial resources from the regulator and regulated entity.[43]

[41] Refer to the discussion in Chapter 5.

[42] As noted in section 3.1, if the Commission elects to continue to revalue assets based upon the hypothetical (efficient) new entrant standard, a methodologically simpler approach would be to use ORC – rather than ODRC – thus replicating the approach in telecommunications.

[43] The 'correct' level of regulatory depreciation requires a forecast of the ODRC value at the end of the period – thus requiring (amongst other things) an assumption about the trend in construction costs, demand, the optimal configuration consistent with the change in demand.

In contrast, under the roll-forward approach, a change to the rate of regulatory depreciation implies a commensurate change to the regulatory value of the business, and not affect the value of the regulated cash flows (at least if the regulator's estimate of the cost of capital is correct). Thus, the appropriate regulatory depreciation rate should be less controversial – indeed, it would be appropriate for the regulator to provide some flexibility over the rate of regulatory depreciation adopted.

Lastly, the issue upon which much effort by regulators and regulated entities has been spent is the estimation of the cost of capital associated with the relevant regulated activities. It is noted that both the ODRC revaluation methodologies and the roll-forward methodology requires an estimate of the cost of capital, and this estimate is equally important to the derivation of regulated charges under each approach. Thus, neither methodology has an advantage over the other with respect to the assumption about the cost of capital associated with the regulated activities.

On balance, it is difficult to see that the use of an ODRC revaluation approach would imply a reduction in the administrative cost or complexity associated with setting revenue caps. As well as the initial investment required to make the ODRC revaluation methodology feasible, its continued use inevitably will leave room for dispute which – given the sums of money likely to be at stake – regulated entities will have an incentive and even duty to their shareholders to seek to exploit. The use of the roll-forward methodology also is not costless, but it is known and widely used, and does not offer the same windfall gains and loss as the ODRC revaluation methodology. Moreover, the greater use of incentive regulation offers the prospect of reducing the cost of implementing the roll-forward model over time.

4.5 Efficient prices and choice of augmentation projects

As noted in section 2.4, a positive effect of revaluing assets at their ODRC value is that this may provide regulated entities with the incentive to have regard to events beyond the current price control period when setting tariffs and deciding on the most appropriate means of meeting increasing demand. In particular, the regulated entity would have an incentive to take account of the value of a flexible response.

The importance of such an incentive is an empirical matter. However, it can be concluded that the benefits from supplementing the incentives provided by the price control would be less important as the length of the regulatory period is extended, and the benefits of such incentive arrangements would need to be traded off against the adverse effects of increased risk for providers from the ODRC revaluation method, discussed above.

However, for electricity transmission, providing regulated transmission entities with an incentive to set efficient prices and to select efficient augmentation projects is likely to be of little practical relevance given that the provider has no incentive over the structure of tariffs, and because the 'regulatory test' required for regulated investments already provides a 'screen' over the efficiency of the response to demand growth.

4.6 Regulatory Asset Valuation vs Financial Accounting

The concept of revaluing assets at an ODRC value has similarities to concepts taken from the financial accounting field. This raises the question as to whether the use of similar concepts for financial accounting purposes provides any further justification for revaluing assets at their ODRC value over time. This matter is addressed below.

Measuring Financial Performance of Government Business Enterprises

The National Electricity Code requires the Commission – when deciding how to set a regulatory value for network assets and to revalue these assets over time – to have regard to the Council of Australian Government's agreement that the Optimised Deprival Valuation methodology should be the preferred basis for valuing transmission assets.[44] As the ACCC has recognised, an ODRC valuation is one of the possible outcomes of the Optimised Deprival Value methodology.[45] This raises the question as to the genesis of the Optimised Deprival Value methodology, and whether it is appropriate as a basis for economic regulation.

As the Productivity Commission has noted, the genesis of deprival value techniques was the desire in the late 1980s and early 1990s to improve the measure of the financial performance of government business enterprises as part of a suite of measures intended to improve what was considered to be poor financial performance. The Productivity Commission has highlighted the differences in the objectives behind the measurement of financial performance on the one hand and economic regulation on the other.[46]

> Underlying the Red Book exercise was governments' desires to improve the generally *inadequate* returns earned by government businesses. In contrast, regulators' concerns are, by and large, to prevent *excessive* returns. That is, rather than using asset values as a monitoring tool, regulators use it to control returns. For the reasons outlined above, it does not necessarily follow that a valuation method appropriate for measuring financial performance is appropriate in all cases for controlling monopoly power.

In particular, the regulatory asset base in regulation has a specific purpose, which is to reflect the value of the regulated assets in the eyes of the regulator at each point in time, and the test for the appropriateness of any method for updating of the regulatory asset base has specific objectives – which is to ensure that the method by which the regulatory value is changed over time provides incentives for efficiency, including to minimise cost but also to continue to investment in the regulated activities where it is efficient to do so. There should be no presumption that accounting conventions developed for other purposes – such as measuring the financial performance of government businesses – are appropriate for this task.

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44 National Electricity Code, clause 6.2.3(d)(iv).

45 Australian Competition and Consumer Commission, Draft Statement of Principles for the Regulation of Transmission Revenues, May 1999, p.39.

46 Productivity Commission, Review of the National Access Regime, Inquiry Report No.17, September 2001, p.361.

Financial Capital Maintenance vs Operating Capital Maintenance

Another debate from the financial accounting field that has been transposed into the regulatory field is the debate about the most appropriate measure of income for financial accounting purposes – that is, whether income should be measured on the basis of the financial capital maintenance concept, or on the basis of the operating (or physical) capital maintenance concept. The differences between the options for the measurement of income are as follows:

- Financial capital maintenance – in which income is defined as the surplus after a sufficient amount has been reserved to maintain the financial value of the business or asset; and
- Operating (physical) capital maintenance – in which income is defined as the surplus after a sufficient amount has been reserved to maintain the physical capability of the asset.

The main distinguishing features of the two are the meaning of depreciation and the basis of asset valuation. Under financial capital maintenance, depreciation is just the return of the original cost of the investment and the book value represents the financial value. In contrast, under operating capital maintenance, depreciation is a provision sufficient to fund replacement of the existing assets when they expire, and the book value reflects the depreciated replacement cost of the current assets. At least on the face of it, the operating capital maintenance concept appears similar to revaluing regulated assets at the ODRC value over time.

For regulation, either of these approaches could be used with appropriate modifications, although the financial capital maintenance approach most closely resembles the accounting convention that regulators have used when setting regulated charges. To set regulated charges based upon the operating capital maintenance approach, the modifications required would include:

- to base depreciation charges on the full current cost valuation of the asset;
- to revalue the regulatory asset base at the full current cost valuation of the asset at price reviews;
- to escalate prices (and the regulatory asset base) by a price index for capital costs rather than the general CPI; and
- to either adjust the regulatory WACC (or to achieve the same effect by adjusting the revenue benchmark) to account for projected holding gains or losses if capital costs are expected to move at a different rate to prices generally.

The main implication of a move to an operating capability maintenance approach would be that investors would be exposed to the risk associated with the unpredicted changes in capital costs relative to prices generally over time, assuming that the opening regulatory value of their assets was the current cost asset valuation.[47]

[47] If the regulatory asset base for the business commenced below the full current cost value, the regulated entity would receive a windfall gain from having prices set on an operating capital maintenance approach: see footnote 77.

More importantly, the debate behind the relative merits of the financial capital maintenance concept and the operating capital maintenance concept in the financial accounting field revolves around which approach is likely to deliver the closest approximation for economic income. For regulated assets, however, the debate over the best proxy for economic income has little relevance – as the regulator effectively determines economic income by setting regulated charges.[48]

As noted above, the relevant objectives for selecting the most appropriate method for updating the regulatory value of transmission assets is not to derive a better measure of economic income, but rather to encourage economic efficiency. Accordingly, again, there should be no presumption that accounting conventions developed for other purposes are appropriate for setting regulated charges.

4.7 Role of Regulatory Stranding and Prudence Tests

In section 3.4, the revaluation of the regulated assets at an estimate of their ODRC value was distinguished from two other tools that regulators may employ, namely 'regulatory stranding' or partly used or unused assets, and the application of a 'prudence test' to new investment. It was noted that neither of these tools are compatible with the ODRC revaluation methodology, but either or both could be employed as additional measures if the 'rolling forward' methodology is used to update the regulatory asset bases of regulated transmission entities.

While it is beyond the current brief, a couple of comments on the appropriate role of these tools are provided below.

The relevant objective when considering whether either or both of the measures should be employed – and how the particular measure should be employed – is the pursuit of economic efficiency and its implications as discussed in Chapter 2.

Regarding the application of a prudence test, it would be expected that the reliance that regulators are required to place upon a formal prudence test would depend upon the strength of the incentives that are provided to regulated entities to minimise cost. In particular, the presence of strong incentives to minimise cost should permit regulators to draw an inference that expenditure was efficient. However, as the design of incentive arrangements inevitable involves a degree of imprecision, the ability to undertake a formal prudence test should be maintained, at least as a fallback.[49]

[48] As discussed in section 4.3, subject to the constraint that a regulated entity always be able to set prices that recover its revenue requirement, any regulatory depreciation schedule is also economic depreciation.

[49] As discussed in section 3.4, the Commission's 'regulatory test' includes a formal prudence assessment for new augmentations.

With respect to 'regulatory stranding', the position is less clear cut. While the threat of future 'stranding' may provide further incentive to minimise cost – and also force a regulated entity to take account of events that extend beyond the next regulatory period when setting regulated charges and selecting the appropriate means of meeting demand growth (given uncertainty about future demand) – a credible threat to 'strand' assets creates further uncertainty,[50] and which may impact upon investment. It is for this reason that some Australian regulators have elected not to preserve the ability to 'strand' assets at future price reviews.[51] However, whether some form of 'regulatory stranding' is considered appropriate for a particular case is a matter that needs to be considered in light of the objectives discussed above – in particular, the relative size of the potential positive and negative impacts on efficiency – and in light of other regulatory tools that may be for achieving the same ends (such as extending the price cap period).

[50] As 'regulatory stranding' would have a one-sided impact on future cash flow, the threat of substantial future 'regulatory stranding' would need to be compensated for in regulated charges.

[51] See, for example, Essential Services Commission (Victoria), Review of Gas Access Arrangement – Final Decision, October 2002, pp.152-155.

Chapter 5

Practice in Other Industries and Jurisdictions

The purpose of this section is to summarise the approaches that other energy regulators have used to update the regulatory asset bases for regulated entities in Australia and in selected other jurisdictions.

5.1 Australian Experience

Gas Transmission and Distribution

The methodology for updating the regulatory asset base for gas transmission and distribution businesses is determined by the National Gas Code, and requires the 'rolling-forward' method to be used to update the regulatory asset base.[52]

The Gas Code requires a 'prudence test' of capital expenditure[53] – although it leaves regulators with discretion as to how to satisfy themselves that the test is satisfied.[54] The Gas Code also permits 'regulatory stranding',[55] but also requires that the option of stranding assets be announced in advance, and reflected in either the rate of regulatory depreciation or return provided on the regulatory asset base.[56]

Electricity Distribution

The process for updating the regulated asset base in future regulatory periods for electricity distribution is governed by specific legislative requirements in a number of jurisdictions. The relevant legislative requirements or recent views of the jurisdictional regulators are summarised below.

- In New South Wales – IPART has proposed using the roll-forward method to update the regulatory asset bases for the NSW electricity distributors in its current review of their price controls. It has also noted that it will test the prudence of capital expenditure prior to rolling it into the regulatory asset bases.[57]

[52] National Gas Code for Third Party Access to Natural Gas Pipeline Systems, section 8.9.

[53] National Gas Code for Third Party Access to Natural Gas Pipeline Systems, section 8.16.

[54] National Gas Code for Third Party Access to Natural Gas Pipeline Systems, section 8.49. For example, a regulator could infer from the operation of incentive arrangements that the expenditure was prudent.

[55] National Gas Code for Third Party Access to Natural Gas Pipeline Systems, sections 8.27-8.29.

[56] National Gas Code for Third Party Access to Natural Gas Pipeline Systems, section 8.27.

[57] Independent Pricing and Regulatory Tribunal, Regulatory Arrangements for the NSW Network Service Providers from 1 July 2004 – Issues Paper, November 2002.

- Victoria – the existing Victorian Tariff Order provisions require the use of the roll-forward methodology when updating the assets in place at the time of privatisation,[58] which the Essential Services Commission has extended to all assets.[59] The then Office of the Regulator-General expressed strong support for the use of the roll-forward methodology in its earlier consultation papers.[60]
- Queensland – used the roll-forward method to update the regulatory asset bases for the two electricity distributors in its most recent price review.[61]
- In Tasmania, the Office of Tasmanian Energy Regulator has stated that it intends to use the 'roll-forward' method to update the regulatory asset base for the Tasmanian electricity distributor for the next regulatory period, but has indicated that will undertake a further examination of whether it is appropriate to use an updated ODRC valuation to reduce the possibility of an ever increasing divergence between a rolled forward asset valuation and an updated ODRC valuation.[62]
- South Australia – the South Australian Electricity Pricing Order effectively requires the use of the roll-forward methodology to update the regulatory asset base for the South Australian electricity distributor.[63]

5.2 Overseas Regulators

US Practice

Asset valuation methodology

In the US, the basis for the valuation and revaluation of regulated assets remained in a state of flux (and confusion) until the seminal decision of the US Supreme Court in the *Hope* case.[64] Over the previous 50 years before that decision, there had been substantial debate over the appropriate standard for the valuation of regulated assets – which included whether 'fair value' was an appropriate benchmark – with the two most widely used standards being depreciated original cost and revaluations based upon current replacement cost.[65] While the *Hope* decision did not mandate a specific methodology for the valuation of regulated assets, it did reject the use of 'fair value' as an appropriate standard, and also signalled a substantial withdrawal of the Court's role in settling disputes between regulated entities and regulators, instead emphasising pragmatism. The implication of this change of approach has been summarised as follows:[66]

58 Victoria Electricity Supply Industry Tariff Order (Victoria), clause 5.10.

59 Office of the Regulator-General (Victoria), Electricity Distribution Price Determination 2001-05 – Statement of Purpose and Reasons, September 2000, p.111.

60 Office of the Regulator-General (Victoria), Electricity Distribution Price Review Consultation Paper No.1 – Cost of Capital Financing, May 1999, pp.6-8.

61 Queensland Competition Authority, Final Determination – Regulation of Electricity Distribution, p.63.

62 Office of the Tasmanian Energy Regulator, Research Paper – Electricity Distribution Pricing, December 2002, p.19.

63 Electricity Pricing Order (South Australia), October 1999, clause 7.2(e).

64 Federal Power Commission v Hope Natural Gas 320 U.S. 591 (1945). For an excellent discussion of the various court decisions that spanned this period, and of the contemporary academic discussion, see: Grout, P and A. Jenkins 2001, Regulatory Opportunism and Asset Valuation: Evidence from the US Supreme Court and UK Regulation, CMPO Working Paper Series No. 01/38.

65 It would be difficult to characterise the current replacement cost valuation methodology as equivalent to the ODRC revaluation methodology assessed in this report. For example, Professor Goodman notes that there was disagreement amongst early courts and commissions as to whether a new (cheaper) technology should be reflected in the valuation of an asset – but with the weight of authority favouring the

> As long as the company was able to operate successfully and to attract capital, the courts should not become involved. This doctrine of the end result made it much more difficult for utilities to appeal to the courts, and left decisions in practice to the regulatory commissions.

Following the Hope decision, however, many of the regulatory commissions turned to the use of depreciated original cost as the valuation methodology. Professor Goodman has summarised the current position of US state regulatory authorities as follows.[67]

> This trend of commission decisions favouring original cost has continued. In 1954, the commissions in only nine states out of 43 surveyed by one author followed fair value 'in its traditional meaning', and the remainder relied wholly or predominately on original cost.
>
> At the present time, fair value decisions may be found in only a handful of states governed by statutory or judicial decisions resting on pre-*Hope* criteria. State commissions, where they have been required to use fair value, chafe under this obligation; and some have even after ordered in court to use fair value, continue using original cost. Once given the opportunity to reflect fair value, they have generally done so.

Goodman referred to more recent evidence on asset valuation in the US, which noted that only six of the state regulatory commissions currently place weight on factors other than original cost. Regarding the federal authorities, Goodman noted that:[68]

> The F.E.R.C (and its predecessor, the F.P.C) has extensively employed original cost in its ratemaking proceedings, which include the regulation of the rates for transportation or sale of gas or electricity by gas producers, gas transporters, gas pipelines and by fossil fuel, nuclear, and water-powered electric utilities.

Accordingly, at least since the *Hope* decision, original cost – adjusted for capital expenditure and depreciation – has been the almost universal methodology for regulatory asset valuation in the energy industries in the US.[69]

Other approaches relevant to asset revaluation

Where the US authorities have adopted depreciated original cost as the standard for asset valuation (and revaluation), it has been common practice for two other checks to be applied prior to assets either being included or retained in the regulatory asset base. These are the 'prudence test', and the used and 'useful test'.

The idea of a 'prudence test' had as its background a general distrust of the books of regulated entities early in the 20th century. Thus, when the concept of 'fair value' for the valuation of assets was replaced with original cost, it was generally done so subject to the caveat to that only the prudently invested capital need be considered, not every cost incurred by the company.[70] Goodman has summarised the current standard applied for the 'prudence test' as follows:[71]

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revaluation of the existing technology: Goodman, L 1998, *The Process of Ratemaking*, Public Utilities Reports, Vol 2, p.774.

66 Grout, P and A. Jenkins 2001, Regulatory Opportunism and Asset Valuation: Evidence from the US Supreme Court and UK Regulation, CMPO Working Paper Series No. 01/38, pp.15-16.

67 Goodman, L 1998, *The Process of Ratemaking*, Public Utilities Reports, Vol 2, p.777.

68 Goodman, L 1998, *The Process of Ratemaking*, Public Utilities Reports, Vol 2, p.782.

69 The standard approach in the US has been to roll-forward the regulatory value of assets set in historical cost terms, and – consistent with this – has used a cost of capital defined in nominal terms. This contrasts with the approach that has become standard in Australia of using a cost of capital defined in real terms, and escalating the regulatory asset base for inflation. The difference in these approaches is in the allocation of inflation risk – see Office of the Regulator-General 1999, Cost of Capital Financing – Electricity Distribution Price Review Consultation Paper No.4, pp.8-9.

70 Goodman, L 1998, *The Process of Ratemaking*, Public Utilities Reports, Vol 2, p.856.

71 Goodman, L 1998, *The Process of Ratemaking*, Public Utilities Reports, Vol 2, p.857. There is substantial precedent on the application of this test (see pp.855-883).

> A regulatory commission, therefore, will adopt the 'reasonable man' test found in many areas of the law, including negligence law, as the general standard by which the prudence of utility management must be judged. Under the 'reasonable man' test the fundamental question for decision is whether management acted reasonably in the public interest, not merely in the interest of the company or group of companies. The overriding issue is not the reasonableness of the cost in the abstract but 'a reasonable and prudent business expense, which the consuming public may reasonably be required to bear'.

The 'used and useful' test, in contrast, is a rule that determines whether a particular asset should be included in the regulated charges. Again, Goodman has summarised the relevant principle as follows:[72]

> Under the phrase 'used and useful', the agency does not reach the question whether the capital was prudently invested, because even if it has been prudently invested but will not produce investments used and useful in the public service, the agency may exclude such properties from the rate base. The used and useful principle is also unrelated to 'honest, economic and efficient' management standards. The agency may and in fact, absent contrary proof, will assume that the expenditures were made in an honest, economic and efficient manner. The sole test is whether the capital in issue is representative of properties used and useful in providing the service under regulation.

Again, there is substantial precedent as to the application of this principle. The 'used and useful' principle may permit the cost associated with excess capacity to be removed,[73] and also may reduce the value of assets where the level of usage of the asset has turned out to be lower than expected,[74] but may also permit a sharing of the cost associated with assets removed from the regulatory asset base.[75]

UK Experience

Asset valuation methodology

Despite some unorthodoxy in the method (for water) and some early confusion (for gas), the regulatory asset bases for the UK energy and water utilities have been updated using an approach that is equivalent to the roll-forward methodology discussed in this report. That is, a regulatory asset base for the assets in existence at the time of privatisation was established, which has then been updated at the time of subsequent price reviews to include capital expenditure undertaken over the previous period and to deduct depreciation.

The unorthodoxy for *water* derives from the method that OFWAT has used to determine the depreciation allowances for the regulated assets in place prior to privatisation and the consequent adjustment that is made to the roll-forward formula.

- In past reviews, OFWAT has determined depreciation allowances for pre-privatisation assets as the full current cost depreciation charge for overground assets and an 'infrastructure renewals' charge for underground assets. As the regulatory value of the water businesses' pre-privatisation assets is only a small fraction of the current cost values, the resulting depreciation allowances would return a value over the life of the relevant assets that would be many multiples of the regulatory value.

[72] Goodman, L 1998, *The Process of Ratemaking*, Public Utilities Reports, Vol 2, p.799.

[73] Goodman, L 1998, *The Process of Ratemaking*, Public Utilities Reports, Vol 2, p.800.

[74] Goodman, L 1998, *The Process of Ratemaking*, Public Utilities Reports, Vol 2, p.804.

[75] Goodman, L 1998, *The Process of Ratemaking*, Public Utilities Reports, Vol 2, pp.819-825.

- However, OFWAT also uses the (high) regulatory depreciation allowance calculated as described above when rolling-forward the regulatory values for the businesses. Thus, no windfall gain would be received (that is, an expected present value of future net cash flow equal to the regulatory value). The only effect of the use of the higher rate of regulatory depreciation is that capital would be returned at a faster rate than if OFWAT had calculated depreciation based upon the regulatory (rather than current cost) values of the pre-privatisation assets.

OFWAT is currently consulting on whether to maintain its existing approach for calculating depreciation allowances, with one alternative being to calculate depreciation based upon the regulatory values of the assets in place.[76]

The early confusion for *gas* arose from the then Monopoly and Mergers Commission's approach in its 1993 decision on Transco (the gas transmission and distribution company). The error made by the MMC was to:

- calculate depreciation based upon the full current cost value of the regulated assets (which exceeded the regulatory value by a substantial margin); but
- to roll-forward the regulatory asset base for Transco using depreciation calculated on the regulatory value of the assets.

The inconsistency between the depreciation included in prices and that used to roll-forward the regulatory asset base would be expected to provide a windfall gain to Transco (that is, an expected present value of future net cash flow in excess of the regulatory value). The Monopolies and Mergers Commission has since accepted the regulator's view (then the Office of Gas Regulation) that its earlier approach was in error, and has accepted that it would be preferable to structure depreciation allowances to return the regulatory value of the assets. It has also affirmed that the most appropriate measure of inflation for escalating regulatory values is the Retail Price Index (the UK equivalent of the Consumer Price Index) rather than an index reflecting construction costs.[77]

New Zealand

The New Zealand Commerce Commission released a discussion paper in 2002, which canvassed various options for rolling forward the asset base, but as yet they have not outlined a preferred approach.[78]

[76] OFWAT 2002, The Approach to Depreciation for the Periodic Review 2004 – A Consultation Paper, March.

[77] Monopolies and Mergers Commission, BG Plc: A Report under the Gas Act 1986 on the Restrictions of Prices for Gas Transportation and Storage Services, 1997, pp.35-44. The approach the MMC adopted in 1993 reflected an operating capital maintenance approach, as discussed in section 4.6, and the MMC's decision in 1997 reflected a rejection of the operating capability maintenance in favour of a financial capital maintenance approach. A key reason for the MMC's rejection of the operating capability standard as a basis for setting regulated charges was that this approach would be expected to provide a financial windfall to the investors in the privatised assets given that the regulatory values commenced at far less than the full current cost values (p.42).

[78] New Zealand Commerce Commission 2002, *Review of Asset Valuation Methodologies: Electricity Lines Businesses' System Fixed Assets: Discussion Paper*, October.

5.3 Implications for Electricity Transmission Regulation in Australia

The dominant practice both within and outside of Australia for updating the regulatory asset bases of regulated energy utilities is to update values with reference to actual costs incurred rather than to re-set regulatory values at a level that is consistent with the estimated cost structure of a hypothetical new entrant. Accordingly, the weight of practice in Australia and other jurisdictions supports the 'rolling forward' methodology rather than re-setting regulatory values at an estimate of the ODRC value.