

Depreciation of assets under the National Gas Rules

Expert report

APA

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1 Introduction and overview

1.1 Introduction

1.1.1 Terms of reference

I have been engaged by Gilbert&Tobin on behalf of APA, who is the owner/ operator of the Victorian declared gas transmission system, to prepare an expert report in relation to regulatory depreciation issues and, specifically, to answer the following questions:

1. *Is APA GasNet's proposed method for designing the depreciation schedule (as described in its access arrangement proposal) consistent with criterion (a) in rule 89(1)—that is, does APA GasNet's proposed method result in a depreciation schedule that is designed so that reference tariffs will vary, over time, in a way that promotes efficient growth in the market for reference services on the Victorian Transmission System?*
2. *Although not relevant under rule 89 of the National Gas Rules, which is a limited discretion rule, which of APA GasNet's and the AER's proposed methods for designing the depreciation schedule is more likely to provide for variation in reference tariffs over time in a way that promotes efficient growth in the market for reference services on the Victorian Transmission System?*

The full terms of reference are at Attachment A.

As context, I note that regulatory depreciation is the allowance included in the calculation of regulated prices for the return of capital to investors over the economic or useful life of the relevant asset or assets. For the 2013-2017 regulatory period, both APA and the AER propose to calculate this allowance by applying straight line depreciation, but differ in their views as to whether this depreciation method should be applied to the capital base without any form of inflation escalation applied, or whether straight line depreciation should be applied to a capital base that is escalated for a measure of general output price inflation (the consumer price index, CPI). APA prefers the former, whereas the AER concluded in the Draft Decision that the latter is required by the National Gas Rules. I note that there is no disagreement between the parties as to how each depreciation approach should be applied to calculate total revenue.¹

1.1.2 Qualifications and compliance with the Expert Guidelines

This report has been prepared by Jeff Balchin, Principal at PricewaterhouseCoopers. I have almost 20 years experience with the application of economic regulation to network businesses, having worked for policy makers, regulators, major customers and network owners across the gas, electricity and other infrastructure sectors in Australia and New Zealand. My full curriculum vitae is at Attachment B.

I have been assisted in the preparation of this report by Adam Rapoport.

¹ More specifically, if the capital base is escalated for inflation and a nominal rate of return is used, then the provider would be compensated twice for expected inflation. This is corrected for by removing the expected annual revaluation gain from the calculation of total revenue, which is performed in the AER's standard post tax revenue model. In contrast, if the capital base is not escalated for inflation, then such a correction is not required. As noted in the text, I understand that there is no disagreement between the parties as to the mechanics of the two calculations.

I confirm that I have read and am familiar with the Federal Court Guidelines for expert witnesses and agree to be bound by its contents.

1.1.3 Summary of findings

In my view, APA's proposed method for calculating the depreciation allowance is consistent with the relevant Rule, i.e. to provide for variation in reference tariffs over time in a way that promotes efficient growth in the market for reference services. In addition, I consider it more likely to do so than the method the AER has proposed.

I have assessed and compared the indexed and unindexed methods of depreciation. I have done this by considering which method better advances the objective of promoting efficient growth in the market, in light of the facts pertaining to APA GasNet.

From my review of economic principles, I conclude that:

- efficient growth in the market for reference services will be encouraged by setting higher reference tariffs during periods where capacity is constrained, and lower prices at other times, and
- if capacity constraints are assumed never to occur, or not to be pervasive,² efficient growth in the market for reference services will be encouraged by setting reference tariffs such that they are approximately constant in real terms over time.

I conclude that APA's proposed depreciation method meets each of these requirements, and better meets these principles than the alternative proposed by the AER. In particular:

- I understand that the VTS is subject to material capacity constraints, which suggests that reference tariffs should be maintained at current levels (or even raised) in the next period.
 - APA's proposed method results in prices that hold almost at their current level in the short term, thus meeting this principle.
 - In contrast, the AER's proposed method is projected to result in a substantial fall in reference tariffs in the next period, which is inconsistent with this principle.
- Even if the possibility or relevance of capacity constraints is ignored – and so the objective is for reference tariffs to be constant in real terms over time – I observe that the link between different depreciation methods and the time path of reference tariffs is an empirical one.
 - From the forecasts that APA has provided to me and my understanding of the future cost pressures on APA, I conclude that APA's proposed depreciation method is likely to result in reference tariffs being approximately constant over time. While APA's forecasts of reference tariffs under a business as usual scenario "drift" downwards over time, I consider this to be a prudent allowance for the potential for costs to rise in the future. Accordingly, I consider that APA's proposed depreciation method meets this principle.
 - In contrast, the AER's proposed depreciation method is forecast to produce a sharp initial reduction in reference tariffs, followed by reference tariffs that increase in real terms over time. Moreover, this increase in reference tariffs is

² By which I mean that different parts of the network may be constrained at different times.

likely to be understated given the factors identified that are likely to cause an increase in cost in the future. I therefore find that APA's depreciation method better meets this principle than the AER's.

1.1.4 Structure of the report

The remainder of the report is structured as follows.

- In section 2, I outline the relevant background to this matter and provide my opinion as to the meaning to an economist of the requirement for the depreciation allowance to provide for variation in reference tariffs over time in a way that promotes efficient growth in the market for reference services. This section also includes other relevant observations about the expected effect of using different depreciation methods.
- In section 3, I then apply the analytical framework developed in section 2 to the specific circumstances of the Victorian Transmission System (VTS) in addressing the questions of the ToR.

2 *What are the principles relevant to Rule 89(1)(a)?*

2.1 *Background*

2.1.1 *Positions of the parties*

Under the building block model, allowable revenues are set so that expected revenues will recover expected capital and operating costs. Capital expenditure, unlike operating expenditure, is, however, not recovered all at once but is returned to investors over the economic life of the assets created, as well as a return on the capital. Regulatory depreciation is the allowance made for the return of capital to investors over the economic or useful life of the asset.

There are several alternative methods for calculating regulatory depreciation. As is well understood, all of these methods (subject to some caveats regarding stranded asset risk) achieve the basic objective of providing for the expected return of capital to investors, meaning that the present value of the different estimates of total revenue are the same when measured over the life of the relevant assets. The differences between methods lie in how the recovery of capital is allocated over time, which in turn has a flow on implication for the time path of revenue and prices.

For the 2013-2017 regulatory period, both APA and the AER propose to apply straight line depreciation. However, while APA has proposed to apply this method to the capital base without any form of inflation escalation applied, the AER has proposed that the straight line depreciation method be applied to the capital base after it has been escalated for changes in the Consumer Price Index (CPI) over time. Given that the difference in view is about whether the capital base should be escalated (or indexed) for inflation, I refer to APA's position as supporting the unindexed method and to the AER's position as supporting the indexed method.

I observe that these different positions give rise to a different interpretation of the depreciation allowance:

- under APA's proposal, the cost of *each asset* is returned in equal portions each year over the economic life of the asset, whereas
- under the AER's preferred method, the cost of *each asset* is returned in equal portions each year in constant price (or inflation-adjusted) terms over the economic life of the asset.

These statements also highlight the fact that the methods of depreciation are applied to individual (or individual groups) of assets. I highlight this to distinguish this from the outcomes that are of most interest, which is the aggregate effect of the relevant depreciation method across all assets. This issue is expanded upon below.

I observe for completeness that neither of these depreciation methods is unusual. APA's preferred method is a standard approach for financial accounting, and I understand that it

has also been a standard method for setting regulated prices in North America for many decades and has been applied when setting regulated prices for another of APA's pipelines.³ Similarly, the AER's preferred method has emerged as the dominant method for arriving at depreciation allowances when setting regulated prices in the UK, Australia and more recently in New Zealand.

2.1.2 Effective differences between the two methods

I observe that, unless other adjustments or corrections are made, there are two key differences in the outcomes that are produced by the two methods.

- *Inflation protection* – the act of escalating the capital base for inflation, as applies under the AER's approach, provides a degree of insulation to the investors in the regulated business against inflation risk (that is, the risk that inflation is different than was forecast). This follows because, when the capital base is escalated for inflation, a high and unexpected rate of inflation will give rise to a higher capital base than otherwise, in turn flowing into higher prices than otherwise from the commencement of the next price review.⁴
- *Time path of revenue and prices* – subject to the regulated business not being exposed to non-trivial stranded asset risk, the regulatory depreciation method will change the timing of total revenue across regulatory periods without affecting the value of that revenue. When all else is held constant, a change from the indexed approach to the unindexed approach will mean that:
 - Total revenue – and hence reference tariffs – will be higher in the next access arrangement period than otherwise, and
 - As a consequence, total revenue – and hence reference tariffs – on average over all subsequent access arrangement periods will be lower than otherwise.

With respect to the first of these differences, I note that it is relatively straightforward to provide the same insulation from inflation risk under APA's preferred approach.⁵ Accordingly, the effect of inflation protection is not considered further in this report.

2.2 Principles for assessing consistency of a regulatory depreciation method with Rule 89(1)(a)

2.2.1 Requirements of the National Gas Rules

As noted above, I have been asked to assess whether APA's depreciation approach is "likely to provide for variation in reference tariffs over time in a way that promotes efficient growth in the market for reference service", which is the first of the criteria set out in Rule 89(1) of the NGR. I am then to provide my view as to whether APA's method is more likely to meet this criterion than is the AER's proposed depreciation approach.

³ This is the Goldfields Gas Pipeline in Western Australia. I note that the AER commented in its draft decision that "the AER is not aware of any regulators adopting the approach in APA GasNet's proposal" (AER, 2012, Draft Decision, p.177), which, in view of the discussion above, would appear to overstate the novelty of APA's proposal.

⁴ This is generally combined with inflation escalation of prices within the regulatory period (that is, CPI-X indexation), which provides insulation against risk within the regulatory period.

⁵ This involves adjusting the capital base for the difference between actual and forecast inflation after actual inflation values are known, rather than escalating the capital base for inflation. Thus, if the inflation forecast turns out to be correct, the capital base is not adjusted from its forecast value.

I now turn to the economic meaning of Rule 89(1)(a) of the NGR, before a discussion of the principles for an efficient path of prices.

2.2.2 Economic meaning of Rule 89(1)(a)

Prices and efficient use of the asset

Rule 89(1)(a) refers to the depreciation method to be compatible with promoting the “efficient growth in the market for reference services”. Starting first with the general concept of economic efficiency, I note that this is essentially a situation where society’s scarce resources are used in a manner that maximises their value to society. It is common to distinguish three different dimensions to economic efficiency, which are as follows:

- *allocative efficiency* – which means the right amount of the right type of the good or service is produced and consumed, so that the economy’s scarce resources cannot be reallocated in a manner that results in a higher valued bundle of outputs
- *productive efficiency* – which means that goods and services are produced at minimum cost, including that the least-cost combination of inputs (land, labour and capital) are employed
- *dynamic efficiency* – which means that allocative and productive efficiency continues to be achieved over time (often referred to as the continued achievement of static efficiency) as consumer tastes and technology changes, which includes both responding to external factors and applying effort to improve performance.

Of these dimensions to economic efficiency, the first – allocative efficiency – is most relevant to the choice between depreciation schedules. In a market economy with competition between firms, allocative efficiency is encouraged by:

- competition forcing firms to set prices in line with the cost of provision
- consumers having the freedom to choose which goods and services to consumer, and so doing so only where they value the good or service more than the price that is charged, and
- the consumption decisions of consumers then determining the profitability of the different goods and services (making those that are highly valued more profitable and the converse for lesser values goods and services), encouraging producers to alter production decisions to those that provide the greatest net benefit (value over cost) to consumers.

These forces create pressure for the “right” goods and services to be produced (and, in parallel, competition also provides pressure for these to be produced at least cost).

A similar set of forces can be applied or simulated for regulated infrastructure. In particular, by setting prices that “signal” to consumers the relative scarcity of the “resources” used to provide the regulated services, consumers are encouraged to consume only when their benefit exceeds cost. Moreover, by signalling to consumers the “resource” cost associated with their use of the asset in question, providers of regulated services can expand the capacity of the service to meet the growing demand confident in the knowledge that it would be efficient to do so. Prices that signal the resource cost associated with the use of an asset are often referred to by economists as signalling *efficient use* of the asset or a situation of *allocative efficiency*, noting that term “use” refers to all consumption decisions, including the question of whether to connect to the network as well as whether and how much to use the system at a particular time.

In my view, the reference in Rule 89(1)(a) to the depreciation method promoting “efficient growth in the market for reference services” means that the depreciation method should

result in prices that signal the resource cost of using the pipeline at any point in time, and so encourage the efficient use of the pipeline at all points in time.⁶ In my view, the fact that the Rule refers to efficient *growth* rather than *use* is not material – growth results when external factors (such as growth in the economy and population) cause use to increase, and so efficient growth over time can be said to be the product of efficient use at each point in time, and with this efficiency continuing in the face of these external factors.

Efficient prices, infrastructure services and depreciation

Turning to the question of the prices required to accurately signal the resource cost of using a regulated service at any point in time, one of the characteristics of infrastructure assets is that a substantial share of the cost of service provision are unaffected by the intensity of use of an asset. This results in the well acknowledged problem in public utility pricing that if a price is charged that reflects the cost of an additional unit of consumption – marginal cost – much of the cost of providing the service would be unrecovered. The response to this, at least where the regulated provider is privately owned and not a recipient of government subsidies, is that the fixed costs (which need to be recovered to ensure continued investment) should be spread across consumers at any point in time in a manner that has least effect on how they would be consumed compared to the situation where the consumer paid a price that is equal to marginal cost.⁷ In practice, a combination of tools is typically used to best achieve this outcome, one of which is to levy a fixed charge in addition to a charge on usage.

In parallel, much of the cost of providing and operating infrastructure services is also independent of its intensity of use in any period. This cost is therefore a fixed cost that needs to be spread *over time*. The implication of the same economic principles as those discussed above suggest that these costs should be allocated over time in a manner that least affects the pattern of usage compared to what would occur if prices were set at marginal cost. This has a direct link to the depreciation method as the depreciation method determines how costs are allocated over time, and so is the mechanism through which the efficient use of the reference service at each point in time – and hence, the efficient growth in the market for reference services – is achieved where the building block approach is used to determine total revenue and, thereby, the path that reference tariffs will take over time.

2.2.3 What is an efficient allocation of costs over time / an efficient time path for reference tariffs?

Simple case – no capacity constraints

A reasonably straightforward outcome for the time path of prices over time can be derived for the simplest of cases, namely where it is assumed that:

- the relevant infrastructure has sufficient capacity to meet all efficient usage for all time and marginal costs are constant, and
- the characteristics of consumers – and most notably, their price sensitivity – are not expected to change over time.

⁶ In the discussion below, I define “resource cost” as the marginal cost of using the asset. It follows that if an asset has spare capacity (as may be the case with a newly constructed pipeline that is built to supply a new and growing market) the “resource cost” would be very low.

⁷ This principle is part of the guidance for pricing for gas distributors – see Rule 94(5).

Under these assumptions, the efficient outcome for prices is that they be stable in real terms over the life of the infrastructure.⁸ The rationale for this outcome is as follows.

- The recovery of fixed costs in any period inevitably (under the restrictive assumptions set out above) will cause some users to reduce their use of the regulated infrastructure even though that use was efficient (in that the consumer valued use at more than marginal cost, i.e. the cost to provide those extra units). This recognises that, while techniques for minimising this inefficiency exist – such as setting fixed charges and other forms of multi-part pricing – these techniques are imperfect and thus some inefficiency (reduction of output below that which would emerge under marginal cost pricing) will remain.
- The inefficiency that is caused in any period from the recovery, via a mark-up, of fixed costs increases *more* than proportionally with the extent of fixed costs that are recovered through this mark-up. In fact, it is a well known outcome in economics that the inefficiency from pricing at a mark-up over marginal costs rises with the *square* of that mark-up.⁹
- The non-linear relationship between the inefficiency caused in any period and the increment over marginal cost means that the aggregate of inefficiencies over time will be minimised by setting prices that cause an equal mark-up over marginal costs in each period.¹⁰ This is the inter-temporal analogue of the well-known Ramsey rule for applying mark-ups across different products/customers at a point in time.¹¹ Under the assumption that customers over time have an equal elasticity, efficiency principles would dictate that an equal mark-up over marginal cost is required over time.

In other words, efficient pricing – both across products and across time (relevant to depreciation) – essentially entails devising tariffs that minimise the demand distortion that results from having to recover non-marginal costs through increases in price above marginal cost.¹²

I have reviewed the AER's reasoning in the draft decision, and it would appear to endorse this reasoning in recognising the linkage between efficient use of an asset, its price, and the depreciation method adopted:

The AER considers that APA GasNet's approach is likely to lead to inefficient growth of the market if it unnecessarily discourages demand early in an asset's life (due to

⁸ This is consistent with the economics literature. For example, this result was obtained by Burness, H, Patrick, R (1992), 'Optimal Depreciation, Payments to Capital, and Natural Monopoly Regulation', *Journal of Regulatory Economics*, Vol 4, for the simplest case where demand and cost were stationary over time, who observed in footnote 13 "this stationary case is analogous to Baumol (1971), Brennan (1991), Panzar (1986), and Greenwald (1984), among others, in that consumer expenditures are smoothed over time."

⁹ One of the seminal papers in this areas is Harberger, A., The measurement of waste, *American Economic Review*, May 1964a, 54(3), 58-76. A paper reviewing Harberger noted, in the context of the similar issue of excise taxes: "[h]e went on to make [the] trenchant observation ... that the area of [the] welfare loss triangle is generally a function of the square of the tax rate." Hines, J., "Three sides of Harberger Triangles", <http://www.nber.org/papers/w6852.pdf>.

¹⁰ A simple example will illustrate this. Assume that there is a fixed cost of 10 that needs to be recovered, there are two periods and the inefficiency in any period is equal to the square of the fixed cost that is recovered. If all of the fixed cost is recovered in one period, then the inefficiency will be 100 (10^2), whereas if the fixed cost is allocated one quarter in one period and three quarters in the next, the inefficiency will be 62.5 ($2.5^2 + 7.5^2$), whereas if the fixed cost is split evenly between the periods the inefficiency will be 50 ($5^2 + 5^2$).

¹¹ Ramsey pricing minimises demand distortions by applying mark-ups to product prices in inverse proportion to each product's demand elasticity.

¹² A further merit of a stable price path over time (assuming no capacity constraints) is that it provides more certainty for consumers of the facility in relation to sunk investments that they may make (that is, investments whose subsequent value is contingent on the price of gas).

the relatively higher prices at this time) and then encourages greater use near the end of its life (due to relatively lower prices).

Having said that, I note that there are two further issues with applying the above logic that would appear to have been overlooked by the AER.

First, the reasoning above that led to the prediction that efficient use requires prices to be approximately level in real terms over time is based upon a series of restrictive assumptions, the most relevant of which for the VTS (in that the facts suggest it is incorrect) is that there is sufficient capacity to serve demand at all times.

Secondly, the link between prices and the selected depreciation method is unlikely to be straightforward in practice. Much of the analysis of depreciation methods in the economic literature focuses on the effect of applying the relevant method to single assets, and the AER has adopted a similar assumption when assessing the situation of the VTS. However, regulated utilities typically have a portfolio of assets of different vintages, and face material ongoing capital expenditure requirements. In this case, the time path for prices that is caused by a particular depreciation method is a function of the aggregate effect of that depreciation method across the portfolio of assets and in view of future capital expenditure needs.

These two issues are discussed in turn below.

Efficient pricing and capacity constraints

As discussed above, the efficient price for the use of any facility is one that reflects the marginal cost. As implied by the discussion above, this is typically very low while the facility has surplus capacity. However, once capacity constraints are approached, the marginal cost of provision increases and reflects the value of the service to the marginal user during congestion¹³.

It follows that, if capacity constraints are expected to occur and be pervasive across the relevant infrastructure,¹⁴ then, for efficiency, prices should no longer be approximately constant in real terms over time. Rather prices should *rise in times of constraints* (following marginal cost) in addition to bearing the equalised share of fixed costs. Conversely, prices should be commensurately *lower at times of low system utilisation*. Thus, a depreciation method that had the effect of increasing prices at the time of capacity constraints should be preferred.¹⁵

A clear corollary of this is that a reduction of prices at the time of capacity constraints cannot increase allocative efficiency, but rather may well reduce allocative efficiency. The logic behind this proposition is as follows.

- An allocative efficiency gain can only arise where a reduction in prices induces additional usage of the facility.¹⁶ If the asset is already at capacity, then such an

¹³ More specifically, the marginal cost in this context captures the cost of congestion, which can be understood as the lost consumer surplus from some consumers not able to be served.

¹⁴ If constraints are predominately localised and occurring at different times, then efficient pricing may well be achieved by a constant average price over time, but with some areas being charged a higher price (where there are local constraints) while others were charged a lower price.

¹⁵ The idea that more fixed costs should be recovered at the times of congestion is recognised in the economics literature – see, for example: Baumol, W (1971), ‘Optimal Depreciation Policy: Pricing the Products of Durable Assets’, *The Bell Journal Economics and Management Science*, Vol 2, pp.645. Baumol aptly captures the intuition: “*The irrationality of a depreciation policy that demands the same contribution toward the cost of an asset in periods of heavy and of light usage is not too dissimilar in character from the curious commuter discounts which, in effect, make it cheapest to travel through tunnels or over bridges precisely at the times of day when they are most crowded. Both practices simply serve to compound the congestion and contribute nothing toward increased utilization at times when unused capacity is available.*”

¹⁶ The value of the allocative efficiency gain from reducing the mark-up over marginal cost is given by the product of the additional demand that is induced and the net economic value (i.e., the value of consumption in excess of marginal cost) of the induced

inducement of use is impossible. Thus, there is no efficiency gain during the period in which the prices are reduced.

- However, if prices are reduced at a time of constraints, then there must be a commensurate increase in prices in some future period, at which time the capacity constraints may well be remedied. If higher prices had to be charged at times where there was surplus capacity on the relevant infrastructure, then an additional allocative efficiency loss would be created in that future period, for the reasons provided earlier.
- Thus, reducing prices at a time of capacity constraints would not raise allocative efficiency in the short term, but could reduce efficiency in subsequent periods, with the net effect a decline in allocative efficiency.

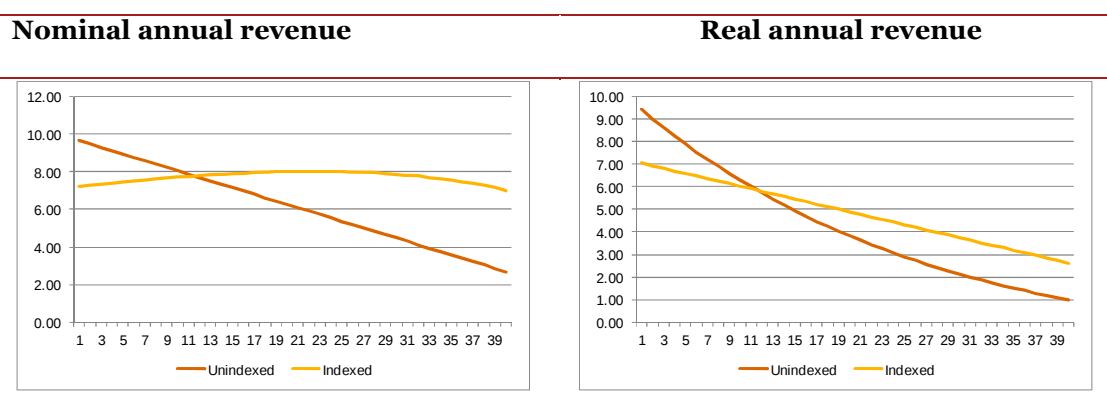
Allocatively efficient pricing is not an arbitrary or arcane concept: it is logical to attempt to set prices that ration demand when capacity constraints exist and by so doing to provide the scope to reduce prices when capacity is in surplus, while recovering costs overall. Thus, where constraints are emerging, rather than lowering prices, efficiency would instead be increased by keeping prices at their current levels – or even increasing them where required to limit demand to the available capacity. The implications for the depreciation method are clear – under these circumstances, it would be sensible to seek a depreciation method that achieved this end, rather than one that led to an untimely reduction in prices

These observations are very relevant to the case of the VTS in view of the fact that it is facing capacity constraints and, in contrast to the apparent assumption of the AER in the relevant section in the draft decision, the effect of the draft decision would be to reduce prices materially. This matter is discussed further in section 4.

Link between the depreciation method and the time path of prices

Single asset

The implication of different depreciation methods for the time path of prices is straightforward if it is assumed that the business is comprised of a single asset. Figure 1 – which illustrates the time path of the capital-related portion of total revenue – demonstrates this.¹⁷



consumption (noting that each additional unit of consumption would be expected to generate a progressively lower net economic value). Thus, if there is no induced demand from reducing prices – which is necessarily the case for an asset that is fully used – then there cannot be an improvement in allocative efficiency.

¹⁷ This assumes a life of 60 years, initial capital base of 100 and a regulatory WACC and inflation forecast from the AER's draft decision.

This figure is materially the same as the AER's Figure 5.1, with the differences arising from our different assumptions about the life of the relevant asset.

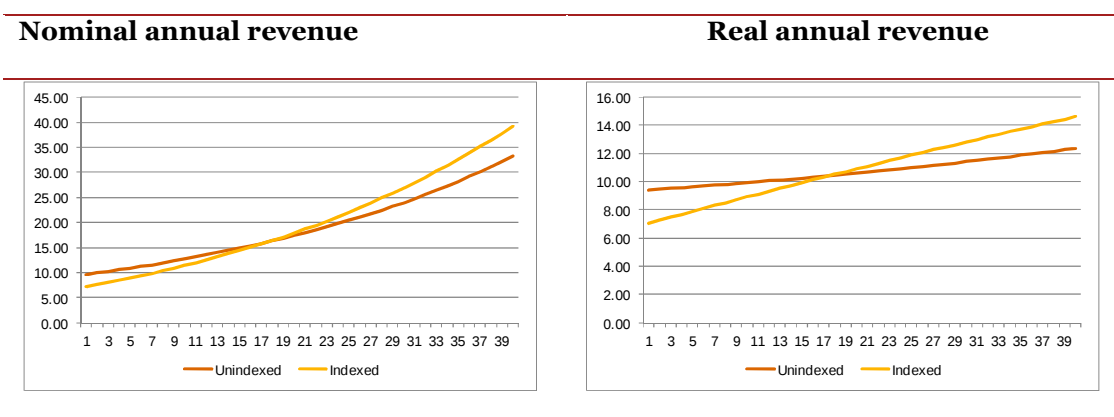
Portfolio of assets

However, as noted above, the effect of different depreciation methods on the price over time depends on the aggregate effect of that method across all of the assets, and the effect of new expenditure, which is an empirical question.

Having said that, I note that it is not difficult to derive plausible scenarios under which the unindexed depreciation method would deliver a flatter profile of revenue over time. The figures below assume the following:¹⁸

- an opening capital base of 100 with a remaining life of 40 years
- a life of 60 years for capital expenditure, and
- a regulatory WACC and inflation forecast equal to those from the AER's draft decision.

The first scenario assumes a material **ongoing capital expenditure** program, which has been assumed to equate to 5 per cent of the starting regulatory asset base, but growing with an assumed inflation of input prices of 3.5 per cent per annum (i.e., 1 per cent real growth in input prices).

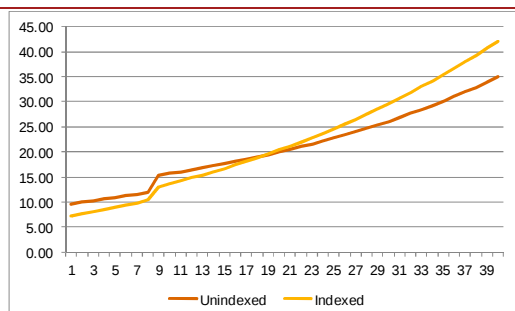


Under these assumptions, both of these methods produce rising revenue over time, but with the unindexed method producing a flatter stream of revenue. As discussed above, a flatter stream of revenue is more efficient and hence more desirable, under the circumstances where there are no capacity constraints.

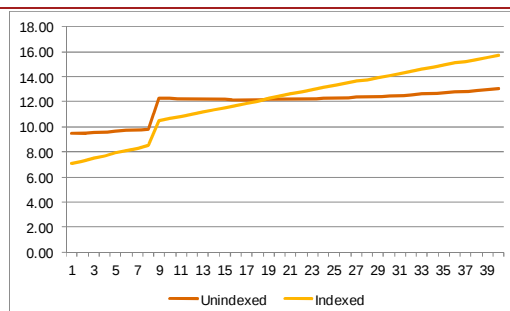
The second scenario below assumes that the ongoing capital expenditure assumed above is maintained, and in addition a **substantial lump of capital expenditure** part way through the second regulatory period (occurring in year 8, and so entering into prices in year 9), takes place. An addition of 33 has been assumed, which is approximately 25 per cent of the original capital base value adjusted for input price inflation.

¹⁸ I also draw attention to the annual revenue amounts rather than to prices, and so implicitly ignore the effect on prices of demand growth. I do this because if material load growth is forecast to be sustained over the long term, then it is necessary to include a forecast of the cost of the augmentations required to serve that demand in the analysis, including the point at which duplication of major components of the infrastructure is required. Ignoring the effect of demand growth is equivalent to assuming that the incremental cost of serving new demand growth is approximately equal to average (embedded) cost, which I consider to be a not unreasonable assumption for a mature piece of infrastructure like the VTS.

Nominal annual revenue



Real annual revenue



Again, a similar pattern to the previous scenario is observed, where both methods imply rising annual revenue, but with the unindexed approach delivering a flatter profile of revenue over time. Two further observations can be made.

- First, where prices are set for a term of five years, prices are naturally smoothed within this time. It follows that the more appropriate test of how prices are expected to change over time is to observe how the present value of revenue in each five year period is expected to change. On this measure, the unindexed method is clearly superior – the present value of the second five year period is 12 per cent higher than in the first five year period, whereas the indexed method produces almost double this at 23 per cent.
- Secondly, from observation, it is clear that the unindexed method also produces a much flatter stream of revenue over the longer term than the indexed method. This would suggest that the best approach for dealing with an impending lump of capital expenditure is to increase the rate of depreciation prior to the step-up occurring, in effect “digging a hole” in the capital base in order to make room for (or reduce the effect of) the lump.¹⁹

One of the important questions in relation to the VTS, therefore, is what are the future prospects for expenditure, which is considered in section 3. It is acknowledged that, when scenarios of future expenditure are considered, there will always be uncertainty. However, as the AER has conceded, increasing the rate of depreciation will not provide the service provider with a more valuable revenue stream, rather it will just provide it with that revenue stream earlier. It follows that if there are emerging risks of a future upswing in expenditure needs – such as increased capital investment or a step increase in the cost of capital, as discussed in section 3 – the scope exists to use depreciation to reduce the risk of a future increase in prices without creating a windfall gain to the service provider.

¹⁹ It may be the case that if the lump of capital expenditure is sufficiently large, a short term increase in prices may be caused even if a “hole” had been created. Under this circumstance, the optimal depreciation method is likely to be to increase the rate of capital recovery prior to the lump occurring, but then to reduce the rate of capital recovery after the lump has occurred. I observe that there is nothing in the NGR that preclude the depreciation method from being reviewed again in the future. Rather, the guidance discussed in this report would appear to assume that the method is able to change in response to the changing circumstances of the relevant regulated pipeline.

3 *Application to the case of APA GasNet*

In this section, I apply the principles derived in the previous chapter to the assessment of whether APA's proposed depreciation methods provides for variation in reference tariffs over time in a way that promotes efficient growth in the market for reference services. I also apply the same principles to assess the question (not relevant under the Rules) of whether APA's method would be more likely to meet these principles than would the AER's method. Given the overlap of these two issues, and the utility in comparing the methods as a means of generating insights and conclusions, I address these issues jointly in the discussion.

The discussion in the previous chapter noted that the question of whether a particular depreciation method was consistent with the efficient growth in the market depended on the extent to which that depreciation method would lead to a price that encouraged the optimal use of the asset at any point in time. However, a general message from the discussion was that the impact of a particular depreciation method on the efficiency of the reference tariffs is complex and in large part an empirical issue. In particular it was noted that:

- the objective for prices – that is, the matter of what reference tariff is required to encourage efficient use – depends upon the facts of the particular situation, principally whether capacity constraints are being experienced or expected, and
- the link between the depreciation method and the time path of reference tariffs over the longer term is also an empirical question, depending, amongst other things, on expected future expenditure needs and the likely future trajectory of the regulatory rate of return.

Accordingly, in this chapter, I address the two matters above, namely:

- whether factors exist for APA that have a particular impact on the efficient level for reference tariffs over the next access arrangement period, focussing on the question of whether capacity constraints are expected to be material, and
- the expected effect of each of the depreciation methods on the level of reference tariffs over time, taking into account:
 - expected future expenditure,
 - expected movement in the WACC, and
 - other factors that are expected to affect future expenditure needs and hence the expected time path of reference tariffs under each option.

3.1 *Factors that affect the efficient level for reference tariffs*

The discussion in the previous chapter highlighted that the assessment of whether a path of prices is efficient cannot be made in the abstract. A stable path of prices is efficient where the capacity of the facility is not constrained, since marginal costs are even across time. Conversely, where there are capacity constraints, marginal costs increase (due to congestion), and therefore prices should rise accordingly – and certainly not fall, which would exacerbate the congestion and place further pressure on the facility. The existence or otherwise of capacity constraints on the VTS is therefore critical to the assessment of

whether and to what extent the AER's or APA's price paths promote efficient growth in the market for reference services.

Thus, in this section I first set out the relevant factual circumstances, particularly whether the VTS is capacity constrained. I then look at the price paths implied by the AER's and APA's proposed depreciation methods. In light of the framework laid out in the previous chapter and in light of the factual circumstances, I then assess whether these price paths are efficient.

3.1.1 Circumstances of the VTS: capacity constraints

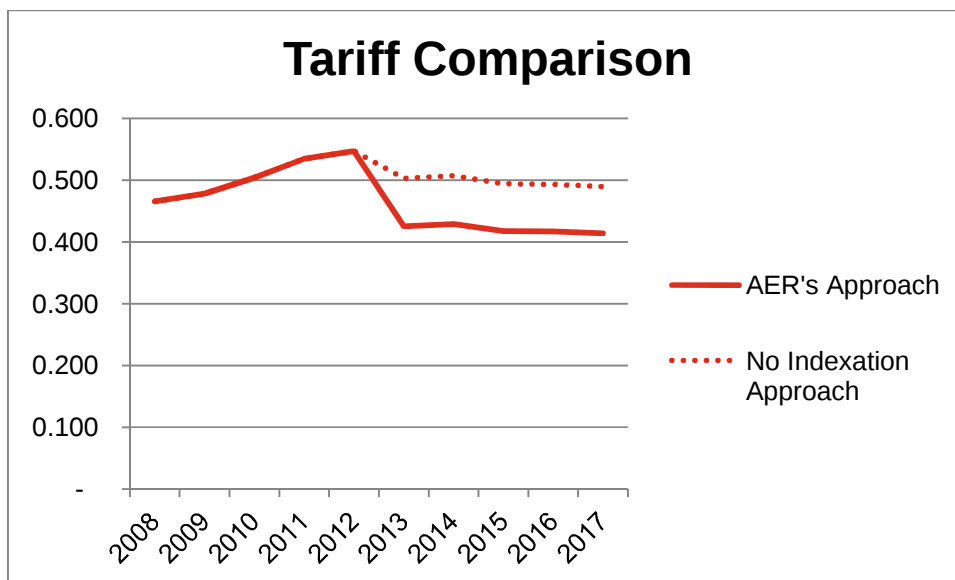
It is my understanding that the VTS pipeline is nearing or at capacity in at least one major location. That is to say, in these locations, the pipeline is fully utilised at times of peak demand, although spare capacity exists at off-peak times.

In particular, AEMO reports²⁰ that the VTS is constrained in the Melbourne and Geelong Zones, noting that there is "insufficient South West Pipeline capacity" on a 5-year outlook and "insufficient system capacity" on a 10-year outlook. It also noted capacity constraints in the Gippsland zone on a 10 year outlook.

In light of my understanding with respect to these capacity constraints, I now consider the price paths generated by the alternative depreciation methods.

3.1.2 Analysis

The chart below shows indicative reference tariffs²¹ (nominal and based on smoothed revenues) over the AA4 period under each of the AER's and APA's methods of depreciation. The method that is referred to as the "AER's Approach" prior to 2013 is the actual depreciation method that has been used to determine prices. The chart otherwise adopts all of the figures that were set out in the AER draft decision (including the rate of return).



It can be observed that, under the indexed approach, reference tariffs are projected to fall substantially from 1 January 2013 in nominal terms, with the reduction after accounting for

²⁰ AEMO, Table 5-2 — Gas DTS constraint summary, 2012 Victorian Annual Planning Report.

²¹ In this section, tariff paths are compared based on indicative tariffs for the VTS as a whole. I note that this is the comparison used by the AER in its Draft Decision (for example Figure 1 on page 1 of Part 1 of the Draft Decision).

inflation even larger. In contrast, the unindexed approach leads to a level of reference tariffs from 2013 that is only modestly lower than it was at the end of the current access arrangement period.

As discussed in the previous chapter and above, to the extent that a network is or is close to capacity, efficiency would require prices to rise, in order to follow marginal cost (as well as continuing to bear the equalised share of fixed costs), in turn permitting prices to be lower at times of low system utilisation and so encouraging additional use when capacity is in surplus. Given my understanding that material parts of the VTS system are approaching capacity constraints, the efficient price for the next access arrangement period would be one that is at least maintained in real terms. Conversely, it would be inefficient to reduce prices for the next access arrangement period – to do so would only exacerbate congestion and leave more of the fixed cost to be recovered when surplus capacity is likely to exist.

Turning to the two proposals:

- I observe that APA's proposed depreciation method generates indicative reference tariffs for the period from 2013 that are approximately the same as the current price level. In view of my understanding that there are capacity constraints on material components of the VTS, the outcome whereby tariffs are maintained at the same level (and not permitted to fall) would be consistent with encouraging efficient use of the VTS, and so would meet criterion (a). Indeed given capacity constraints, an approach which provided for *increasing* tariffs would also meet criterion (a) in this context.
- In contrast, the AER's proposed depreciation method would deliver a substantial reduction in the indicative reference tariff. In view of my understanding that there are capacity constraints on material components of the VTS, this outcome is at odds with allocative efficiency. That is, such a reduction in tariffs would not increase allocative efficiency in the next access arrangement period, and be likely to reduce allocative efficiency in future periods. Thus, I view the AER's approach as not consistent with criterion (a).

It logically follows from my two findings above that I consider APA's depreciation method to be more likely than the AER's method to be consistent with criterion (a).

3.2 Link between the depreciation method and the time path of prices

If the possibility of capacity constraints on the VTS and their implications for prices were ignored, then the discussion in the previous chapter concluded that the efficient use of the pipeline would be encouraged by setting a path of prices over time that remains more level (or constant) in real terms, with minimal step changes or 'price shocks'.

However, that chapter also indicated that the long term price path that is generated by a given depreciation method will be sensitive to the specific factual circumstances of the facility, particularly where the "asset" in question comprises a portfolio of assets with a range of vintages, and there where is material ongoing capital expenditure and likely future cost pressures. I also showed through the use of scenarios that a faster rate of depreciation (as is provided by using the unindexed method rather than the indexed method) can produce prices that are more constant over time where there is a material ongoing capital expenditure requirement, and that applying a faster rate of depreciation in the short term is sensible where a material lump of future expenditure or other upward pressure on cost (such as an increase in the future rate of return) is expected – in effect "digging a hole" in which to absorb that future expenditure or other pressure on cost.

This section first sets out four forecasts of future reference tariffs that APA has provided me that reflect different scenarios about the future expenditure requirements and the rate of return, with the results provided for the different depreciation methods. I then discuss some

of the other factors that may cause pressure on cost in the future that have not been taken into account in these forecasts.

3.2.1 20 year reference tariff forecasts – business as usual assumption

APA has provided me with four sets of forecasts for the reference tariff over the 20 years commencing with 2013, with the results provided for both the indexed and unindexed methods.

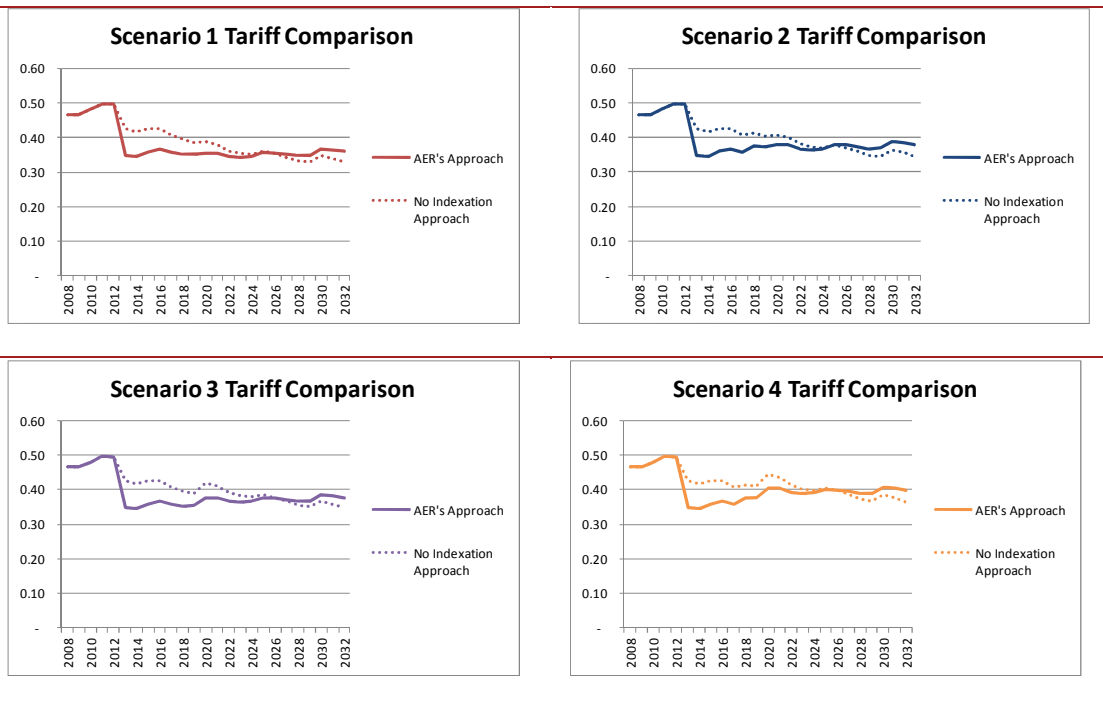
I am informed that the expenditure forecasts that are built into the reference tariffs reflect an assumption that the current operating environment for the VTS continues into the future meaning that, amongst other things, there is no change to safety requirements and the cost of future augmentations is not adversely affected by further urban encroachment. These factors are discussed separately below.

The four scenarios for which reference tariffs have been produced can be summarised as follows:

- *Scenario 1* – base case scenario, which includes that the regulatory rate of return set out in the AER’s draft decision applies for the 20 year period
- *Scenario 2* – assumes that the regulatory rate of return increases from 2018 onwards as the risk free rate used in the estimate of the cost of equity returns to levels more consistent with a conservative expectation of the future yield on 10 year bonds
- *Scenario 3* – assumes that the WORM project is undertaken, which is primarily a project to maintain system security in the face of growing demand and the changing source of gas production
- *Scenario 4* – is a combination of scenarios 2 and 3, and assumes a higher rate of return and that the WORM project is undertaken.

The rationales for scenarios 2 and 3 (and therefore 4) are explained in Box 1 below. The forecasts of reference tariffs under these four scenarios are set out below.²²

²² APA produced the forecasts of their reference tariffs in nominal terms. I converted those forecasts to constant price (real) terms using an assumed inflation rate of 2.5 per cent per annum, and using 2008 as the base year.



I draw the following observations from these forecasts.

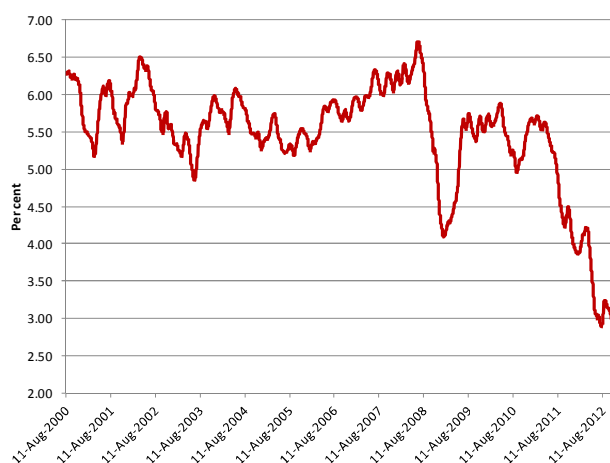
- In all cases, the AER's depreciation method produces a sharp fall in reference tariffs in the short term, whereas APA's method produces reference tariffs that are forecast to fall in real terms but by a much lesser extent.
- The pattern over the longer term depends on the assumption that is made about whether the WORM project occurs and the expected future rate of return. I consider the most realistic scenario is scenario 4 in view of the AER's positive comments about the WORM project and my own views about the likely trajectory of future government bond rates. In this scenario, the AER's depreciation method is forecast to produce a sharp reduction in reference tariffs in the short term, but with reference tariffs then increasing again in the medium to long term. In contrast, APA's preferred depreciation method results in a reasonably stable time path for reference tariffs, albeit with a modest downward "drift" in tariffs forecast.

It is emphasised here, however, that these forecasts do not account for a number of possible future pressures on expenditure needs, which are discussed next.

Box 1 Rationale for the higher long term rate of return

Rate of return in the medium to long term

The risk free rate of return (for which the 10 year Commonwealth Government security was employed) that was used as an input into the regulatory rate of return was 2.98 per cent. I observe that this rate is anomalously low compared to the rate observed over the period since 2000, as shown in the following chart (the figures shown are the 20 day moving average of the 10 year risk free rate calculated using the AER's standard method).



Given the anomalously low level of the current rate compared to the historically observed values, I consider it reasonable to assume that the risk free rate of return will increase in future regulatory periods. I also observe that other independent forecasts have forecast an increase in the 10 year Commonwealth Government bond rate, including:

- BIS Shrapnel, whose average long term view of this rate between financial years 2017 to 2027 is 5.1%.²³
- Oxford Economics, who was quoted in an Independent Expert Report by KPMG as forecasting the yield on 10 year Commonwealth Government Bonds to approximate 5.1 per cent from 2016 onwards.²⁴

For the purpose of modelling an increase in the rate of return, I asked APA to assume a (nominal) risk free rate of 5 per cent and to apply this to the estimate of the cost of equity component only from 2018 onwards (that is, with the cost of debt retained at 6.74 per cent). This implied a rate of return (nominal, vanilla WACC terms) of 7.93 per cent for the period from 2018.

²³ BIS Shrapnel Long Term Forecasts, October 2012.

²⁴ Oxford Economics Country Economic Forecast, 31 August 2012, quoted in KPMG, Independent Experts Report in relation to Consolidated Media Holdings Ltd, 24 September 2012, p.92. I have sighted the KPMG report, but not the Oxford Economics report to which it refers.

Box 2 Rationale for the WORM project

I understand that APA expects to spend material sums in future periods to maintain the pre-existing security of gas supply in Victoria. This principally means adding additional pipeline capacity to allow supply from suppliers other than the dominant Longford supply. This is facilitated by the proposed Western Outer Ring Main (WORM) project. This project is intended to reduce exposure to loss of supply from major gas plant (especially Longford), but will also facilitate incremental capacity of the pipelines between Iona, Melbourne and Culcairn. According to APA's business case for the WORM project:

the study has demonstrated that the VTS, in its current configuration, has an unacceptable level of security of supply in the event of a major gas plant outage at Longford. In short, an outage at Longford of the scope and duration as has been seen in the last decade would lead to forced curtailment of domestic customers in both shoulder and winter periods

It is worth noting that the primary purpose and benefit of the WORM project is maintenance of security of supply rather to add significant extra capacity, although some additional capacity will be added. As noted in the business case:

In summary, the WORM project provides the greatest benefit to security of supply and provision for long term growth than all other options. Currently, the WORM pipeline between Plumpton and Wollert is the missing interconnection to the configuration of the VTS, which remove the constraining section around Melbourne and unlocks the available gas from Iona...

While the main justification for the WORM is for security of supply, the WORM does provide capacity for the VTS for future growth.

It is worth noting that while the AER did not accept the majority of the WORM-related expenditure for the forthcoming regulatory period, it was positive towards its justification in future periods:²⁵

In not accepting the majority of proposed capex for the WORM project, the AER has not concluded that the WORM project might not, in the future, prove to be a prudent response to the augmentation needs of the VTS in the longer term. The AER's technical consultant and AEMO have confirmed that the completion of the outer ring main around Melbourne has merit from a technical perspective.

I believe it is reasonable, therefore, to assume that it is likely that the WORM project will occur in a future period.

3.2.2 Further factors affecting the future level of prices

In addition to the factors mentioned, there are additional factors that could influence the cost associated with providing transmission services through the VTS in the future, and thereby the long term path for reference tariffs.

First, it is my understanding that the cost of augmenting the pipeline in the future is expected to be much higher cost than in the past. This expected increasing trend in cost reflects numerous pressures, including:

- that cheaper augmentation options have been employed in the past;

²⁵ AER Draft Decision, Part 2, p.47

- urban encroachment along pipeline easements means that some of the cheaper augmentation options are no longer available, and
- materials prices have increased materially over recent years driven by, amongst other things, the rise in the price of steel.

In addition, I understand there to be a risk that the safety requirements imposed upon APA are likely to increase over time, and that this will add materially to cost in the future. These increasing safety requirements are expected as a result of the increasing urban encroachment around major pipelines. I observe that safety requirements in all industries tend to increase over time as economies grow wealthier and are happy to trade-off a higher cost for products in return for greater safety standards.

These factors, if realised, would be expected to lead to reference tariffs that rise more quickly over time than reflected in the previous charts. The implications of this are discussed in the next section.

3.2.3 Analysis

If the objective was taken as setting a reference tariff that was as constant as possible (in real terms) – meaning that the importance of capacity constraints are set aside – then the evidence suggests that this objective would be more likely to be met for the VTS from APA’s proposed depreciation method. In particular, I note that:

- under the scenario that assumes no change to APA’s operating environment, APA’s proposed method is forecast to lead to reference tariffs that are reasonably constant in real terms, albeit with a slight downward drift, and
- given that there is a range of factors that may cause APA’s expenditure requirements to increase in the future compared to the business as usual forecasts, the projected slight downward drift in reference tariffs is desirable as it would leave a capacity to absorb these cost pressures and thereby ameliorate the effect on reference tariffs.

I therefore conclude that even if the possibility of capacity constraints were ignored, APA’s proposed depreciation method would meet criterion (a) of rule 89(1).

In contrast, the AER’s preferred method:

- under the scenario in which there is no change to APA’s operating environment, is forecast to result in a sharp reduction in reference tariffs in the short term, followed by a gradual rise in the medium to long term, and
- the range of factors that may cause APA’s expenditure requirements to increase in the future compared to the business as usual forecasts would exacerbate this forecast future increase in reference tariffs.

I therefore conclude that APA’s proposed depreciation method better meets criterion (a) of rule 89(1).

Attachment A: Terms of Reference

We are seeking a report from you, setting out your expert opinion in relation to the following matters:

- 1 Is APA GasNet's proposed method for designing the depreciation schedule (as described in its access arrangement proposal) consistent with criterion (a) in rule 89(1)—that is, does APA GasNet's proposed method result in a depreciation schedule that is designed so that reference tariffs will vary, over time, in a way that promotes efficient growth in the market for reference services on the Victorian Transmission System?
- 2 Although not relevant under rule 89 of the National Gas Rules, which is a limited discretion rule, which of APA GasNet's and the AER's proposed methods for designing the depreciation schedule is more likely to provide for variation in reference tariffs over time in a way that promotes efficient growth in the market for reference services on the Victorian Transmission System?

Your responses to each of the above questions should be based on your expertise as an economist, the information contained in the Draft Decision and APA GasNet's access arrangement proposal, and the additional information provided by us (set out below and attached).

Attachment B: Jeff Balchin CV

Jeff Balchin - Principal at PwC (Economics)

Summary of Experience

Jeff is an economist in the PwC Economics and Policy team. Jeff has almost 20 years of experience in relation to economic regulation issues across the electricity, gas and airports sectors in Australia and New Zealand and experience in relation to water, post and telecommunications. He has advised governments, regulators and major corporations on issues including the development of regulatory frameworks, regulatory price reviews, licensing and franchise bidding and market design. Jeff has also undertaken a number of expert witness assignments. His particular specialities have been on the application of finance principles to economic regulation, the design of tariff structures, the design of incentive compatible regulation and the drafting and economic interpretation of regulatory instruments.

In addition, Jeff has led a number of analytical assignments for firms to understand the responsiveness of consumers to changes to prices or other factors (like promotional activities) and to use this information to inform pricing strategy.

His experience is outlined below in more detail.

Qualifications

- B.Ec. (Hons.) at the University of Adelaide (First Class Honours)
- CEDA National Prize for Economic Development

Previous Experience

Prior joining PricewaterhouseCoopers, Jeff was a Director with the Allen Consulting Group and prior to becoming a consultant, Jeff held a number of policy positions in the Commonwealth Government.

- Commonwealth representative on the secretariat of the Gas Reform Task Force (1995-1996) - Played a lead role in the development of a National Code for third party access to gas transportation systems, with a particular focus on market regulation and pricing.
- Infrastructure, Resources and Environment Division, Department of the Prime Minister and Cabinet (1994-1995) - Played a key role in the creation of the Gas Reform Task Force (a body charged with implementing national gas reform that reports to the Heads of Government). During this time he also had responsibility for advising on primary industries, petroleum and mining industry issues, infrastructure issues, government business enterprise reform and privatisation issues.
- Structural Policy Division, Department of the Treasury (1992-94). Worked on environment policy issues in the lead up to the UN Conference on Environment and Development at Rio de Janeiro, as well as electricity and gas reform issues.

Experience – Economic Regulation of Price and Service:

Periodic Price Reviews – Major Roles for Regulators

- **ACT regulated retail electricity price review (Client: Independent Competition and Regulatory Commission, ACT, 2009)** – Directing a team that is developing a method to derive a benchmark cost of purchasing wholesale electricity for a retail business that is subject to a regulated price but exposed to competition.
- **South Australian default gas retail price review (Client: the Essential Services Commission, SA, 2007-2008)** - Directed a team that derived estimates of the benchmark operating costs for a gas retailer and the margin that should be allowed. This latter exercise included a bottom-up estimate of the financing costs incurred by a gas retail business.
- **South Australian default electricity retail price review (Client: the Essential Services Commission, SA, 2007)** -Directed a team that estimated the wholesale electricity purchase cost for the default electricity retail supplier in South Australia. The project involved the development of a model for deriving an optimal portfolio of hedging contracts for a prudent and efficient retailer, and the estimate of the expected cost incurred with that portfolio. Applying the principles of modern finance theory to resolve issues of how the compensation for certain risk should be quantified was also a central part of the project.
- **South Australian default gas retail price review (Client: the Essential Services Commission, SA, 2005)** - As part of a team, advised the regulator on the cost of purchasing gas transmission services for a prudent and efficient SA gas retailer, where the transmission options included the use of the Moomba Adelaide Pipeline and SEAGas Pipeline, connecting a number of gas production sources.
- **Victorian Gas Distribution Price Review (Client: the Essential Services Commission, Vic, 2006 2008)** - Provided advice to the Essential Service Commission in relation to its review of gas distribution access arrangements on the treatment of outsourcing arrangements, finance issues, incentive design and other economic issues.
- **Envestra Gas Distribution Price Review (Client: the Essential Services Commission, SA, 2006)** - Provided advice on several finance related issues (including 'return on assets' issues and the financial effect of Envestra's invoicing policy), and the treatment of major outsourcing contracts when setting regulated charges.
- **Victorian Electricity Distribution Price Review (Client: the Essential Services Commission, Vic, 2003 2005)** - Provided advice to the Essential Service Commission on a range of economic issues related to current review of electricity distribution charges, including issues related to finance, forecasting of expenditure and the design of incentive arrangements for productive efficiency and service delivery. Was a member of the Steering Committee advising on strategic regulatory issues.
- **Victorian Water Price Review (Client: the Essential Services Commission, Vic, 2003 2005)** - Provided advice to the Essential Services Commission on the issues associated with extending economic regulation to the various elements of the Victorian water sector. Was a member of the Steering Committee advising on strategic regulatory issues, and also provided advice on specific issues, most notably the determination of the initial regulatory values for the water businesses and the role of developer charges.
- **ETSA Electricity Distribution Price Review (Client: the Essential Services Commission, SA, 2002 2005)** - Provided advice on the 'return on assets' issues

associated with the review of ETSA's regulated distribution charges, including the preparation of consultation papers. The issues covered include the valuation of assets for regulatory purposes and cost of capital issues. Also engaged as a quality assurance adviser on other consultation papers produced as part of the price review.

- **Victorian Gas Distribution Price Review (Client: the Essential Services Commission, Vic, 2001 2002)** - Economic adviser to the Essential Services Commission during its assessment of the price caps and other terms and conditions of access for the three Victorian gas distributors. Was responsible for all issues associated with capital financing (including analysis of the cost of capital and assessment of risk generally, and asset valuation), and supervised the financial modelling and derivation of regulated charges. Also advised on a number of other issues, including the design of incentive arrangements, the form of regulation for extensions to unreticulated townships, and the principles for determining charges for new customers connecting to the system. Represented the Commission at numerous public forums during the course of the review, and was the principal author of the finance related and other relevant sections of the four consultation papers and the draft and final decisions.
- **ETSA Electricity Distribution Price Review (Client: the South Australian Independent Industry Regulator, 2000 2001)** - As part of a team, prepared a series of reports proposing a framework for the review. The particular focus was on the design of incentives to encourage cost reduction and service improvement, and how such incentives can assist the regulator to meet its statutory obligations. Currently retained to provide commentary on the consultation papers being produced by the regulator, including strategic or detailed advice as appropriate.
- **Dampier to Bunbury Natural Gas Pipeline Access Arrangement Review (Client: the Independent Gas Pipelines Access Regulator, WA, 2000 2002)** - Provided economic advice to the Office of the Independent Regulator during its continuing assessment of the regulated charges and other terms and conditions of access for the gas pipeline, including a review of all parts of the draft decision, with particular focus on the sections addressing the cost of capital (and assessment of risk generally), asset valuation and financial modelling. Represented the Office on these matters at a public forum, and provided strategic advice to the Independent Regulator on the draft decision.
- **Goldfield Gas Pipeline Access Arrangement Review (Client: the Independent Gas Pipelines Access Regulator, WA, 2000 2004)** - Provided economic advice to the Office of the Independent Regulator during its continuing assessment of the regulated charges and other terms and conditions of access for the gas pipeline, including a review of all parts of the draft decision, with particular focus on the sections addressing the cost of capital (and assessment of risk generally), asset valuation and financial modelling. Represented the Office on these matters at a public forum, and provided strategic advice to the Independent Regulator on the draft decision.
- **Victorian Electricity Distribution Price Review (Client: the Office of the Regulator General, Vic, 1999 2000)** - Economic adviser to the Office of the Regulator General during its review of the price caps for the five Victorian electricity distributors. Had responsibility for all issues associated with capital financing, including analysis of the cost of capital (and assessment of risk generally) and asset valuation, and supervised the financial modelling and derivation of regulated charges. Also advised on a range of other issues, including the design of incentive regulation for cost reduction and service improvement, and the principles for determining charges for new customers connecting to the system. Represented the Office at numerous public forums during the course of the review, and was principal author of the finance related sections of three consultation papers, and the finance related sections of the draft and final decision documents.

- **Victorian Ports Corporation and Channels Authority Price Review (Client: the Office of the Regulator General, Vic, 2000)** - Advised on the finance related issues (cost of capital and the assessment of risk generally, and asset valuation), financial modelling (and the derivation of regulated charges), and on the form of control set over prices. Principal author of the sections of the draft and final decision documents addressing the finance related and price control issues.
- **AlintaGas Gas Distribution Access Arrangement Review (Client: the Independent Gas Pipelines Access Regulator, WA, 1999 2000)** - Provided economic advice to the Office of the Independent Regulator during its assessment of the regulated charges and other terms and conditions of access for the gas pipeline. This advice included providing a report assessing the cost of capital associated with the regulated activities, overall review of all parts of the draft and final decisions, with particular focus on the sections addressing the cost of capital (and assessment of risk generally), asset valuation and financial modelling. Also provided strategic advice to the Independent Regulator on the draft and final decisions.
- **Parmelia Gas Pipeline Access Arrangement Review (Client: the Independent Gas Pipelines Access Regulator, WA, 1999 2000)** - Provided economic advice to the Office of the Independent Regulator during its assessment of the regulated charges and other terms and conditions of access for the gas pipeline, including a review of all parts of the draft and final decisions, with particular focus on the sections addressing the cost of capital (and assessment of risk generally), asset valuation and financial modelling. Also provided strategic advice to the Independent Regulator on the draft and final decisions.
- **Victorian Gas Distribution Price Review (Client: the Office of the Regulator General, Vic, 1998)** - Economic adviser to the Office of the Regulator General during its assessment of the price caps and other terms and conditions of access for the three Victorian gas distributors. Major issues addressed included the valuation of assets for regulatory purposes, cost of capital financing and financial modelling. Principal author of the draft and final decision documents.

Periodic and Other Price Reviews – Other Activities

- **Regulatory cost of debt (Clients: Powerlink, ElectraNet and Victorian gas distributors 2011 2012)** – provided a series of reports addressing how the benchmark cost of debt should be established pursuant to the National Electricity Rules and on the appropriate benchmark allowance for debt and equity raising costs.
- **Strategic advice, Victorian electricity distribution review (Client: Jemena Electricity Networks, 2009 2011)** – provided ongoing advice on regulatory economic issues during the course of the price review, including on regulatory finance matters, issues associated with the AER's desire to end the former service performance incentive scheme, issues associated with the regulatory treatment of related party contracts, allocation of costs between regulated and unregulated activities and forecasting of expenditure.
- **Regulatory cost of debt (Client: Powercor Australia Limited, 2009 2010)** – provided a series of reports addressing how the benchmark cost of debt should be established pursuant to the National Electricity Rules.
- **Cessation of service incentive scheme (Client: Powercor Australia Limited, 2010)** – assisted Powercor to quantify the financial effect that would have flowed if the former service performance incentive scheme had continued. Also prepared an expert report pointing to a material inconsistency in how the AER intended to close out the old scheme and the parameters for the new service performance incentive scheme, which was accepted by the AER.

- **Strategic advice, NSW gas distribution review (Client: Jemena Gas Networks, 2009 2011)** – provided ongoing advice on regulatory economic issues during the course of the price review, including on regulatory finance matters, issues associated with the regulatory treatment of related party contracts, allocation of costs between regulated and unregulated activities, forecasting of expenditure and issues associated with the updating of JGN’s regulatory asset base.
- **Input methodologies for NZ regulated businesses (Clients: Powerco NZ and Christchurch International Airport, 2009 ongoing)** – advising in relation to the Commerce Commission’s development of input methodologies and related matters, covering issues associated with regulatory asset valuation, the regulatory cost of capital, the use of productivity trends in regulation and the design of incentive compatible regulation.
- **Equity Betas for Regulated Electricity Network Activities (Client: Grid Australia, APIA, ENA, 2008)** - Prepared a report presenting empirical evidence on the equity betas for regulated Australian electricity transmission and distribution businesses for the AER’s five yearly review of WACC parameters for these industries. The report demonstrated the implications of a number of different estimation techniques and the reliability of the resulting estimates. Also prepared a joint paper with the law firm, Gilbert+Tobin, providing an economic and legal interpretation of the relevant (unique) statutory guidance for the review.
- **Economic Principles for the Setting of Airside Charges (Client: Christchurch International Airport Limited, 2008 2009)** - Provided advice on a range of economic issues relating to its resetting of charges for airside services, including the valuation of assets and treatment of revaluations, certain inputs to the cost of capital (beta and the debt margin) and the efficiency of prices over time and the implications for the depreciation of assets and measured accounting profit.
- **Treatment of Inflation and Depreciation when Setting Landing Charges (Client: Virgin Blue, 2007 2008)** - Provided advice on Adelaide Airport’s proposed approach for setting landing charges for Adelaide Airport, where a key issue was how it proposed to deal with inflation and the implications for the path of prices over time. The advice also addressed the different formulae that are available for deriving an annual revenue requirement and the requirements for the different formulae to be applied consistently.
- **Application of the Grid Investment Test to the Auckland 400kV Upgrade (Client: Electricity Commission of New Zealand, 2006)** - As part of a team, undertook a review of the Commission’s process for reviewing Transpower’s proposed Auckland 400kV upgrade project and undertook a peer review of the Commission’s application of the Grid Investment Test.
- **Appropriate Treatment of Taxation when Measuring Regulatory Profit (Client: Powerco New Zealand, 2005 2006)** - Prepared two statements for Powerco New Zealand related to how the Commerce Commission should treat taxation when measuring realised and projected regulatory profit for its gas distribution business (measured regulatory profit, in turn, was a key input into the Commission’s advice to the Minister as to whether there would be net benefits from regulating Powerco New Zealand’s gas distribution business). A key finding was that care must be taken to ensure that the inputs used when calculating taxation expenses are consistent with the other ‘assumptions’ that a regulator adopts if it applies incentive regulation (most notably, a need for consistency between assumed tax depreciation and the regulatory asset value).
- **Application of Directlink for Regulated Status (Client: Directlink, 2003 2004)** - Prepared advice on the economic issues associated with the Directlink Joint Venture’s request to be converted from an unregulated (entrepreneurial)

interconnector to a regulated interconnector. As with the Murraylink application, the key issues included the implications for economic efficiency flowing from its application and the appropriate application of a cost benefit test for transmission investment (and the implications of that test for the setting of the regulatory value for its asset).

- **Principles for the ‘Stranding’ of Assets by Regulators (Client: the Independent Pricing and Regulatory Tribunal, NSW, 2005)** - Prepared a report discussing the relevant economic principles for a regulator in deciding whether to ‘strand’ assets for regulatory purposes (that is, to deny any further return on assets that are partially or unutilised). An important conclusion of the advice is that the benefits of stranding need to be assessed with reference to how future decisions of the regulated entities are affected by the policy (i.e. future investment and pricing decisions), and that the uncertainty created from ‘stranding’ creates real costs.
- **Principles for Determining Regulatory Depreciation Allowances (Client: the Independent Pricing and Regulatory Tribunal, NSW, 2003)** - Prepared a report discussing the relevant economic and other principles for determining depreciation for the purpose of price regulation, and its application to electricity distribution. An important issue addressed was the distinction between accounting and regulatory (economic) objectives for depreciation.
- **Methodology for Updating the Regulatory Value of Electricity Transmission Assets (Client: the Australian Competition and Consumer Commission, 2003)** - Prepared a report assessing the relative merits of two options for updating the regulatory value of electricity transmission assets at a price review - which are to reset the value at the estimated 'depreciated optimised replacement cost' value, or to take the previous regulatory value and deduct depreciation and add the capital expenditure undertaken during the intervening period (the 'rolling-forward' method). This paper was commissioned as part of the ACCC's review of its Draft Statement of Regulatory Principles for electricity transmission regulation.
- **Application of Murraylink for Regulated Status (Client: Murraylink Transmission Company, 2003)** - Prepared advice on the economic issues associated with Murraylink Transmission Company's request to be converted from an unregulated (entrepreneurial) interconnector to a regulated interconnector. The key issues included the implications for economic efficiency flowing from its application and the appropriate application of a cost benefit test for transmission investment (and the implications of that test for the setting of the regulatory value for its asset).
- **Proxy Beta for Regulated Gas Transmission Activities (Client: the Australian Competition and Consumer Commission, 2002)** - Prepared a report presenting the available empirical evidence on the 'beta' (which is a measure of risk) of regulated gas transmission activities. This evidence included beta estimates for listed firms in Australia, as well as those from the United States, Canada and the United Kingdom. The report also included a discussion of empirical issues associated with estimating betas, and issues to be considered when using such estimates as an input into setting regulated charges.
- **Treatment of Working Capital when setting Regulated Charges (Client: the Australian Competition and Consumer Commission, 2002)** - Prepared a report assessing whether it would be appropriate to include an explicit (additional) allowance in the benchmark revenue requirement in respect of working capital when setting regulated charges.
- **Pricing Principles for the South West Pipeline (Client: Esso Australia, 2001)** - As part of a team, prepared a report (which was submitted to the Australian Competition and Consumer Commission) describing the pricing principles that should

apply to the South West Pipeline (this pipeline was a new asset, linking the existing system to a new storage facility and additional gas producers).

- **Relevance of ‘September 11’ for the Risk Free Rate (Client: the Australian Competition and Consumer Commission, 2001)** - Prepared a report assessing the relevance (if any) of the events of September 11 for the proxy ‘risk free rate’ that is included in the Capital Asset Pricing Model (this is a model, drawn from finance theory, for estimating the required return for a particular asset).
- **Victorian Government Review of Water Prices (Client: the Department of Natural Resources and the Environment, Vic, 2000 2001)** - Prepared a report discussing the principles regulators use to determine the capital related cost (including reasonable profit) associated with providing utility services, and how those principles would apply to the water industry in particular. The report also provided an estimate of the cost of capital (and assessment of risk in general) associated with providing water services. The findings of the report were presented to a forum of representatives of the Victorian water industry.
- **Likely Regulatory Outcome for the Price for Using a Port (Client: MIM, 2000)** - Provided advice on the outcome that could be expected were the dispute over the price for the use of a major port to be resolved by an economic regulator. The main issue of contention was the valuation of the port assets (for regulatory purposes) given that the installed infrastructure was excess to requirements, and the mine had a short remaining life.
- **Relevance of ‘Asymmetric Events’ in the Setting of Regulated Charges (Client: TransGrid, 1999)** - In conjunction with William M Mercer, prepared a report (which was submitted to the Australian Competition and Consumer Commission) discussing the relevance of downside (asymmetric) events when setting regulated charges, and quantifying the expected cost of those events.

Licensing / Franchise Bidding

- **Competitive Tender for Gas Distribution and Retail in Tasmania (Client: the Office of the Tasmanian Energy Regulator, 2001 2002)** - Economic adviser to the Office during its continuing oversight of the use of a competitive tender process to select a gas distributor/retailer for Tasmania, and simultaneously to set the regulated charges for an initial period. The main issues concern how the tender rules, process and future regulatory framework should be designed to maximise the scope for ‘competition for the market’ to discipline the price and service offerings. Principal author of a number of sections of a consultation paper, and the regulator’s first decision document.
- **Issuing of a Licence for Powercor Australia to Distribute Electricity in the Docklands (Client: the Office of the Regulator General, Vic, 1999)** - Economic adviser to the Office during its assessment of whether a second distribution licence should be awarded for electricity distribution in the Docklands area (a distribution licence for the area was already held by CitiPower, and at that time, no area in the state had multiple licensees). The main issue concerned the scope for using ‘competition for the market’ to discipline the price and service offerings for an activity that would be a monopoly once the assets were installed. Contributed to a consultation paper, and was principal author of the draft and final decision documents.

Development of Regulatory Frameworks

- **Review of the Australian energy economic regulation (Client: Energy Networks Association, 2010-ongoing)** – assisting the owners of energy infrastructure to engage in the current wide-ranging review of the regime for economic regulation of energy infrastructure. Advice has focussed in particular on the setting of the regulatory WACC and on the regime of financial incentives for capital expenditure

efficiency, and included strategic and analytical advice, preparation of expert reports and assistance with ENA submissions.

- **Review of the Australian electricity transmission framework (Client: Grid Australia, 2010-ongoing)** – assisting the owners of electricity transmission assets to participate in the wide-ranging review of the framework for electricity transmission in the national electricity market, covering such matters as planning arrangements, the form of regulation for non-core services and generator capacity rights and charging. Has included analytical advice on policy choices, facilitation of industry positions and articulation of positions in submissions.
- **Implications of greenhouse policy for the electricity and gas regulatory frameworks (Client: the Australian Energy Market Commission, 2008 2009)** – Provided advice to the AEMC in its review of whether changes to the electricity and gas regulatory frameworks is warranted in light of the proposed introduction of a carbon permit trading scheme and an expanded renewables obligation. Issues addressed include the framework for electricity connections, the efficiency of the management of congestion and locational signals for generators and the appropriate specification of a cost benefit test for transmission upgrades in light of the two policy initiatives.
- **Economic incentives under the energy network regulatory regimes for demand side participation (Client: Australian Energy market Commission, 2006)** – Provided advice to the AEMC on the incentives provided by the network regulatory regime for demand side participation, including the effect of the form of price control (price cap vs. revenue cap), the cost efficiency arrangements, the treatment of losses and the regime for setting reliability standards.
- **Application of a ‘total factor productivity’ form of regulation (Client: the Victorian Department of Primary Industries, 2008)** - Assisted the Department to develop a proposed amendment to the regulatory regime for electricity regulation to permit (but not mandate) a total factor productivity approach to setting price caps – that is, to reset prices to cost at the start of the new regulatory period and to use total factor productivity as an input to set the rate of change in prices over the period.
- **Expert Panel on Energy Access Pricing (Client: Ministerial Council on Energy, 2005 2006)** - Assisted the Expert Panel in its review of the appropriate scope for commonality of access pricing regulation across the electricity and gas, transmission and distribution sectors. The report recommended best practice approaches to the appropriate forms of regulation, the principles to guide the development of detailed regulatory rules and regulatory assessments, the procedures for the conduct of regulatory reviews and information gathering powers.
- **Productivity Commission Review of Airport Pricing (Client: Virgin Blue, 2006)** - Prepared two reports for Virgin Blue for submission to the Commission’s review, addressing the economic interpretation of the review principles, asset valuation, required rates of return for airports and the efficiency effects of airport charges and presented the findings to a public forum.
- **AEMC Review of the Rules for Setting Transmission Prices (Client: Transmission Network Owners, 2005 2006)** - Advised a coalition comprising all of the major electricity transmission network owners during the new Australian Energy Market Commission’s review of the rules under which transmission prices are determined. Prepared advice on a number of issues and assisted the owners to draft their submissions to the AEMC’s various papers.
- **Advice on Energy Policy Reform Issues (Client: Victorian Department of Infrastructure/Primary Industries, 2003 ongoing)** - Ongoing advice to the Department regarding on issues relating to national energy market reform. Key areas

covered include: reform of cross ownership rules for the energy sector; the reform of the cost benefit test for electricity transmission investments; and the reform of the gas access arrangements (in particular, the scope for introducing more light handed forms of regulation); and the transition of the Victorian electricity transmission arrangements and gas market into the national regulatory regime.

- **Productivity Commission Review of the National Gas Code (Client: BHP Billiton, 2003 2004)** - Produced two submissions to the review, with the important issues including the appropriate form of regulation for the monopoly gas transmission assets (including the role of incentive regulation), the requirement for ring fencing arrangements, and the presentation of evidence on the impact of regulation on the industry since the introduction of the Code. The evidence presented included a detailed empirical study of the evidence provided by the market values of regulated entities for the question of whether regulators are setting prices that are too low.
- **Framework for the Regulation of Service Quality (Client: Western Power, 2002)** - Prepared two reports advising on the framework for the regulation of product and service quality for electricity distribution, with a particular focus on the use of economic incentives to optimise quality and the implications for the coordination of service regulation coordinated with distribution tariff regulation.
- **Development of the National Third Party Access Code for Natural Gas Pipeline Systems Code (Client: commenced while a Commonwealth Public Servant, after 1996 the Commonwealth Government, 1994 1997)** - Was involved in the development of the Gas Code (which is the legal framework for the economic regulation of gas transmission and distribution systems) from the time of the agreement between governments to implement access regulation, through to the signing of the intergovernmental agreements and the passage of the relevant legislation by the State and Commonwealth parliaments. Major issues of contention included the overall form of regulation to apply to the infrastructure (including the principles and processes for establishing whether an asset should be regulated), pricing principles (including the valuation of assets for regulatory purposes and the use of incentive regulation), ring fencing arrangements between monopoly and potentially contestable activities, and the disclosure of information. Was the principal author of numerous issues papers for the various government and industry working groups, public discussion papers, and sections of the Gas Code.

Pricing work for non-regulated businesses

- **Application of the netback calculation for MRRT purposes (Client: Confidential, 2011-12)** – advised on how ‘arms length prices that would be observed in a competitive market’ for the use of downstream infrastructure should be computed, focussing in particular on what economic principles predicts for the valuation of assets, the rates of return and the potential for providers to earn higher returns arising from incentive compatible contracts.
- **Cost justification of airport charges (Client: Dunedin Airport, 2010 11)** – assisted Dunedin Airport to quantify the cost of providing its airport landing and terminal charges and justify to its major customers a substantial increase in its charges.
- **Australian airport landing charges (Client: Virgin Australia, 2009 12)** – have assisted Virgin during its negotiations of airport landing and terminal charges for a number of Australian airports, including review of the airports’ proposed pricing models, asset valuation methods and proposed rates of return.
- **Measuring the effectiveness of promotions (Client: a major Australian department store 2011/12)** – as part of a team, drawing on ‘point of sale’ information to estimate the effect of price and promotions on sales (using transaction information) as part of a major review of the store’s promotional activities.

- **Estimating the price sensitivity of consumers for retail goods (Client: a major Australian supermarket (2010/11))** – led a team to develop of a dynamic model to estimate the sensitivity of sales of an item to its price, the price of substitutes and other factors using transactions data. Allowed the client to predict how changing prices across a group of close substitutes would affect margin and to understand the effect of promotional activities.

Regulatory due diligence and related work

- **Sale of the Sydney Desalination Plant (Client: a consortium of investors, 2011-12)** – Prepared a regulatory due diligence report for potential acquirer of the asset, including a review of the financial modelling of future pricing decisions.
- **Sale of the Abbot Point Coal Terminal port (Client: a consortium of investors / debt providers, 2010-11)** – Prepared a regulatory due diligence report for potential acquirer of the asset, including a review of the financial modelling of future pricing decisions.
- **Private Port Development (Client: Major Australian Bank, 2008)** - Prepared a report on the relative merits of different governance and financing arrangements for a proposed major port development that would serve multiple port users.
- **Sale of Allgas gas distribution network (Client: confidential, 2006)** – Prepared a regulatory due diligence report for potential acquirer of the asset.
- **Review of Capital Structure (Client: major Victorian water entity, 2003)** - Prepared a report (for the Board) advising on the optimal capital structure for a particular Victorian water entity. The report advised on the practical implications of the theory on optimal capital structure, presented benchmarking results for comparable entities, and presented the results of detailed modelling of the risk implications of different capital structures. Important issues for the exercise were the implications of continued government ownership and the impending economic regulation by the Victorian Essential Services Commission for the choice of – and transition to – the optimal capital structure.

Expert Witness Roles

- **Victorian gas market pricing dispute – dispute resolution panel (Client: VENCorp, 2008)** – Prepared a report and was cross examined in relation to the operation of the Victorian gas market in the presence of supply outages.
- **Consultation on Major Airport Capital Expenditure – Judicial Review (Client: Christchurch International Airport, 2008)** - Prepared an affidavit for a judicial review on whether the airport consulted appropriately on its proposed terminal development. Addressed the rationale, from the point of view of economics, of separating the decision of ‘what to build’ from the question of ‘how to price’ in relation to new infrastructure.
- **New Zealand Commerce Commission Draft Decision on Gas Distribution Charges (Client: Powerco, 2007 2008)** - Prepared an expert statement about the valuation of assets for regulatory purposes, with a focus on the treatment of revaluation gains, and a memorandum about the treatment of taxation for regulatory purposes and appeared before the Commerce Commission.
- **Sydney Airport Domestic Landing Change Arbitration (Client: Virgin Blue, 2007)** - Prepared two expert reports on the economic issues associated with the structure of landing charges (note: the evidence was filed, but the parties reached agreement before the case was heard).

- **New Zealand Commerce Commission Gas Price Control Decision – Judicial Review (Client: Powerco, 2006)** - Provided four affidavits on the regulatory economic issues associated with the calculation of the allowance for taxation for a regulatory purpose, addressing in particular the need for consistency in assumptions across different regulatory calculations.
- **Victorian Electricity Distribution Price Review – Appeal to the ESC Appeal Panel: Service Incentive Risk (Client: the Essential Services Commission, Vic, 2005 2006)** - Prepared expert evidence on the workings of the ESC's service incentive scheme and the question of whether the scheme was likely to deliver a windfall gain or loss to the distributors (note: the evidence was filed, but the appellant withdrew this ground of appeal prior to the case being heard).
- **Victorian Electricity Distribution Price Review – Appeal to the ESC Appeal Panel: Price Rebalancing (Client: the Essential Services Commission, Vic, 2005 2006)** - Prepared expert evidence on the workings of the ESC's tariff basket form of price control, with a particular focus on the ability of the electricity distributors to rebalance prices and the financial effect of the introduction of 'time of use' prices in this context (note: the evidence was filed, but the appellant withdrew this ground of appeal prior to the case being heard).
- **New Zealand Commerce Commission Review of Information Provision and Asset Valuation (Client: Powerco New Zealand, 2005)** - Appeared before the Commerce Commission for Powerco New Zealand on several matters related to the appropriate measurement of profit for regulatory purposes related to its electricity distribution business, most notably the treatment of taxation in the context of an incentive regulation regime.
- **Duke Gas Pipeline (Qld) Access Arrangement Review – Appeal to the Australian Competition Tribunal (Client: the Australia Competition and Consumer Commission, 2002)** - Prepared expert evidence on the question of whether concerns of economic efficiency are relevant to the non price terms and conditions of access (note: the evidence was not filed as the appellant withdrew its evidence prior to the case being heard).
- **Victorian Electricity Distribution Price Review – Appeal to the ORG Appeal Panel: Rural Risk (Client: the Office of the Regulator General, Vic, 2000)** - Provided expert evidence (written and oral) to the ORG Appeal Panel on the question of whether the distribution of electricity in the predominantly rural areas carried greater risk than the distribution of electricity in the predominantly urban areas.
- **Victorian Electricity Distribution Price Review – Appeal to the ORG Appeal Panel: Inflation Risk (Client: the Office of the Regulator General, Vic, 2000)** - Provided expert evidence (written and oral) to the ORG Appeal Panel on the implications of inflation risk for the cost of capital associated with the distribution activities.

Major Coal Producers and Ports Corporation of Queensland Access Negotiation (Client: Pacific Coal, 1999) - Provided advice to the coal producers on the outcome that could be expected were the dispute over the price for the use of a major port to be resolved by an economic regulator. The main issues of contention were the valuation of the assets for regulatory purposes, whether the original users of the port should be given credit for the share of the infrastructure they financed, and the cost of capital (and assessment of risk generally). Presented the findings to a negotiation session between the parties.

