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An analysis of Competition Benefits.

Report to the ACCC

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Table of contents

1

Introduction and background

In February 2003, the Australian Competition and Consumer Commission (ACCC) published a discussion paper on a review of the Regulatory Test. One of the important themes in the discussion paper is whether or not Competition Benefits should be included in the Regulatory Test. The Commission states that the failure of the Regulatory Test to recognise Competition Benefits was one of the biggest criticisms of the test and it was considering whether to include such benefits in future. Amongst the Commission's objectives in developing a competition based test is that it should be objective and robust over a range of market development scenarios.

Interested parties submitted responses to the discussion paper. It is clear from this that there are a wide range of views on what Competition Benefits are, whether or not they are already included in the Regulatory Test and how they should be measured. A summary of views of Competition Benefits is contained in Appendix A.

This report was commissioned by the ACCC in June 2003. The purpose of the report (see Appendix D) is to "review, analyse and report on the issues arising from the practical implementation of the approaches to the measurement of Competition Benefits proposed by interested parties in response to the Commission's discussion paper."

The report is set out as follows:

- Chapter 2 defines Competition Benefits.
- Chapter 3 describes how Competition Benefits can be calculated.
- Chapter 4 reviews a range of factors that may affect the impact of a transmission augmentation on the exercise of market power.
- Chapter 5 examines the impact of the use of different market development assumptions (as required in clause 6 of the Regulatory Test) on the exercise of market power.
- Chapter 6 reviews other approaches to Competition Benefits described in the Commission's discussion paper.

- Finally Chapter 7 summarises the key points and discusses the Commission's objectivity and robustness criteria.

It should be stressed that the focus of this paper is not on suggesting solutions to difficulties that arise in implementing the calculation of Competition Benefits, or making recommendations on how they should be calculated or included. Rather, the focus is on clarifying what Competition Benefits are, describing how they might be calculated, understanding the factors affecting the impact of transmission augmentation on market power, defining the market modelling needed to quantify Competition Benefits, and analysing proposals by interested parties on Competition Benefits.

The Commission has emphasised objectivity and robustness in its consideration of the approach to Competition Benefits. In the last chapter we draw together some of the important observations in this paper in a discussion of the Commission's objectivity and robustness criteria.

2

Definition of Competition Benefits

2.1 A definition of Competition Benefits

There may be a number of ways to define Competition Benefits. In the economics literature generally and the welfare economics literature in particular, the term "Competition Benefits" does not appear to have a well accepted meaning.

In its discussion paper, the ACCC defined Competition Benefits "to arise from increased competition between generators, and the reduction in market power, resulting from free-flowing interconnectors".[1] We noted in Appendix A that interested parties had different views on what this means.

We understand Competition Benefits to be the benefits attributable to increased transmission capability of bringing NEM prices closer to Short Run Marginal Costs (SRMC).[2] Other definitions may be envisaged, but we think this aligns with the Commission's intent in the use of this term in the context of the Regulatory Test. Competition Benefits can be understood to give rise to allocative and productive efficiencies. We use these terms by way of explaining the efficiencies arising from increased competition, but their use does not extend beyond that.

Allocative efficiency is maximised when resources are allocated such that the value in the use of the resource at the margin is equal to the increment in the cost of supplying the resource at the margin. The necessary rule can be summarised as the application of marginal cost pricing. In this case it describes:

a) the economic benefit arising from higher consumption and production when prices decrease (become closer to marginal costs) in response to greater competition attributable to greater interconnection.

[1] ACCC 2003, page 38.

[2] Challenges in the practical definition of short marginal costs and whether in fact this is a suitable assumption of a competitive equilibrium are issues that are considered later in this paper.

b) In the long term an additional allocative efficiency arises if inefficient generation and transmission investment (arising because prices are above marginal costs) is avoided.[3]

Productive efficiency describes the economic benefit (increased consumer surplus) that arises when increased interconnection causes lower priced generation to displace higher priced generation.

In addition to these economic efficiencies, lower prices can also redistribute income between producers and consumers, with the gain to consumers matching the loss to producers. Counting such wealth redistribution as the benefit of a transmission investment would therefore value consumer benefits more highly than producer benefits. Whether or not this benefit should be counted in the evaluation of an augmentation, is a question of the relative value that the ACCC place on the benefits that accrue to producers and consumers. It would be inappropriate for us to opine on this and therefore we do not consider it further here.

2.2 The relationship between Market Benefits and Competition Benefits

To establish the relationship between Competition Benefits and Market Benefits it is necessary to first describe Market Benefits. The Regulatory Test defines Market Benefits to be the "total net benefits of the proposed augmentation to all those who produce, distribute and consume electricity in the National Electricity Market". Market Benefits can also be defined as the increase in total welfare (the sum of producer and consumer surplus) arising from a transmission augmentation.

Clause Six of the Regulatory Test requires that in calculating Market Benefits, modelling of future prices and investment should reflect two approaches:

- the *'least-cost market development'* approach. The test describes the 'least-cost' approach as 'akin to conventional central planning'; and
- the *'market-driven market development'* approach. With this approach "the forecast of spot price trends should reflect a range of market outcomes, ranging from short run marginal cost bidding behaviour to simulations that approximate actual market bidding and prices …"[4].

2.2.1 'Least-cost market development' approach

It has been suggested that "under the least cost approach, modelled investments are assumed to come on-stream in order to meet the required reliability standards in the

[3] We note that in the debate on the Regulatory Test to-date, the avoidance of inefficient investment has sometimes been classified as a dynamic efficiency. However, we understand that dynamic efficiency is generally used to describe efficiencies attributable to technological and managerial innovation.
[4] ACCC, December 1999.

NEM, on a least cost basis".[5] The generally accepted standard of "conventional central planning" in transmission expansion is to define the efficient level of generation costs in the long term to be the Long Run Marginal Cost (LRMC) of new entrants. This approach ignores the existence of a market. i.e. that generators can determine their own "bids" and that spot prices based on these bids determine the remuneration of all generation and the wholesale price to be paid by all consumers (ignoring contracts). Instead it assumes that generation is dispatched in order from least expensive to most expensive (based on short run avoidable costs)[6] and the cost of the last generating unit to be dispatched is of no significance.

There are many details in the implementation of this approach[7], but conceptually the 'least-cost market development' approach is a central planning approach: it explicitly ignores the dynamics of prices and investment decisions that are likely to arise in the market. Instead the LRMC of new entrants becomes the basis of future price projections to be used in evaluating transmission investments. Since there is no measurement of the extent to which an augmentation is able to bring prices closer to short run marginal costs, Competition Benefits would not be calculated with this approach. The calculation of Market Benefits (the increase in consumers' and producers' surplus) of a proposed investment would include the allocative and productive efficiencies described above (i.e. increased consumption caused by lower prices, cheaper plant displacing more expensive plant, savings from deferred investment). But these would reflect cost-based assessments and as such would not consider changes in prices attributable to the reduction in the exercise of market power.

2.2.2 'Market driven market development' approach

Clause 6b of the Regulatory Test prescribes that under the market-driven market development approach modelling should consider a range of bidding assumptions including 'short run marginal cost bids'; and 'actual bids' which are at a premium to the SRMC to reflect generator market power. The test also prescribes that with this approach new generation should be developed "on the same basis as would a private developer (where the NPV of the spot price revenue exceeds the NPV of generation costs)". The combination of these prescriptions defines the hallmark of the 'market-driven market development' approach. This is that the dynamic between market prices and investment decisions is to be reflected in forecasts: future prices should affect entry decisions and vice versa.

[5] Houston, June 2002.

[6] It is very important to note that short run avoidable costs are not the same as SRMC. At times of capacity constraint, SRMC can rise above short run avoidable costs.

[7] Such as the precise definition of Long Run Marginal Costs and how LRMC prices should be profiled over a day. Also the fundamental assumption that the long term market equilibrium will be LRMC may be true over the very long term, but in an energy only market such as the NEM, a case could be made that the likely outcome is a market vacillating between boom and bust.

In the case of price projections calculated on the basis of SRMC bids, Competition Benefits by definition do not exist because these benefits only arise when prices are brought closer to short run marginal costs: if bids are already assumed to be SRMC there is no benefit from increased competition.[8]

In the case of price projections on the basis of anything other than SRMC (referred to in the rest of the paper as non-SRMC bids), Competition Benefits will arise to the extent that the proposed augmentation causes the gap between the assumed market prices and SRMC-based prices to narrow.[9] Assuming the existence of market power before the augmentation (i.e non-SRMC bids) the Competition Benefit would be the portion of the Market Benefit that is attributable to the effect of that augmentation in causing prices to become closer to marginal costs. In some cases, the effect may be so significant that all market power is eliminated and prices are brought all the way to SRMC. In this case the total Market Benefit from such an augmentation will comprise the Competition Benefit as well as other benefits attributable to reduction in underlying costs.

We can not see how to objectively split Competition Benefits from other benefits. But, this is not relevant anyway. As defined here, the Competition Benefit is simply an element of the Market Benefit that may arise under the non-SRMC bidding assumptions required by the Regulatory Test.[10]

2.3 The inclusion of Competition Benefits in previous applications of the Regulatory Test

Our understanding of the previous applications of the Regulatory Test is based on published reports. A careful review of these reports suggests that in most cases the

[8] We note that there are objections to the assumption of SRMC-bidding as a sustainable competitive equilibrium in electricity markets. For example Newbery (2002, page 11) in the context of SRMC-bidding suggests that "truly competitive markets for electricity are probably either not attainable or not sustainable."[8] Professor Littlechild suggests that "prices that do not cover all costs over the long run are not consistent with a sustainable competitive market … it is possible that in some cases pricing at SRMC covers the costs of baseload plant because rents at base load cover the balance of costs, but it is also necessary that the costs of all capacity are covered including those of peaking plant" (personal communication May 2003). It is an interesting and relevant discussion as to whether SRMC bidding is a valid basis for price projection in the evaluation of transmission augmentations, but this issue is beyond the scope of this paper.

[9] This does not mean that the proposed interconnector has eliminated market power, it just means that prices are lower because lower priced plant has displaced higher priced plant - the bids of the lower priced plant may still be above their SRMC levels.

[10] We note that the Regulatory Test requires modelling of both the 'least-cost market development' and 'market-driven market development' approaches, and that a proposed augmentation should maximise market benefits against the majority of scenarios. By implication therefore, Competition Benefits are meant to be included in the evaluation of the Regulatory Test, at least under those market-driven scenarios that assume non-SRMC bids.

precise bidding assumption and ways in which generation entry has been determined is not always clear and it appears that various (different) interpretations of 'market-driven market development', 'least cost market development', 'SRMC' and 'LRMC' have been used. For this reason analysing past applications of the test may not be particularly informative or conclusive. However, for completeness we have attempted to analyse past applications of the test and have described this in Appendix C. From this we infer that:

- TransEnergie alone (in the context of the Murraylink conversion application) projected prices on the basis of SRMC-bids only. By definition therefore, no Competition Benefits were counted[11].
- For all other cases where non-SRMC bids had been assumed, such bids have been assumed to remain unchanged over the life of the proposed augmentation. In other words, there was no assessment of the way that generators may alter their bids in response to increased competition resulting from a proposed augmentation. This is likely to mis-calculate the Market Benefit (and the Competition Benefits that are part of the Market Benefit) that is likely to arise in a real market.

[11] VENCorp, in evaluating a proposed upgrade of the Latrobe Valley to Melbourne capacity used SRMC for all scenarios except one.

3

Calculation of Competition Benefits

The previous chapter concluded that Competition Benefits are an element of Market Benefits that may arise under specific generator bidding assumptions. As such, Competition Benefits would not be calculated directly, but would simply be included in the total estimate of Market Benefits. However, Competition Benefits have a conceptually clear meaning (benefits that arise when prices become closer to marginal cost) and it may be useful to look more closely how and where these benefits arise, and the factors that are likely to affect the estimation of such benefits. This chapter tries to do that.

3.1 Allocative efficiency from increased consumption in response to lower prices

This benefit is the increased welfare attributable to any increased consumption and production that may arise from price decreases attributable to the proposed transmission augmentation. Note that price decreases in previously higher-priced regions resulting from access to cheaper generation in previously lower-priced regions may be off-set by price increases in previously lower priced regions – since that capacity is no longer available to meet local demand. A net increase in consumption (and production) will only arise if the percentage price decrease in the previously higher priced region multiplied by the total demand and by the elasticity of demand in that region, is greater than the percentage price increase in the previously lower priced region multiplied by the total demand and elasticity of demand in that region.

Conceptually this benefit is the reduction in the so-called "dead-weight loss". The extent of this allocative efficiency over the life of the transmission augmentation is likely to be affected by:

- Non-linear demand and supply curves and hence different values of this allocative efficiency at different times of the day;

- The capacity of the proposed augmentation which is not static but will vary in different trading periods in relation to the configuration of demand and supply around the system and the availability of the transmission network;
- The change in the shape of the demand and supply curves over the life of the investment e.g. due to new generation and changes in the demand profile over time.

We note that in previous applications of the Regulatory Test, elasticity of demand has assumed to be so low that this efficiency has been assumed to be negligible. It may be the case that taking account of demand elasticities in the long term (which are usually higher than short term elasticities) and greater possible price reductions from sharp reductions in the extent of market power, would produce a more significant benefit.

3.2 Productive efficiency: displacing more expensive generation

This efficiency saving is the present value of the saving over the life of the transmission augmentation arising from the ability of the augmentation to allow lower-priced generation to displace higher-priced generation in the competition for dispatch.

The extent of productive efficiencies will depend on a range of factors including:

- The shape of the supply curve (if the displaced generation is very much more expensive than the new generation, savings will be greater).
- The level of demand (if the generation mix between two regions is such that only peaking units would be displaced then productive efficiencies are only likely to arise when peaking units are dispatched i.e. during peak periods of the day).

3.3 Allocative efficiency from avoiding or deferring generation and transmission investment[12]

In many cases this is likely to be the most significant Competition Benefit (besides wealth transfers if these are to be counted as Competition Benefits). The calculation of this benefit is based on determining the extent to which lower prices attributable to the proposed transmission augmentation defers or avoids generation, merchant transmission or (regulated) transmission investment. [13] The benefit is the present

[12] Note that an additional allocative efficiency is likely to arise if generators retire or mothball existing capacity in response to lower prices, thereby reducing fixed operation and maintenance costs and other avoidable fixed costs. However, the extent of such savings is likely to be much smaller than the savings from avoiding or deferring new investment.

[13] The inclusion of deferral or avoidance of transmission investment is a significant additional complication. In the Murraylink conversion application, one of the imputed benefits from

value of the annual saving in depreciation and return on assets and other fixed costs, of new generation and transmission assets that would be deferred or avoided.

The extent of this efficiency is likely to be affected by (amongst other things):

- The amount prices will change through-out the system as a result of the proposed transmission augmentation, for the life of the augmentation;
- The profile of price changes at different times of the day (this will affect the profitability of different types of generating plant);
- The price-entry dynamic (how investment decisions will change in response to price changes);
- The capital and operating costs of different types of generating plant or transmission investments (and how these are expected to change over the life of the transmission augmentation);
- Investor's payback periods and required rates of return for different types of generating plant and merchant transmission investments.

Clearly there is considerable scope for different but nonetheless plausible assumptions on each of the above factors, and very different results may follow.

An additional NEM-specific complication is taking into account investment based on reliability criteria. The reliability criteria relate to the margin of reserve capacity above the expected peak demand and the probability of involuntary load curtailments. This is a completely different investment criterion than that described in the market-driven-market-development approach. It raises questions of how future investment should be projected if the modelling of new entry – based on expected prices - results in investment below that required by the reliability criterion.

3.4 Wealth transfers

For completeness we describe how wealth transfers should be calculated. Wealth transfers arising as a result of transmission augmentations are calculated by comparing, before and after the augmentation, the price decrease in the importing zone multiplied by the total sales in the importing zone, less a possible price increase in the exporting zone multiplied by the total sales in that zone. The figures for total sales should not include any additional/reduced sales that may result from price decreases/increases as these will already have been taken into account in the calculation of allocative efficiencies. In many cases, if there is sufficient cheap capacity in the exporting zone (i.e. exporting this capacity will not drive up prices in the exporting region), then the dominant effect will be price decreases in the importing zone. In this case the dominant "wealth transfer" will occur from generators to customers in this zone.

Murraylink included the deferral of investment in transmission. Similarly in the VENCorp application of the Regulatory Test for the upgrade of the Latrobe Valley to Melbourne transmission capacity, the avoidance of investment in reactive transmission investment was counted as a benefit.

As with the calculation of allocative and productive efficiencies, the calculation of wealth transfers depends on the extent of price reductions attributable to the augmentation.

3.5 Intra versus inter-regional augmentations

The 2002 Network and Distributed Resources Electricity Code changes replaced the distinction between inter and intra-regional network augmentations with a distinction between large and small assets. There is therefore no distinction, in principle, between the calculation of the Competition Benefits for inter versus intra-regional augmentations.

However, the design of the NEM provides an additional complexity to the calculation of Competition Benefits for intra-regional augmentations. In particular, a single regional price is calculated for each NEM region based on the market-clearing prices at the Regional Reference Node (RRN). Therefore while intra-regional constraints exist, these constraints are not reflected in intra-regional price separation.[14] Therefore by definition of the NEM design, augmentations designed to eliminate constraints will not provide benefits unless they result in a reduction in the regional price as calculated at the RRN: prices (and hence price changes) anywhere else in the network are not calculated. Intra-regional augmentations that relieve intra-regional constraints would get no credit for doing this.

One approach to this problem is to model the economics of an intra-regional augmentation on the basis of a NEM model with nodal/sub-regional pricing. This would allow the calculation of allocative and productive efficiencies in the same way as for inter-regional augmentations. The problem however, is that such calculations would produce hypothetical price changes (NEM participants would not see them) and efficiencies calculated on hypothetical price changes would be hypothetical efficiencies. This is a problem of market design for which we can see no solution short of changes to that design.

[14] Biggar 2003(b) page 5 cites NEMMCO (2003) who identifies four intra-regional network constraints: in the Snowy region, network limitations between Murray switching station and Upper and Lower Tumut switching stations; in Queensland, the Tarong network limitation; in NSW, the Liddell-Bayswater network limitation; the Braemar transformer network limitation –following commissioning of the two Millmerran generators..

4

Factors affecting the reduction in market power from transmission augmentation

The extent to which an augmentation will reduce market power depends on a number of factors. This chapter describes some of the main factors. Ideally the assessment of price reductions from augmentations, based on economic modelling, should reflect each of these factors. In most cases knowledge of the relationship between them and bidding behaviour and the exploitation of market power is still far too immature to postulate either heuristic (rule-of-thumb) or more rigorous mathematical relationships appropriate for any form of optimisation modelling.

These factors are important to bear in mind in any practical assessment of market power and the impact of transmission augmentations on the mitigation of market power.[15]

4.1 Market design

The details of the market design can affect the ability of market participants to exploit market power and the impact that a transmission augmentation is likely to have in reducing market power. With regard to the NEM design we note the following:

- In the NEM's re-bidding debate, the appropriateness of SRMC bids as an appropriate benchmark has been debated. Newbery (2002) points out that "in

[15] For example Newbery (2002) attributes the main reason for the change from the old England and Wales Pool to the opportunities for 'tacit collusion' that the old pool design engendered (page 16). Wolak (2001) postulates that the profit maximising bids for generators in NEM1 was so close to marginal costs due to large quantity of hedge contracts held by major firms (page 5). Borenstein et al (1999) points to the inability of Cournot or Supply Function modelling approaches to address issues of collusion (page 5).

mature systems … average system marginal cost is typically only about half the average cost of generation. In order to cover the fixed costs and make it worthwhile retaining marginal plant to supply reserves, prices will either have to be very high some fraction of the time, or these fixed costs will have to be paid by some form of capacity payment."[16] On this analysis, with the NEM's energy-only market very high prices are at times to be expected in the NEM at times of capacity constraints.

- The Electricity Code empowers NEMMCo to act as a reserve trader and to contract for the provision of reserve capacity if the margin of generation above peak demand is below a specific level. This can increase the available capacity during high price periods and may reduce prices at these times (from what they would otherwise be).
- Also as discussed earlier, the prices within each NEM region are uniform (excluding losses) and based on the highest-priced unit to be dispatched at each Regional Reference Node (RRN). This market design feature therefore assumes that intra-regional constraints do not lead to price separation within a region for consumers, and the prices paid to producers does not properly reflect the impact of the constraint since constrained-off payments are not made and constrained-on payments are not based on bids. Intra-regional transmission investments that lead to an increase in the transfer capability between two previously constrained points in a region may not significantly affect flows into or out of the RRN and hence may not affect prices at the RRN. Therefore although such investments may significantly affect the ability to exercise market power at either of the previously constrained nodes within a region, this may not be reflected in increased competition and hence reduced prices at the RRN.

4.2 Level of contracting

Financial hedges around the spot price, or forward sales can affect generator bids into the market. Highly contracted generators have stronger incentives to bid their avoidable costs. (If spot prices are below a generator's variable cost, it would have an incentive to purchase from the spot market instead. If, on the other hand, it bids above its variable costs it may not be dispatched and therefore would need to purchase any contractual shortfall at a premium to its production cost, from the spot market.)

For this reason, mandatory forward contracting is often seen as an attractive instrument to curb the abuse of market power. For example the California Independent System Operator Market Surveillance Committee proposed that the three investor-owned utilities that still possessed market power sell at cost-based rates and other generators would only be allowed to sell in California at market based rates if they offered forward contracts for 70% of their expected sales.[17]

[16] Newbery D 2002, page 11.
[17] Wolak F 2001(b), page 9.

However the existence of substantial start-up costs means that marginal (short run variable) costs will only be known after the duration of operation is known. This is a particular issue in the assessment of market power: marginal costs will only be known once the operating regime has been determined. In the NEM, start costs and no-load costs are not separately expressed – generators need to reflect the recovery of these costs in their bids. Taking start-up costs and physical operating constraints (start-times, no-load costs, minimum generation levels, ramp rates etc.) into account means that base load generators may simply bid below their variable costs in order to ensure that they are dispatched continuously. Wolak (2001) in a study based on bidding behaviour using data from the first three months of NEM1 found that "for sufficiently high hedge contract levels, a generator should attempt to reduce market prices below its own marginal cost of production …". [18]

Leaving other considerations aside, high levels of contracting may provide an upper limit on the extent of price changes that could result from the interconnection of higher priced and lower priced regions, at least during the period of the existing contracts: with high contract levels demand-weighted prices very much above SRMC levels may be difficult to sustain. [19]

The existence of inter-regional swap contracts may also affect the competitiveness of the market and the impact on the competitiveness of the market of transmission augmentations. The inability to offer financially firm contracts for trade across NEM boundaries has, we understand, led to the implementation of inter-regional swaps: generator 1 located in region A supplies generator 2's customers which are located in region A (generator 2 is located in region B) and vice versa. Such swap contracts create contractual relationships between generators that may subsequently be brought into competition with each other as a result of greater interconnection between regions. The actual competitiveness of the combined interconnected region may be affected by such contracts as they could effectively reduce the number of independent competitors and potentially encourage collusion.

4.3 Vertical integration

Vertical integration of producers and retailers can reduce reliance on the spot market to settle imbalances or as an organised exchange for the wholesale trade of electricity. This can affect the competitiveness of the spot market by reducing liquidity or by changing the incentives of generators who trade in the market. For example increased vertical integration will move the spot market from a wholesale exchange towards a balancing market (in the same way as would occur if sales were more fully contracted outside the spot market). This can impact bidding incentives and trading strategies in the spot market and can affect market entry barriers. However the relationship between vertical integration and the competitiveness of the wholesale market is

[18] Wolak F, 2001(a) page 4.

[19] On the other hand, we note a study of NEM prices in 2000 which concluded that "eliminating the 20 high priced events … reduced the NEM average pool price by $912m dollars or $5.7/MWh, a reduction of 13% (alternatively, the average pool price for that year was 15.3% above the level otherwise applying)". Source: Bardak Ventures 2001, Page 6.

complex and increased vertical integration does not necessarily imply decreased competitiveness.[20] It is beyond the scope of this paper to consider the full complexity of this issue. However, vertical integration can affect spot market incentives and hence the impact of a transmission augmentation in the same way as forward contracts and price hedges, and so would need to be brought into a robust assessment.

4.4 Elasticity of demand

The theoretical and empirical literature on market power frequently refers to the elasticity of demand as a major factor affecting the existence and exploitation of market power. Borenstein et al (1999) found that in their modelling of the Californian electricity market, increasing the elasticity of demand from 0.1 to 0.4 produced substantial price decreases[21].

Transmission augmentations may affect the elasticity of demand by interconnecting large elastic customers (such as aluminium smelters, mines etc.) thus potentially changing the shape of the demand curve in the interconnected market and thus the calculation of prices in the interconnected market.

4.5 Industry structure, shape of the supply curve and capacity margin

Industry structure

The number of competitors can have an impact on the competitiveness of the market – with fewer competitors the ability to collude to inflate prices may improve, particularly if demand is inelastic. The number of competitors needs to be considered in aggregate as well as at different points on the supply curve.

Shape of the supply curve

Steps in the supply curve may provide the opportunity for the exploitation of market power. In particular, on parts of the supply curve when the next bid may be significantly higher than the current bid and there is only one or a few competitors at the margin, the bids of the marginal units could shadow the prices of the next unit (be raised to just below the SRMC of the next unit in the merit-order). This could be an issue in some regions in the NEM, such as South Australia where the supply curve is dominated by a few large generating units, and could give rise to some degree of bidding above SRMC even in lower demand periods.

[20] We note for example that prices have substantially decreased in the England and Wales electricity market at the same time as vertical integration has increased.
[21] Borenstein et al 1999, page 16.

By increasing interconnection it is possible to increase the number of competitors at all points on the supply curve and thereby encourage prices closer to SRMC levels even during lower demand periods.

Capacity margin

The ability for generators to bid substantially above their costs will, in principle, be influenced by the Capacity Margin i.e. the margin of available plant above demand: competition may typically (but not always) be more intense when the capacity margin is wider.

The actual capacity margin at any moment is a function of the demand and available generation and transmission in each settlement period and these are subject to stochastic outages as well as planned outages.

As described earlier, the NEM reliability standard requires a minimum capacity margin - expressed as a percentage of available capacity above the peak demand and empowers NEMMCo to act as a reserve trader if it appears that the market is unlikely to develop capacity to this standard. The existence of this provision may suppress prices and hence the extent of Competition Benefits from increased interconnection.

4.6 Transmission incentives

The actual capacity of a transmission network is a function of a number of factors. Transmission network service providers have little control over many of these. However, empirical evidence of the transmission incentive scheme in England and Wales suggests that such incentives can significantly affect the way that assets are operated and maintained and thereby increase the actual capacity of the network and reduce the level of transmission constraints. This translates into reduced ability to exploit localised market-power and raise prices above cost marginal costs.

If the experience in England and Wales with such incentives is suggestive of what may be achieved in the NEM[22], the development of a transmission incentive could have a substantial impact in reducing the possible Competition Benefits arising from some augmentation

[22] We note however, compared to the old England and Wales Pool, the NEM does not compensate constrained-off generators, and constrained-on generators are remunerated on the basis of an ex-post marginal cost assessment. For these reasons the opportunity to raise prices in the exploitation of transmission constraints – for generation not located at the regional reference node - may be somewhat lower than in England and Wales. On the other hand, in the NEM constrained generation at the Regional Reference Node will set the pool price for the whole region. In this case the ability to raise prices in exploiting the constraint will be reflected in the pool price for that region. In this case, incentives on transmission network service providers to maximise the availability of the network so as to minimise constraints can be expected to have a considerable impact on prices.

4.7 Transmission capacity

One of the most significant factors affecting the impact of a transmission augmentation on the competitiveness of the market is the impact of that augmentation on the capacity and use of the existing network. A transmission augmentation can make a market less competitive. For example placing a transmission line in parallel with another can, counter-intuitively, reduce the effective total transfer capacity if the capacity of the new link is less than the existing link.[23] Obviously detrimental investments such as these should not be allowed. But that such investments are obviously detrimental can not be determined simply by inspection of nominal impedances and capacities. Rather it requires detailed load-flow modelling of the whole connected NEM system to determine the actual expected capacity of new augmentations and the impact on the existing network.

Another feature of transmission networks is that investments that reduce transmission constraints between two constrained points will not only affect the prices at those points, but could potentially affect prices at other points on the system even if they are unconstrained.[24] However as described earlier, in the NEM spot prices are only calculated at the Regional Reference Nodes. To properly account for Competition Benefits it would be necessary to calculate the impact of an augmentation on prices throughout the system at each node/(unconstrained group of nodes) on the system.

Finally we note that the estimation of Competition Benefits depends largely on the assumption of the capacity of the proposed augmentation and the capacity of the existing network and the expected pattern of load flows on the system. This in-turn depends on the actual impedances and load carrying capacities which are a function of a number of factors including ambient temperature, the disposition of generation and demand through-out the system and network availability. Modelling an augmentation on the basis of its installed or nominal capacity may introduce errors to the estimation of the impact of the augmentation on the mitigation of market power.

[23] This assumes that both lines are of equal impedence. More generally, the extent to which a line will affect the transfer capacity of the line that it is parallel to depends on the relative impedence of both lines. For example placing a line with a transfer capacity of 1MW in parallel with one of 1000 MW can reduce the effective capacity of the pair to close to 1 MW if the impendence of the 1 MW link is very much less than that of the 1000 MW link. Conversely, if the impedence of the 1 MW link is very much higher than the 1000 MW link, then the transfer capacity of the pair will remain close to 1000MW.

[24] For example, in a three node triangular network where any two nodes are constrained and with equal impedance lines between each node, the price at the third node is the average of the price of the nodes at either end of the constraint. See in particular Darryl Biggar (2003a).

5

Modelling Market Benefits under the Market-Driven Market Development approach

Competition Benefits, based on the definition we have adopted, arise as long as transmission augmentations result in bids becoming closer to marginal costs. As discussed in the second chapter such benefits are not calculated directly, but instead are part of the Market Benefits calculated on the assumption of non-SRMC bids. Conceptually, the extent of Competition Benefits depends on the change in market power and hence prices following the transmission augmentation.

This chapter explores the issues that arise in modelling Market Benefits under the Market-Driven Market Development approach. We first examine SRMC-bidding partly to explain the often underestimated complexity of this approach, and also partly to establish a point of comparison for the modelling of non-SRMC bids.

5.1 Modelling Market Benefits assuming SRMC bidding

The Market Benefits that arise assuming SRMC-bids reflect economic efficiencies attributable to the reduction of costs (where cost differences are assumed to reflect only exogenous factors, such as higher fuel costs or labour costs etc. in one region of the NEM compared to another).

Developing SRMC-based spot prices entails a significant degree of subjective judgement and by trying to reflect the full complexity of the relationship between costs, output and operating constraints, the accurate modelling of SRMC prices is analytically very demanding. In particular, we highlight the following:

- **Data availability:** the thermal efficiency (heat rate) of non-hydro generating units is dependent on the loading level of those units. Information on this and on fuel contracts is proprietary, and modelling of these costs is often reduced to a consideration of average values based on information in the public domain.[25] Further, including the complexity of non-linear heat rates in least-cost optimisations is onerous. The use of average heat rates can introduce significant errors, particularly at peak periods when open cycle gas turbines may be dispatched.[26]
- **Modelling hydro bids:** The Snowy hydro scheme provides a significant amount of capacity to the NEM (around 3700MW), although the annual energy available from this scheme is very low (annual load factor of around 15%). In SRMC calculations, generally accepted practise is that hydro is assumed to bid so as to maximise the value of its production, typically by shadow-pricing its competitors – in the case of Snowy hydro most likely to be OCGT. However in modelling the system SRMC, this introduces an obvious circularity: when hydro is dispatched it will affect the spot price, but in order to decide when it should be dispatched so as to maximise the value of its production it needs to know the spot price.
- **Start-costs and operating constraints:** Thermal generating units have significant start costs and technical operating limitations (start-times, ramp-rates, minimum stable generation levels etc.). The optimal least-cost dispatch will not always be the cheapest (by fuel cost) unit first. It also means that there is no single correct SRMC – it depends on your assumptions of the demand profile and how frequently you will need to switch units on and off. This may be important in low demand periods particularly in some regions of the NEM where there may be significant steps in the supply curve in off-peak periods.
- **SRMC when demand exceeds supply:** The mark of an (idealised) perfectly competitive market is that no participant is a price maker and all offer their produce at their short run marginal costs (SRMC). The curve of SRMC versus output can be described as a reverse hockey-stick: if a unit is dispatched at or below its capacity, its SRMC is simply its fuel costs and other short run operating costs. At full capacity there is nothing the generator can do in the short term to increase its capacity no matter how much it is paid. The curve becomes vertical and there is no unique SRMC: a bid of anywhere between the

[25] In a study on the competitiveness of the Australian electricity market, ABARE (2002) commented that "… accurate and detailed information on marginal costs for Australian generation stations is in most cases not publicly available and is difficult to estimate". We note that in applications of the Regulatory Test to date, a key data source on short run marginal costs has been a database of publicly available data compiled by Peter Garlick, an industry consultant, based on publicly available information. Peter Garlick claimed to be "somewhat bemused that Independent Regional Planning Committee endorsement seems to have conferred a high degree of legitimacy on the accuracy of the data". (Garlick & Associates 2003.)

[26] OCGT heat rates can vary more dramatically over the range of output than coal thermal or CCGT units.

avoidable variable costs and VOLL can be considered to be a legitimate SRMC bid. SRMC-based spot prices can therefore be expected to be very volatile.

- **Interaction of prices and investment decisions:** Modelling the dynamic interaction of prices and generation investment decisions in an SRMC-bidding market is likely to produce volatile results: if generators only enter when they expect to recover their fixed costs, it will require sharp price spikes to provide the necessary signals for new generation. When such generation is commissioned, price spikes will diminish or disappear to be replaced by prices at short run avoidable costs for possibly long periods. This is a challenging dynamic to model.

5.2 Modelling Market Benefits assuming non-SRMC bidding

5.2.1 Objective

The exercise of market power entails bidding above short run marginal cost levels so as to achieve market prices above competitive levels. In an idealised perfectly competitive market such behaviour would be unsustainable. But, on the assumption that market power exists, such behaviour is sustainable at least for a period of time and profit maximising producers have reason to engage in such "strategic" bidding if this maximises their profits.

Determining the existence and extent of market power is very difficult, not least because the competitive benchmark is - as discussed above – not objectively definable. Price changes attributable to reduction in Market Power provides the basis for the allocative efficiencies from increased consumption, productive efficiencies from the despatch of the cheapest plant and allocative efficiencies from deferring or avoiding generation and transmission expansion.

Applying strategic modelling approaches to the calculation of Market Benefits allows the impact of market power changes attributable to a transmission augmentation to reflect the response of market participants to the changed environment. In this way it is intended to provide a far more realistic assessment of Markets Bids than would be produced by simply assuming constant bids over the life of the proposed interconnector. As we discussed earlier, this is the basis on which non-SRMC bidding has been modelled in previous applications of the Regulatory Test.

The next section describes recognised approaches in modelling strategic behaviour and following this we consider challenges in the application of these approaches in the calculation of Market Benefits .

5.2.2 Recognised approaches in modelling strategic behaviour

There are a number of possible approaches to modelling strategic behaviour. They all have a common goal of finding the "equilibrium" outcome of an interactive "game" played by profit-maximising participants. The equilibrium is the point at which no participant is able to increase its profits, given the bidding strategies of other participants. Part of the specification of this equilibrium is the market price. The different approaches vary in their assumptions of how firms compete (on prices or on quantities) and how the relationship between supply and price is specified. In addition to these fundamental differences, in the course of the application of these approaches in market power assessments, there can be a whole range of other assumptions and refinements to distinguish one approach from another. [27]

Borenstein et al (1999) and Newberry (2002) describe different approaches to simulating the strategic behaviour of firms:

- The Cournot-Nash approach which assumes that firms employ quantity strategies: each firm chooses its production quantity, taking as given the output being produced by all other firms;
- The Bertrand equilibrium in which firms compete on price and it is assumed that the winner-takes-all i.e. any firm can capture the entire market by pricing below others and can expand output to meet such demand.
- The Supply Function Equilibrium in which the strategies of firms are actual price-quantity bid functions, rather than the inflexible quantity given by the Cournot model.

Borenstein et al (1999) suggests that "it is difficult to point to a single equilibrium concept as the "best" approach for all markets. Each has strengths and weaknesses that make such a choice very much case-specific."[28]

The Cournot assumption is not valid in a typical electricity market: when a firm chooses its production quantity, it does not know what the other firms are planning to produce. This is particularly true in the NEM with 5-minute markets and re-bidding almost up to real time, and rapid demand changes that can be subject to large stochastic jumps due to sharp temperature changes.

The main criticism of the Bertrand approach is that capacity is fixed in the short term and generators are not able to expand production to capture the full market and so the underlying assumption of Bertrand competition seems to be quite inappropriate to the electricity market.

Borenstein et al 1999 suggests that the main criticisms of the supply function model is that it assumes that trades occur primarily through a supply-function bid process and elasticity of demand is constant across time and demand levels. It also produces multiple equilibria and does not lend itself well to markets where there is a

[27] See in particular: Bushnell et al, 1999.

[28] Page 4.

competitive fringe whose capacity may be limited due to either generation or transmission constraints.[29]

Our search for information in this area suggests that the application of game theory in market power assessments – particularly in the context of transmission expansion planning - remains substantially in the academic arena and is still fairly limited at that. The commercial application of game theory in the electricity industry appears to be mainly focussed on developing bidding strategies for generators. If this information was in the public domain, it is would be helpful in better understanding the modelling of strategic behaviour in electricity markets. However, it is unlikely to inform the main questions on the use of game theory in market power assessments for the purpose of quantifying the Competition Benefits of transmission investment.

The only example that we are aware of of the application of strategic modelling of electricity markets in the context of transmission expansion evaluation, is a methodology recently developed by the Californian Independent System Operator (CAISO) in collaboration with a consultancy. The methodology has been developed "over a year of joint research" and claims to "far exceed anything that has been done to date in the area of transmission planning studies."[30] The modelling methodology simulates strategic behaviour through an interactive process in which participants conjecture that their competitor's bids are some function of their bids in previous iterations. It incorporates a simplified assessment of new generation investment based on an entry trigger that compares the annual average unit revenues for a new combined cycle unit with the prices derived from the strategic bidding model. If these revenues are above the trigger level, new CCGT generation will be added and the price simulations recalculated on the basis of the entry of the new generation.

5.2.3 Application of strategic bidding approaches in the calculation of Market Benefits of transmission augmentation

The modelling of strategic behaviour tries to capture the way that market participants are likely to react to a proposed transmission augmentation, without subjective interpretation of they bid, assuming they have market power. Even if such modelling holds delivers its objectives, the application of game theory to the electricity industry – whether Cournot-Nash, Bertrand or Supply Function Analysis or variants of these - is generally to find *short term* equilibria given the current stock of generation and transmission assets, expected demand and rules on the way market participants are likely to interact with each other[31]. As a tool to evaluate market outcomes in the short term, such strategic modelling may be useful.

[29] Page 5.

[30] California ISO and London Economics International LLC, February 2003. A proposed Methodology for Evaluating the Economic Benefits of Transmission Expansions in a Restructured Wholesale Electricity Market.

[31] The economic benefit arising from a transmission investment will be subject to the way that the market develops and particularly generators' investment decisions. For example, an

However, the calculation of Market Benefits assuming non-SRMC bidding requires an economic evaluation over the long term (the life of a transmission augmentation). In this case, a meaningful model of strategic bidding should take account of competition between existing and future market participants on the basis that they are able to invest in new capacity or decommission existing capacity, over the life of the augmentation. This is an altogether different and far more complex dynamic modelling problem: effectively the problem amounts to modelling the future of a market in which there is imperfect competition and investors will invest strategically to compete over the long term.

There may be ways to simplify such dynamic models through the use of subjective assumptions. For example: participants can't decommission capacity; new investment will always arrive if the annual revenue from the pool exceeds the total costs etc. In its modelling of transmission augmentations, CAISO for example adopted simplified assumptions on new generation entry.[32] The implementation of this assumption seems to imply that once a short term equilibrium is established this equilibrium will be maintained in perpetuity i.e. it will not be affected by investment decisions. The empirical evidence of the development of electricity markets for example in England and Wales and California does not seem to support such cosy assumptions.

CAISO provides the only example that we are aware of, of strategic market modelling in the context of transmission expansion planning, and CAISO claims to have "far exceeded" anything that has been done to-date in this field. However, sophisticated strategic modelling to estimate the *short term* market equilibrium without modelling the strategic development of a market in the long term may be akin to solving the first half of a problem to the third decimal point, but then effectively ignoring the second half.

Producing reliable results from the modelling of Market Benefits assuming non-SRMC bidding is clearly extremely demanding. With the available modelling methods and the existing knowledge of market power in electricity markets, we think there is reason to be sceptical that modelling Market Benefits on the basis of non-SRMC bids is able to produce meaningful results at all.

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interconnector between two regions may offer Competition Benefits but if generators subsequently locate in the high price region, this could result in such interconnectors being used less than expected and the investment potentially stranded. In addition, in strongly interconnected networks, such asset stranding may occur as a consequence of transmission or generation investments in a completely different part of the system – not just changes to the markets directly at either end of an interconnector.

[32] The assumptions are that new entry is non-strategic and that it will be just sufficient to maintain prices at the level to repay costs. CAISO(2003)

6

Review of other approaches to the measurement of Competition Benefits

The Commission's February 2003 discussion paper suggested a number of alternative approaches to the measurement of Competition Benefits. These included:

- A 'public benefits test' proposed by Powerlink
- The Hirschmann-Herfindahl Index (and adaptions of this index)
- Residual Supply Analysis
- A 'Commercial Benefits Test'
- A competition index proposed by Stanwell

The purpose and method of each of these 'approaches' is quite different and some reflect a definition of Competition Benefits (and their relationship to Market Benefits) that may be somewhat different from the definition suggested in this paper. This chapter reviews each of the different proposed alternative approaches.

6.1 Powerlink's public benefits test

Powerlink has suggested a "third-limb" to the Regulatory Test to include the wealth transfers attributable to price decreases arising from increased competition attributable to the proposed transmission investment. Their specific proposal is for a two-step process as follows:

- Step 1: Determine whether a transmission augmentation could potentially increase generator competition. This step is a test of the competitiveness of the wholesale market and the potential for use of market power by generators.

- Step 2: Quantify the benefits (including wealth transfers) of the proposed transmission augmentation.

Carrying out this step would mean that wealth transfers would be included in the evaluation of a transmission augmentation. However, Powerlink suggest that this second step should only be carried out if the analysis in the first step produces a 'positive' trigger which they have defined as "the potential for prices to be higher than marginal costs".[33]

There are perhaps two key issues arising from this proposal:

- Firstly, whether wealth transfers should be counted if generators are deemed to exhibit market power;
- Secondly, the appropriateness/need for a trigger based on "the potential for prices to be higher than marginal costs".

With regard to the first point, as discussed earlier, this is a matter for the Commission and not for consideration in this paper.

With regard to the second point, our review of SRMC-based bids concluded that the start-cost non-convexities, the significant role played by hydro in the NEM, justifiable deviations from avoidable costs at times of capacity constraint, the lack of available data and the interaction between prices and investment means that determining the SRMC competitive benchmark is far from straight-forward or objective. This means that the "trigger" that Powerlink propose (based on the difference between bids and costs) is not a verifiable or objective measure of market power. We also note the considerable complexity of trying to measure or demonstrate the existence of enduring market power.

In addition, even if the proposed trigger is a meaningful measure of market power, from the perspective of the estimation of Competition Benefits, the existence of market power is not the issue. Rather the point is whether the proposed transmission augmentation is able to diminish the ability to exercise market power and hence give rise to allocative and productive efficiencies (and potentially wealth transfers if the Commission chooses to include these). There may be many cases where market power exists and where a proposed augmentation has little or no effect on this. Injecting an interim step – assessing whether market power exists – says nothing about whether the augmentation will necessarily provide Competition Benefits. It therefore appears to impose a significant analytical burden for no useful purpose.

6.2 The Hirschmann-Herfindahl Index (and adaptions of this index)

As the Commission's February 2003 discussion paper sets out, the HHI index is a widely accepted measure of the concentration of an industry, and under assumed Cournot competition the change in the index is linearly related to changes in the

[33] Powerlink 2003, page 24

price-cost mark-up (formally the Lerner Index) multiplied by the elasticity of demand.

On the face of it this relationship holds the appealing prospect that by examining changes in the HHI of any industry before and after a transmission augmentation, it is possible to deduce the change in prices if costs and the elasticity of demand is known. We have not examined this in great detail, but a cursory examination suggests that the practical application of this relationship may be challenging. In particular:

- The calculation of the HHI is far from simple or necessarily robust: many competing producers have a portfolio of base, mid-merit and peaking plant. However competition takes place in the 5-minute markets through-out the day when different types of plant are at the margin. While a transmission augmentation may increase the number of firms competing with each other (an increase in the HHI), what really matters is the increase in competition in relevant 5-minute markets, for each region (there may be more than one if constraints are binding). This implies the calculation of HHI's in relevant settlement periods (or grouping of periods such as peak, off-peak). This leaves the problem of interpreting different HHIs in each settlement period and possibly in multiple regions if constraints are binding. Furthermore, the existence of forward contracts or hedges may affect changes in the way that units are bid into the market, irrespective of changes in the number of competitors.
- To translate changes in the HHI into changes in prices, the equality between changes in the HHI and changes in the Lerner Index multipled by the elasticity of demand would be used. Therefore it is necessary to calculate Marginal Costs and the elasticity of demand. The calculation of marginal costs, as we described earlier is far from objective or straightforward. And, the elasticity of demand varies with the level of demand. The long term elasticity of demand in electricity markets remains poorly understood, and for the most part is not directly observable.
- As discussed earlier, while the assumption of Cournot competition may be a recognised method for modelling electricity markets, in the NEM, market participants simply do not know the production quantities of their competitors and the opportunity to re-bid almost to real time would seem to undermine the appropriateness of Cournot competition in NEM modelling.
- The definition of the markets affected by a transmission augmentation is problematic. It will depend on whether the proposed augmentation relieves constraints all or only some of the time, and different HHI measures would be calculated in each case. It also depends on the extent of constraints in other parts of the system.[34]

[34] In this regard we note a report prepared on behalf of Macquarie Generation and the National Generator's Forum which calculated an HHI (at the level of the firm) for the NEM of 852 (NECG, September 2002.) Besides the fact that such a measure does not meaningfully

Finally, leaving aside these criticisms, if it was accepted that changes in the HHI adequately described the changes in prices, this would still not take us very far in the calculation of Competition Benefits. Price changes of themselves may be sufficient to calculate allocative efficiencies from increased consumption in response to lower prices. However, they do not provide a basis for calculating productive efficiencies (for this we need to know how the despatch has changed as a result of the augmentation) or allocative efficiencies from deferring or avoiding generation and transmission investment (for this we need to know how investors will change investment decisions in response to changes within each market affected by the augmentation).

In summary therefore, as appealing as it may be to use changes in the HHI concentration measure as a method of calculating changes in prices and hence the measurement of Competition Benefits, our examination suggests a number of fundamental problems with this.

6.3 Residual supply analysis

Residual supply analysis tries to relate the margin of spare capacity to the exercise of market power. Searching for relationships between the amount of spare available capacity and likely profit margin seems to have intuitive appeal: as supply becomes more scare so the opportunity of the remaining producers to mark up their sales would seem to increase.

In developing its transmission expansion planning methodologies, CAISO has developed a multiple linear regression in which a Residual Supply Index (RSI) was used as one of five explanatory variables for predicting changes in the Lerner Index (the other four were Zonal Load, Uncommitted Supply of the Largest Supplier, and two dummy variables). [35]

In developing their analysis they needed to consider (for each hour and zone):

- The capacity of the network;
- How to define the available supply (in each of the markets they were analysing);
- The definition of the RSI (which meant defining total available supply, the total uncommitted capacity of the largest single supplier, and the residual demand – which was the actual zonal demand less utility owned generation output less qualifying facility generation less long term contracts).

A review of their analysis suggest that each of these factors are complex, data intensive and susceptible to subjective manipulation.

measure the concentration of the industry in its different sub-markets (for example Snowy simply does not compete with Loy Yang A), it also assumes that all regions of the NEM are unconstrained, which is not the case for significant periods through-out the day and year.

[35] See CAISO (2003)

The regression equation resulting from this analysis is then used to predict future values of the Lerner Index based on CAISO's projections of future values of the five explanatory variables.

Drayton (2003) identified the following possible shortcomings of their approach:

- It relies on historical relationships to predict future behaviour and therefore excludes generator responses to interconnection.
- It is not clear how the RSI would be calculated if an interconnector eliminates constraints between two regions: which pre-interconnection pricing region's estimated regression coefficients are used for calculating the price-cost margin?
- It is (unrealistically) assumed that all generating units (base load, mid-merit and peaking) mark-up price against marginal cost by the same percentage.

To these we would add a general criticism of statistical regression approaches such as these to predict future behaviour. The starting point is usually an intuitively sensible relationship between variables. However it quickly becomes bogged-down in the detail of the statistical analysis. The CAISO experience suggests that the analysis also relies on a significant amount of data, much of which is not objectively verifiable. Unless the resulting statistic relationships are utterly compelling (and it would take many years to tell if they were anyway) such approaches are easy to discredit and may be unlikely to withstand logical, empirical scrutiny.[36]

6.4 Commercial benefits test

The Commercial Benefits (CB) test, if we understand it correctly, would allow a proponent to include a rolling average of the Inter-Regional Settlement Residues between two regions, as the competition benefit of a proposed augmentation between those regions.

This approach is a "commercial" approach as opposed to a welfare economics approach. The IRSRs is simply the sum-product of inter-regional price differences in trading periods multiplied by the inter-connector capacity as defined by NEMMCo. This capacity is not a firm level – it can be (and is) de-rated from a predefined level, by NEMMCo from time-to-time.

Effectively the CB approach tries to value a regulated transmission augmentation in the way that a market network service provider would value such investment: with reference to the revenues that an interconnector is likely to capture by allowing physical transfers between higher and lower priced regions. As such, it assumes a completely different definition of Competition Benefits to those assumed in the Regulatory Test. It is not concerned with maximising the net market benefit (productive and allocative efficiencies and reliability benefits less costs) that the

[36] CAISO's analysis for example produces an R-squared of 62% - i.e. that 38% of the change in the Lerner index can not be explained by their five explanatory variables. It also suggests, quite plausibly, that the value of the Lerner Index is almost as sensitive to the season of the year as it is the RSI.

transmission investment may produce. Rather, it defines as the Competition Benefit, the wealth transfer that a transmission augmentation would be able to effect by increasing interconnection between constrained regions, and it doesn't count as a benefit the (economic) Competition Benefits and reliability benefits that the augmentation would give rise to.[37] The Commercial Benefits approach is so clearly at odds with the welfare economic basis of the Regulatory Test that there seems little purpose in considering it further, unless the Commission is minded to pursue a completely different approach to the regulation of transmission augmentation.

6.5 Stanwell Competition Index

Stanwell Corporation has suggested a "benchmark" approach to transmission investment "so that a competitive platform can be established within the NEM" on the basis that "the lack of transmission capacity in the NEM requires a competitive benefits methodology that can be developed quickly which simply and reliably accounts for Competition Benefits".

Their proposal is for a "competitive benefits hurdle" which, if met, will allow the Transmission Network Service Provider to proceed with the development of the least cost alternative. Their proposal is that the index incorporate the following information:

- "The number of electricity consumers currently affected by the constraint.
- The incremental electricity capacity supplied to the market following augmentation.
- Fuel mix of the incremental electrical capacity.
- The number of independent entities supplying the market following augmentation.
- The number of hours a constraint has bound over a specified period of time.
- The price effect of binding constraints."

Stanwell suggest that "one possible concept" is to allocate points for each component of the index so that when a threshold level of points is reached, the constraint qualifies for augmentation.

Stanwell's proposal reflects their desire for speedier decision-making on transmission augmentation, on the basis that the network is under-invested at present. On this

[37] By virtue of the interconnection, the economic efficiency element of the competition benefit would also be realised i.e. prices would decrease in the importing region offering the prospect of increased sales in response to lower prices Productive efficiencies would be realised by allowing the cheapest cost plant to be dispatched and allocative efficiencies by avoiding/deferring the construction of generation and transmission capacity. In addition, reliability benefits would be also be delivered if the interconnection decreased the probability of unserved energy and reduced the need for reserve.

basis they suggest that an "economically based approach" is not an appropriate "short term solution".

We have no view of whether or not the NEM's transmission network is under-invested and if so whether this should lead to the development of alternative approaches to ensure speedier approval of network development. We have therefore reviewed Stanwell's proposal on its own merits.

In summary we think that the various elements of their index are vaguely defined and so we are unable to assess what their proposed benchmark means. For example, and with reference to their list of factors:

- Are all consumers affected by a constraint to be equally counted? How do you count consumers affected by a constraint – if a constraint between Snowy and Victoria affects Victorian exports to South Australia are South Australians also counted as those affected by constraints? Are domestic customers consuming a small fraction of large industrial customers to be counted equally? What about intra-regional constraints – these aren't reflected in price differentials – should these be counted? At what point is the number of consumers affected by a constraint large enough to justify the award of a point for this component of the index? Why are consumers only counted – what about generators unable to access a larger market because of transmission constraints?
- What difference does incremental capacity after an augmentation make? Does more capacity or less capacity score a point? If so, how much? How do you know if there will be more capacity or less capacity after an augmentation unless you have done an economic analysis of the resulting efficiencies?
- Why does the fuel mix matter? Does a certain mix of fuel score more highly than others? What does the fuel mix have to do with cost structures? How do you know what the fuel mix will be post augmentation unless you have done an economic analysis?
- Why does the number of independent entities matter? How much is one additional entity worth – one point each?
- How are the benefits of eliminating constraints meant to relate to the costs of the investment needed? If sufficient "points" are scored so that "a constraint qualifies for augmentation" what limit of investment is justified in relieving those constraints? What if cheaper alternatives such as demand-side response or local generation are more economic than transmission investment?

7

Summary and observations on objectivity and robustness

7.1 Summary of key points

Definition of Competition Benefits

- We understand Competition Benefits to be the benefits, attributable to increased transmission capacity, of bringing NEM prices closer to short run marginal costs. Competition Benefits arise under the Regulatory Test's 'market-driven market development' approach when non-SRMC bidding is assumed.
- Competition Benefits can be considered to consist of three main economic efficiency elements:
  - Allocative efficiencies from increased production and sales if a transmission augmentation lowers prices;
  - Allocative efficiencies from avoiding or deferring the construction of generation and transmission assets (which may otherwise be developed if prices were higher);
  - Productive efficiencies from lower priced generation plant replacing higher priced plant.
- In addition to these economic efficiencies, lower prices can also redistribute wealth from generators in previously higher priced regions and consumers in lower priced regions to generators in lower priced regions and consumers in higher priced regions. If the importing region is electrically smaller than the exporting region, the dominant impact of the wealth transfer is likely to be from generators in importing regions to consumers in importing regions. The

existing definition of Market Benefits would appear to exclude this benefit, but whether this should be included as a benefit of transmission augmentation is a matter for the ACCC.

- In the case of price projections calculated on the basis of SRMC bids, Competition Benefits by definition do not exist because these benefits only arise when prices are brought closer to short run marginal costs: if bids are already assumed to be SRMC there is no benefit from increased competition.[38]
- In the case of price projections on the basis of anything other than SRMC, Competition Benefits will arise to the extent that the proposed augmentation causes the gap between the assumed market prices and SRMC-based prices to narrow.[39] Competition Benefits are the portion of the Market Benefit that is attributable to the effect of that augmentation in causing prices to become closer to marginal costs. In some cases, the effect may be so significant that all market power is eliminated and prices are brought all the way to SRMC. In this case the total Market Benefit from such an augmentation will comprise the Competition Benefit as well as other benefits attributable to underlying cost reductions. However, in other cases, an augmentation may only partially reduce market power. In this case the Market Benefit would comprise only the Competition Benefit.
- We can not see how to objectively split Competition Benefits from other benefits. But, this is not relevant anyway. This definition of Competition Benefits does not introduce any additional benefit that is not already counted in the application of the Regulatory Test. Rather, it simply describes an element of the Market Benefit that may arise under the non-SRMC bidding assumptions included as part of the Regulatory Test.
- In applications of the Regulatory Test to-date for all cases where non-SRMC bids had been assumed, such bids were assumed constant over the life of the proposed augmentation. In other words, there was no assessment of the way that generators may alter their bids in response to competitive threats brought-on by the proposed augmentation. This is likely to miscalculate Market Benefits

[38] We note that there are objections to the assumption of SRMC-bidding as a sustainable competitive equilibrium in electricity markets. For example Newbery (2002, page 11) in the context of SRMC-bidding suggests that "truly competitive markets for electricity are probably either not attainable or not sustainable."[38] Professor Littlechild suggests that "prices that do not cover all costs over the long run are not consistent with a sustainable competitive market … it is possible that in some cases pricing at SRMC covers the costs of baseload plant because rents at base load cover the balance of costs, but it is also necessary that the costs of all capacity are covered including those of peaking plant" (personal communication May 2003). It is an interesting and relevant discussion as to whether SRMC bidding is a valid basis for price projection in the evaluation of transmission augmentations, but this issue is beyond the scope of this paper.

[39] This does not mean that the proposed interconnector has eliminated market power, it just means that prices are lower because lower priced plant has displaced higher priced plant - the bids of the lower priced plant may still be above their SRMC levels.

in any real market where competitors are likely to adjust their bids in response to changes in the market.

Factors affecting the reduction in market power from transmission augmentation

- Competition benefits arise from a proposed transmission augmentation if it is able to reduce prices by increasing competition. But the extent to which an augmentation will reduce market power depends on a number of factors. These may include the level of forward contracting or hedging, the degree of vertical integration of generation and supply, the industry structure, shape of the supply curve, capacity margins, elasticity of demand, transmission incentives, market design and definition of transmission capacity.
- Ideally, modelling the impact of transmission augmentations would take account of these factors in a systematic and objective way. However, the relationship between these factors and the impact of transmission augmentation on market power is complex and generally has not been reduced to statistical or mathematical relationships. An assessment of the impact of a transmission augmentation on the mitigation of market power (and hence the derivation of Competition Benefits) would need to consider these factors in some way.

Modelling Market Benefits under the Market Driven Market Development approach

- The Market Benefits that arise assuming SRMC-bids reflect economic efficiencies attributable to the reduction of costs where cost differences are assumed to reflect only exogenous factors, such as higher fuel costs or labour costs etc. in one region of the NEM compared to another. Price projections on the basis of SRMC bids are complex. The main sources of such complexity include significant start-costs, operating constraints (ramp-up times and minimum generation levels), differences between marginal and average heat rates, hydro bidding and no unique specification of SRMC when capacity is constrained. Developing SRMC-based spot prices entails a significant degree of subjective judgement. Further, modelling the price-entry dynamic in an SRMC market is likely to produce volatile results: if generators only enter when they expect to recover their fixed costs, it will require sharp price spikes to provide the necessary signals for new generation. When such generation is commissioned, price spikes will diminish or disappear to be replaced by prices at short run avoidable cost for possibly long periods. This is a challenging dynamic to model.
- The exercise of market power entails bidding above SRMC so as to achieve market prices above competitive levels. In an idealised perfectly competitive market such behaviour would be unsustainable. But, where enduring market power exists, such behaviour is sustainable at least for a period of time and profit maximising producers have reason to engage in such "strategic" bidding if this maximises their profits.

- Determining the existence and extent of market power is very difficult, not least because the competitive benchmark is - as discussed above – not objectively definable. Price changes attributable to reduction in Market Power provides the basis for the allocative efficiencies from increased consumption, productive efficiencies from the despatch of the cheapest plant and allocative efficiencies from deferring or avoiding generation and transmission expansion.
- Applying strategic modelling approaches to the calculation of Market Benefits allows the impact of market power changes attributable to a transmission augmentation to reflect the response of market participants to the changed environment. In this way it is intended to provide a far more realistic assessment of Markets Bids than would be produced by simply assuming constant bids over the life of the proposed interconnector.
- There are a number of possible approaches to modelling strategic behaviour. They all have a common goal of finding the "equilibrium" outcome of an interactive "game" played by profit-maximising participants. The equilibrium is the point at which no participant is able to increase its profits, given the bidding strategies of other participants. Part of the specification of this equilibrium is the market price.
- The different approaches vary in their assumptions of how firms compete (on prices or on quantities) and how the relationship between supply and price is specified. In addition to these fundamental differences, in the course of the application of these approaches in market power assessments, there can be a whole range of other assumptions and refinements to distinguish one approach from another.
- CAISO provides the only example that we are aware of, of strategic market modelling in the context of transmission expansion planning, and CAISO claims to have "far exceeded" anything that has been done to-date in this field. However, sophisticated strategic modelling to estimate the *short term* market equilibrium without modelling the strategic development of a market in the long term may be akin to solving the first half of a problem to the third decimal point, but then effectively ignoring the second half.
- Producing reliable results from the modelling of Market Benefits assuming non-SRMC bidding is clearly extremely demanding. With the available modelling methods and the existing knowledge of market power in electricity markets, we think there is reason to be sceptical that modelling Market Benefits on the basis of non-SRMC bids is able to produce meaningful results at all.

Other approaches to the measurement of Competition Benefits

- The Commission's February consultation paper described a number of alternative ways of measuring Competition Benefits/deciding transmission expansion. These included:

  - A ‘public benefits test’ proposed by Powerlink suggesting that wealth transfers be included if market price were deemed to much above competitive levels.
  - The use of changes in the Hirschmann-Herfindahl Index (and adaptions of this index) to measure price changes resulting from transmission augmentation.
  - Residual Supply Analysis which tries to relate the margin of spare capacity to the exercise of market power.
  - A ‘Commercial Benefits Test’ which provides for the calculation of Competition Benefits on the basis of the rolling average of Inter-regional Settlement Residues.
  - A competition index proposed by Stanwell which suggests a “benchmark” approach to transmission investment “so that a competitive platform can be established within the NEM” on the basis that “the lack of transmission capacity in the NEM requires a competitive benefits methodology that can be developed quickly which simply and reliably accounts for Competition Benefits.”
- We don’t think any of these approaches are helpful in providing a way to calculate Competition Benefits by avoiding complex market modelling. In particular:
  - The Powerlink Public Benefits approach appears to impose a potentially significant analytical burden for no useful purpose;
  - Even if we accepted that changes in the HHI adequately described the changes in prices, this would still not take us very far in the calculation of Competition Benefits. Price changes of themselves may be sufficient to calculate allocative efficiencies from increased consumption in response to lower prices. However, they do not provide a basis for calculating productive efficiencies (for this we need to know how the dispatch has changed as a result of the augmentation) or allocative efficiencies from deferring or avoiding generation and transmission investment (for this we need to know how investors will change investment decisions in response to changes within each market affected by the augmentation).
  - CAISO’s work on building a relationship between prices and the residual supply is interesting. The starting point is an intuitively sensible relationship between variables. However statistical approaches such as these quickly become bogged-down in the detail of the statistical analysis. The CAISO analysis also relies on a significant amount of data, much of which is not objectively verifiable. Unless the resulting statistic relationships are utterly compelling (and it would take many years to tell if they were anyway) such approaches are easy to discredit and may be unlikely to withstand logical, empirical scrutiny.

- The Commercial Benefits approach is at odds with the welfare economic basis of the Regulatory Test that there seems little purpose in considering it further, unless the Commission is minded to pursue a completely different approach to the regulation of transmission.
- The various elements of the Stanwell Competition index are vaguely defined so we are unable to assess what their proposed benchmark means.

7.2 Observations on the Commission's objectivity and robustness criteria

The Commission has emphasised the need for objectivity and robustness in Competition Benefit assessments. Since Competition Benefits are simply part of the Market Benefit calculated on the assumption of non-SRMC bidding, the issue is therefore the relative objectivity of the estimation of Market Benefits under non-SRMC bidding assumptions compared to the alternative economic assessments of transmission augmentations (which do not include Competition Benefits). The alternatives are to assume SRMC-bids in the 'market-driven market development approach', or the estimation of Market Benefits under the 'least-cost market development' approach.

Objectivity

Considering first the potential ability of each method to accurately model the benefit of transmission augmentation taking account of the actual development of the market:

- The 'least-cost market development' approach assumes away much of the uncertainty by prescribing that the market is fully competitive and that the long term equilibrium is the LRMC of new entrants.
- SRMC-bidding in the 'market-driven market development' at least tries to recognise the existence of a market by determining the market price based on generator bids. However, it assumes that the market is fully competitive.
- Actual-bidding in the 'market-driven market development' approach is the most sophisticated approach and tries to estimate Market Benefits in a way that takes account of market power and how this is expected to change following the development of the proposed augmentation. Whereas other approaches reduce the scope for subjective interpretation by assuming away uncertainties, this approach attempts to deal with the uncertainty through models that capture the actual evolution of the market. Analytically this is by far the most demanding approach as it requires the development of a dynamic model that captures competitive interaction, not just in the short term, but over the life of the proposed augmentation.[40]

[40] Simplification in this approach – for example assuming that bids are unchanged over the life the augmentation, or replacing the price-investment dynamic with a simple rule – have been

However accepting for the moment the premise that the "least-cost market development' approach is based on - fully competitive market and long term equilibrium at LRMC of new entrants – the 'least-cost-market-development' approach is perhaps the most objective method. But, the scope for subjective assessment has been diminished, only by assuming away one of the big uncertainties. If we reject the assumption that the long term equilibrium market price is the LRMC of new entrants and that least-cost dispatch reasonably approximates actual dispatch – and empirical evidence in a number of competitive electricity markets suggests that this is not an unreasonable point of view - then this approach is no more objective than the others.

Robustness

In terms of robustness, if we characterise this by the ability of a methodology to deliver consistent results, then the pecking order is likely to be 'least-cost market development' followed by SRMC bids followed by actual bids. With regard to actual bidding, the development of a market is unpredictable. For each different prediction there is likely to be a different, but plausible, assessment of Competition Benefits. This is also true for the other approaches, but since these assume the market is always competitive, the range of possible outcomes may be narrower.

We also note that the different modelling approaches described in this section are broadly defined. In the practical implementation of each of these approaches, a number of subjective assumptions and "fiddles" are needed to produce answers. The actual robustness of each approach will be highly affected by these assumptions and fiddles: a more sophisticated approach rigorously implemented could be more robust than a less sophisticated approach poorly implemented. Similarly, a more sophisticated approach poorly implemented will be less robust than a less sophisticated approach rigorously implemented.

The Regulatory Test sets very demanding standards for the economic evaluation of transmission augmentations by requiring that they be evaluated on conventional central planning criteria and by taking account of the impact of the augmentation on market power. In our view, the application of the Regulatory Test to-date appears to have fallen well short of the stated intent. This may reflect a number of limiting factors including the cost of more sophisticated analyses, the time allowed for the assessment, the availability of data, the limitations of available expertise, public consultation requirements, transmission governance arrangements[41] and other

adopted to make this approach tractable. However, while such simplifications are understandable they are contrary to the whole purpose of modelling actual bids which is to take competitive interaction into account.

[41] In this regard we note the current proposals by the Federal and State governments to change the organisation and governance of transmission planning. This proposes to change current Electricity Code arrangements, under which TNSPs have a monopoly over intra-regional transmission augmentations. Inter-regional augmentations (interconnectors) are effectively constestable, but it is most likely that regulated interconnections will be proposed by TNSPs in order to recover costs through regulated charges. For non-reliability network augmentations whether inter or intra-regional, proposed augmentations are required to maximise Market

factors. As we discussed in this paper, producing reliable results from the modelling of Market Benefits assuming non-SRMC bidding is extremely demanding. In view of the available modelling methods and the existing knowledge of market power in electricity markets, we think there is reason to be sceptical that modelling Market Benefits on the basis of non-SRMC bids is able to produce meaningful results at all.

Benefits. The Electricity Code provides for appeal to the Commission against TNSP assessments under certain conditions.

These arrangements may detrimentally affect the rigorous application of the Regulatory Test for the following reasons:

- The application of the Regulatory Test is extremely demanding analytically. The dispersion of the application of the test to four TNSPs may retard the development of a consolidated body of knowledge and expertise.
- The calculation of Competition Benefits is data intensive and individual TNSPs may find it difficult to access accurate data on, for example, generation costs. In addition, accurate NEM-wide network modelling with accurate information on network impedances, load conditions and network capabilities is vital to the modelling of many significant transmission augmentations. Individual TNSPs will have to rely on the cooperation of fellow TNSPs to gain access to such information. In addition, the dispersion of responsibility may mitigate the funding and development of complex network analytical tools;
- TNSP customers are effectively a regulator "of first resort" – it is only if TNSP customers appeal the TNSP's application of the Regulatory Test that the Commission is required to make a determination. This places a particular obligation on customers to develop the capability to review the TNSP's application of the Regulatory Test. For customers to appeal TNSP assessments, this will require that they develop a sophisticated knowledge of transmission economics. This can be expensive and time-consuming. In addition, the obligation on TNSPs to consult with customers in the first instance on the application of the regulatory, will require TNSPs to take into account their customer's knowledge of the subject and their ability to analyse complex assessments. This may unduly restrict a TNSP's freedom to develop sophisticated analyses.

Appendix A: Competition Benefit definitions suggested by interested parties

	Suggested definition of competition benefits
ACCC	Not directly defined but stated that *"competition benefits arise from increased competition between generators, and a reduction in market power, resulting from free-flowing interconnectors."* The Commission goes on to explain that this means that "*a competition benefits test may therefore ensure that all allocative efficiency benefits (market prices at marginal cost) and dynamic efficiency benefits (eliminating inefficient generator entry) … are captured*."
VENCorp	Not explicitly defined. But VENCorp suggest that some of the measures of competition benefits (proposed by the ACCC) include changes in "transfer payments". VENCorp go on to suggest that "a valid basis for assessing competition benefits may be to estimate the ***net*** (their emphasis) benefits expected to flow from changes in transfer payments (i.e. lower electricity prices) which lead to an increase in efficiency for the economy as a whole". VENCorp suggest that competition benefits are not contemplated in the current definition of the Regulatory Test – "the RT should continue to be the primary economic evaluation tool applied by TNSPs".
SPI PowerNet	Not explicitly defined. But SPI PowerNet suggest that the calculation of "competition benefit" relies on *"an assessment that market participants have market power"*. Evidently they suggest that the calculation of competition benefits is not contemplated in the current Regulatory Test: *"SPI PowerNet considers that the primary test should remain as a market benefits test"*.
Powerlink	Competition benefits *"describe the benefits of lower pool prices from increased competition between generators in the wholesale electricity market that can result from a network augmentation"*. Powerlink distinguish "net benefits" and "gross benefits". Net competition benefits *"include the consumption benefits that exist due to consumers being willing to purchase greater quantities of electricity at lower prices"*. Gross benefits *"include reduction in the purchase cost of electricity resulting from the lower pool prices that occur due to increased competition amongst generators. That is, the benefit to consumers of lower overall prices due to increased competition …". Powerlink argue that "the existing test does not allow the inclusion of net competition benefits associated with changes in the cost of supply (where this above marginal cost) and the effects of resulting pool price changes on electricity consumption"*. By implication, although not explicitly stated, Powerlink would argue that gross benefits are also not included in the current test.
Gallaugher and Associates (on behalf of TXU, Loy Yang, International Power Hazelwood, Edison Mission,	Not defined. However, from the nature of the argument presented to the ACCC by G&A, it would appear that G&A implicitly define competition benefits to be mainly (or exclusively) "distributional" rather than "economic".

Yallourn)	
TransGrid	TransGrid suggest that competition benefits arise from: *"spot market prices being above marginal costs (due to … generation market power) and then becoming more aligned with marginal costs as a consequence of a project (due to reduction of market power, i.e. "greater competition"); and* *Consumption of electricity increasing in response to lower spot prices."* The first of these, TransGrid's consultant, NERA have called "gross" benefits and the second "net" benefits, and the difference between the two represents "a wealth transfer from producers to consumers". TransGrid believe that the Regulatory Test currently allows net benefits to be included, but that "gross" benefits are not currently included.
ElectraNet	Drayton Analytics (ElectraNet's consultants) suggest that the measures of benefits and costs under the existing Regulatory Test, by definition account for all relevant economic impacts from changes in production and consumption (due to a project), given they are applied correctly. They therefore argue that benefits due to market power reductions are implicitly included in the definition of "market benefit" and as a result are allowable under the test. They further argue that *"attaching a connotation to 'competition benefits' that relates specifically to market power implies (incorrectly) that such benefits must not be allowable under the current test and may inadvertently lead to participants overlooking or disregarding other legitimate net benefits from consumption changes that have no relationship to market power reduction"*
Origin Energy	Did not explicitly define competition benefits. But suggested that *"given the low elasticity of demand of electricity it is likely that nay estimates of lower pool prices will reflect distributional transfers from generators to consumers rather than changes in net market benefits per se." They go on to say that "it will be difficult, if not impossible, to disentangle net market benefits from distributional benefits on an ex-ante basis …"*
TXU	TXU noted that" *the exact interpretation of 'competition benefits' within an economic test has been a point of confusion to the industry". TXU suggest that competition benefit ma y be "economic" and "social"*. Economic benefits are *" the increased economic surplus that occurs as a result of increased satisfied demand when prices return to marginal cost due to increased competition"*. Social benefits are *"the direct transfer of value away from producers to consumers when prices fall due to increased competition."* TXU suggest that the economic benefits are already included in the definition of "net market benefits"
Stanwell	Did not explicitly define competition benefits. However, from their submission it appears that they envisage that "competition benefits" would include "efficiency" effects as well as "distributional" effects.
Headberry Partners (on behalf of the Electricity Consumers Coalition of South Australia and the Energy Users	Did not explicitly define competition benefits. However, from their submission it appears that they envisage that "competition benefits" relate mainly to benefits that would be captured by customers.

Coalition of Victoria)	

Appendix B: The calculation of Competition Benefits in previous applications of the Regulatory Test

The table below summarises the basis upon which market development has been modelled (and forward prices determined) in previous applications of the Regulatory Test.

Project	Reference	Basis of price projection and generation entry decisions
SNOVIC 400	IRPC (Modelling by ROAM Consulting[42]	A range of "least-cost", "SRMC-bidding" and "LRMC-bidding" scenarios were modelled.[43] No single scenario was used, but the results were instead weighted in some way.[44] Generation investment decisions were not related to price outcomes.
SNI	IRPC (modelling by ROAM Consulting)[45]	As above.
Latrobe to Melbourne upgrade	VENCorp[46]	SRMC bids were assumed for all scenarios (defined as different investment options demand projections and discount rates) except one which assumed "LRMC bidding". Generation investment decisions were not related to price outcomes.

[42] IRPC(a)

[43] LRMC bids are described as ensuring that "as many as possible of the electricity market participants obtain sufficient revenue from the pool to satisfy their total financial requirements". Beyond this, it is unclear how such bids were calculated, but the reported LRMC bids ranged between $32/MWh and $4580/MWh for different units. Against the economic definition of SRMC, such LRMC bids therefore represent a premium on the SRMC that could be eroded through increased competition. (Source: IRPC (a) October 2001).

[44] We have reviewed the IRPC report, but it is not clear from this how results were ultimately weighted.

[45] IRPC(b) October 2001

[46] VENCorp(2002)

SNI	TransGrid (Modelling by IES)[47]	Three price scenarios were developed: SRMC, Realistic 1 (bidding based on what was observed in the NEM, with new generator investment decisions based on projected pool revenues) and Realistic 2 (bidding in line with what is actually observed in the NEM and new generator investment decisions not determined solely on projected pool revenues).
Murraylink conversion	MTC (Modelling reported by Charles River Associates)	CRA report that TransEnergie assumed that all generators (existing and new entrants) bid at marginal cost.[48]

From this we can draw the following conclusions:

- None of the projects have been modelled on the basis of the "least-cost market development" scenario as defined in this chapter. (The IRPC claimed that the "least-cost market development scenario is the same as the market-driven market development approach with SRMC bids and additional generation to meet the reliability standards)[49].
- The so-called LRMC bidding approach adopted by the IRPC and VENCorp represents an extreme form of market power in which the clearing price is calculated based on the LRMC of the last unit dispatched. This means that base-load generators recover their full LRMC during off-peak periods but the even higher LRMC of peaking units during peak periods.
- Other than for TransEnergie's application of the test, generation entry decisions appear to reflect a trigger based on the difference between the pool price and SRMC for different types of plant. If this is higher than the imputed fix costs of generation, then entry has been assumed to occur.

With the exception of the application of the Regulatory Test by TransEnergie for Murraylink, all other cases have projected spot prices on the basis of scenarios that included bids above SRMC (whether called 'LRMC' or 'bids based on what was observed in the NEM'). In all cases, bids were assumed to be fixed for the period of the analysis i.e. they were not assumed to react dynamically to each other as would be expected in a competitive market i.e. no account has been taken of the strategic response of producers to the proposed transmission augmentation under review.

Other than for Murraylink's conversion application (which assumed SRMC bids) for all other applications of the Regulatory Test where non-SRMC bidding assumptions have been made, Competition Benefits have potentially been counted to the extent that some assessment has been made of how prices are brought closer to SRMC following the augmentation. However we note that in previous applications of the

[47] Campbell A, June 2002.
[48] Charles River Associates, October 2002.
[49] IRPC(a) page 23.

Regulatory Test there has been no assessment of the way that generators may alter their bids in response to competitive threats brought-on by proposed augmentations. This is likely to miscalculate Market Benefits in any real market where competitors are likely to adjust their bids in response to changes in the market.

Appendix C: Terms of Reference

Project Brief

Review of the Regulatory Test

Background

Development of the regulatory test

The regulatory test was developed in response to concerns raised by the National Electricity Market Management Company (NEMMCO) in its application of the customer benefits test[50] to an interconnector between South Australia and New South Wales (SANI) in 1998. Concerns were raised with respect to the ambiguities of terms used in the National Electricity Code at the time[51], and concerns that the test as it stood might make it difficult for any inter-regional augmentation to satisfy the criterion. As such, the NSW Government lodged this issue in the NEMMCO's Issue Register requiring it to be resolved prior to the commencement of the National Electricity Market (NEM). Consequently, the Australian Competition and Consumer Commission (the "Commission" or "ACCC") was asked, as an independent party, to review the test.

The Commission engaged Ernst & Young to assist it in conducting its review. The Commission published the Ernst & Young report in March 1999. On the basis of that report, the Commission published a preliminary view of the regulatory test in April 1999. That paper acknowledged the merit in changing the test from a Customer benefits test to a market benefit test based on maximising net public benefits.

On 23 July 1999, the National Electricity Code Administrator (NECA) sought authorisation of amendments to the National Electricity Code (the code), which included changes to replace the existing Customer benefits test with a regulatory test to be determined by the Commission. The amendments also required all network service providers (including both transmission network service providers (TNSPs) and distribution network service providers (DNSPs)) to consult with interested parties when applying the regulatory test in deciding which network augmentations should proceed. The consultation included examining, amongst other things, alternative generation and

[50] The customer benefits test was designed to ensure that network investment would only be undertaken if customers benefited from that investment

[51] some clauses referred to public benefits and others referred to customer benefits, with customers being defined in the code as wholesale market customers, rather than customers at large.

demand side options to determine the option that satisfied the regulatory test, while meeting the technical requirements (reliability) of schedule 5.1 of the code. The amendments also required the Inter Regional Planning Committee (IRPC) and NEMMCO to apply the regulatory test when considering possible system augmentations. The Commission authorised the code changes on 20 October 1999[52].

The Commission adopted a parallel process with the code change consultation for developing its preliminary views on the regulatory test and sought additional submissions. It released a draft regulatory test on 22 September 1999 and, following further consultation, finalised the regulatory test in December 1999.

In developing the regulatory test the Commission relied on the two key principles of economic efficiency and competitive neutrality. Consequently, the Commission based the regulatory test on the traditional cost-benefit analysis framework but with a number of clarifications to limit any adverse impacts that regulated network investments might have on the competitive processes in the contestable parts of the industry. One of the recommended changes to the test was to remove the volatility inherent in the Customer benefits test and ensure even-handed treatment between network and non-network investment. That is, to extend the neutrality in the code between network and non-network alternatives such as generation, demand side or unregulated network investment to the regulatory test.

Regulatory test review

On 19 June 2001, the Commission and NECA released a joint statement announcing their commitment to review the current framework for essential new investment. For its part, the Commission stated that it would review the regulatory test to ensure that it does not result in a complex and lengthy process that delays the development of regulated investment.

As part of this commitment, the Commission released an issues paper on 10 May 2002, which highlighted a number of concerns raised by interested parties with the operation of the current regulatory test. From submissions to the Issues Paper the Commission identified three options for the development of the regulatory test, which it outlined in a Discussion Paper released on Wednesday 19 February 2003.

The three options identified are:

- maintaining the current test with minor modifications to ensure consistency between the regulatory test and the code, especially following the Network and Distributed Resources (NDR) code changes;

52 ACCC; Applications for authorisation: Market Operations for Y2K, Regulated Interconnectors and Augmentations and System Security Compensation; 20 October 1999.

- define and clarify elements of the regulatory test to ensure consistent application of the test across the NEM – (the National Electricity Tribunal's decision on the SNI Option plays an important role in how terms are defined); and

- outline possible methods for assessing competition benefits.

One of the contentious issues and criticisms of the regulatory test is the exclusion of competition benefits. In promulgating the regulatory test the Commission argued that the test should use the principles associated with cost/benefit analyses. The implications for the test was that market prices would not be incorporated in an assessment of a potential interconnector particularly where there is reason to believe that the prices are distorted by a market failure. The Commission has acknowledged that network investment, and interconnectors in particular, can have a impact on competition in a region, either by reducing generator market power or reducing prices. The Commission has noted that one of the key objectives in developing a competition based test is that it must be objective and robust over a range of market development scenarios.

Terms of Reference

The consultant is to review, analyse and report on the issues arising from the practical implementation of the approaches to the measurement of Competition Benefits proposed by interested parties in response to the Commission's discussion paper.

Output

The output of the consultancy will be a report to the ACCC addressing the terms of reference. Authorship will be clearly attributed to the consultant. The report will subsequently be released by the ACCC for public discussion. The consultant will be required to present his/her findings at the Market Review Forum which will be held on the XX 2003.

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