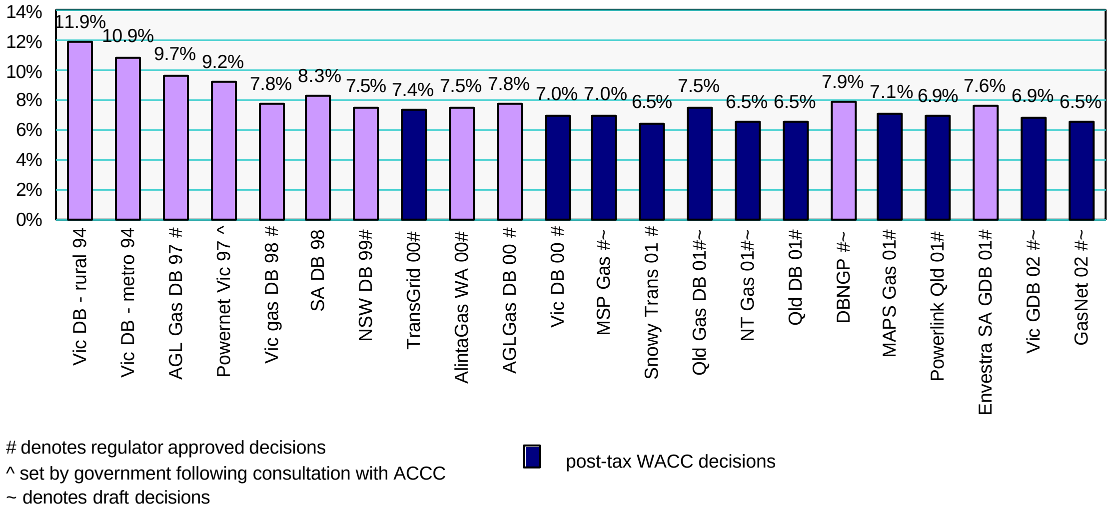

Figure 1: Rates of return allowed in revenue setting expressed as a pre-tax real WACC

We have also compiled information on the real 'risk premium' that is effectively allowed for in the decisions shown in Figure 1 (i.e. the premium over the real risk free rate that is reflected in the equivalent pre-tax real WACC). This information is shown in Figure 2 below.

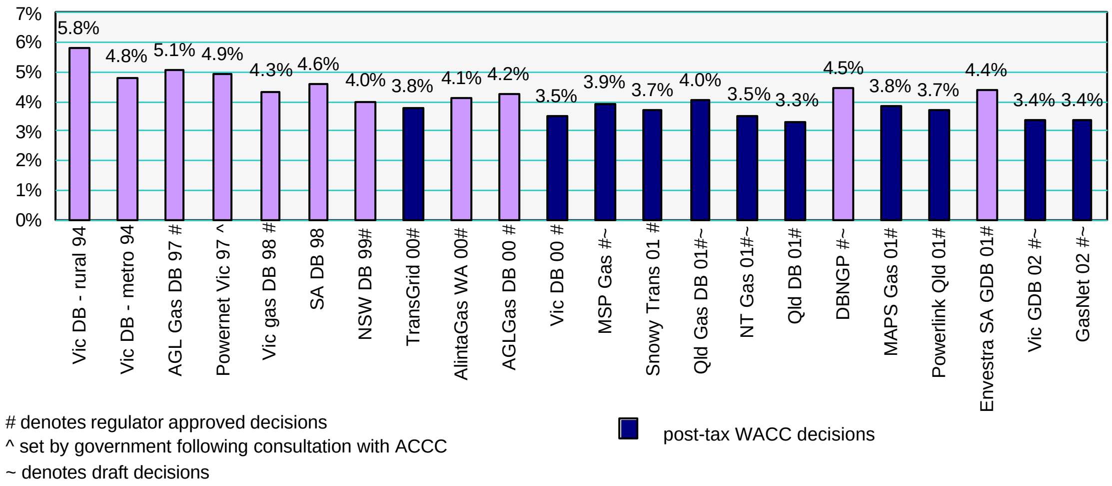

Figure 2: Equivalent pre-tax real WACC allowed for revenue setting expressed as a premium over the real risk free rate prevailing at the time of the determination

The data shown in Figure 1 above indicates that there has been a marked decline in rates of return allowed by regulators in setting the revenue requirements for gas and electricity network service providers. Figure 2 indicates that this decline is caused by factors other than movements in the market rate of interest. It is also apparent that the decisions with the lowest premium over the real risk free rate are those that apply a 'post tax framework' for revenue setting.

3.4.2 The evidence of inadequate returns

Inadequate rates of return are harmful to investment. Establishing whether the rates of return currently provided to regulated electricity and gas businesses are adequate is, however, conceptually difficult. As the PC has noted, this is partly because of the lack of an obvious counter-factual. It is also because the effects of inadequate incentives can take time to emerge, particularly in infrastructure industries, which often involve lumpy investments with long lives. Much of the evidence on both sides of the debate is therefore anecdotal.

These difficulties have not, however, stopped both the PC and the Government reaching the conclusion that the current focus of regulation has tilted the playing field too far into the direction of "eliminating monopoly rents", and thus away from providing adequate incentives for investment.

As the following press extract suggests, investors in regulated businesses and regulators hold divergent views on whether incentives provided for investment are adequate:

"The managing director of DB Capital Partners, Felicity Gates, told the conference that because of the investment uncertainty created by regulation, her group had not invested in regulated assets for four years.

… Mr [Mike] Fitzpatrick quipped that his returns made him a member of the "1 per cent" club.

… AMP's Asia-Pacific head of infrastructure, Danny Latham, said most balanced funds allocated 5 per cent to infrastructure. Super funds available for infrastructure would be $150 billion by 2011: the Australian Council for Infrastructure Investment's cost estimate to upgrade infrastructure. He said AMP was also not investing in regulated assets.

… Professor Fels had told the conference the previous day that regulation had not deterred new investment."[10]

Regulators have variously relied on average returns on equity, rates of return provided to regulated businesses in other countries, and the value at which regulated businesses are sold as evidence that returns are adequate. On the first point, the PC concluded:

"comparisons between the returns on infrastructure projects and average returns on equity reveal little about the adequacy of the current investment climate. The significant project-specific risk that often attaches to infrastructure projects means that investors will require returns on successful projects that are greater than those on 'average' projects."[11]

On the second and third points, closer analysis reveals that the evidence is at best ambiguous.[12]

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[10] "Regulation turns investors off", by Philip Hopkins, 16 August 2002, The Age.

[11] Productivity Commission, Review of the National Access Regime: Position Paper, 2001, page 65.

[12] NECG, International comparisons of rates of return, July 2001. KPMG, Submission to the Essential Services Commission in response to the ESC's Draft Determination on its 2003 Review of the Victorian Gas Distribution Access Arrangements, August 2002.

While issues of commercial confidentiality and client interest affect our ability to list specific instances of inadequate investment, we would point to the following as evidence of serious problems:

- during the period 1994 to 1998 investors were clearly prepared to invest in Australian energy infrastructure. A large number of domestic and overseas companies committed significant funds to Victorian, South Australian and Western Australian privatisation programs. Other companies made direct investments in network development;
- this pattern of investment has reversed in the period since 1998 with a number of overseas investors exiting and others looking for an opportunity to do so;
- the pattern of investment in existing infrastructure has changed significantly. The investors in the earlier period were mainly what might be termed 'owner operators' actively interested in optimising their new investments and using Australia as a base for further investment in our region. The acquirers of existing businesses in recent years have, increasingly, been institutional and more passive in orientation. Some might see this trend as an improvement in the efficiency with which the market is dealing with these types of investment (eg. by separating two of the critical functions - financial and operational expertise). However, such an approach is not nearly as prevalent in similar industries and the Australian infrastructure market appears to be unique in the degree and speed with which asset ownership is being transferred directly from owner operators to essentially passive investors. This appears to be a function of the limited scope for owner operators to generate the scale in Australia necessary to justify their presence in the market, and to the returns on offer;
- much has been made by user groups of the hundreds of millions of dollars of investment approved by regulators in price determinations – and the fact that much of that investment has subsequently been made. We would view most of this investment as being of a 'stay in business' nature. Any rational owner will continue to make 'stay in business' investments – even if only in order to retain value for a subsequent sale. It will not, however, encourage managers to address proactively emerging network issues that customers might be willing to pay to have dealt with. They will not do this because the investor will not allow it, the culture of the organisation will become focussed on a minimalist approach and, where doubt exists, deferring investment will be the norm in the hope that the investment environment might improve over time (eg. as regulators come to recognise the consequences of their actions). There is plenty of evidence that needed discretionary extensions of infrastructure are not being made;
- where ever possible facility owners are trying to avoid regulatory coverage. Duke Energy has built the Eastern Gas Pipeline and the Bass Straight Pipeline on this basis. Epic Energy and APT are seeking revocation of coverage under the Gas Code for their investments in the Moomba to Adelaide and Moomba to Sydney pipelines;
- there is also evidence that gas transmission businesses are planning to build facilities sized only for identifiable foundation customers in order to remove the uncertainties and unattractive returns of regulated access. This, unfortunately, is a logical (though inefficient) response to the existing regulatory incentives; and
- significant attempts have been made to clarify whether the regulators' approach to regulation is consistent with their legal obligations. The regulatory regime is producing an impressive amount of litigation, often relating to fundamental issues. This is despite the limited grounds for appeal (eg. to errors of law), and the wide discretion afforded to regulators.

Our view is that regulators should be seeking to provide regulated electricity and gas businesses with a regulated return in the region of 4.5% to 5.5% over the real risk free rate. It is apparent that this level of return (from 1994 to 1998) led to a pattern of investment in Australian energy infrastructure that is consistent with Government policy and the original intention of the regulatory regime.

It is also apparent that the more recent regulatory decisions, where the margins are in the order of 3-4%, are not providing adequate investment incentives.

Moreover, we believe that Australian regulators should make it plain that this level of regulatory return is expected to apply for the foreseeable future and would not be altered unless there was an overwhelming and compelling reason to do so (ie. such as a major exogenous economic shock).

4 Implications for the ACCC

The clarification of the regulatory regime would appear to have potentially profound impacts for decisions made by the ACCC in the gas and electricity sectors because:

- it operates under the TPA and the guidance provided by the Regime;
- the Regime and the National Electricity Code (the Electricity Code) contain provisions that are similar to those in the Gas Code;
- the ACCC's Draft Statement of Principles for the Regulation of Transmission Revenues (the Statement of Regulatory Principles) is based on a different interpretation of these provisions; and
- decisions made by the ACCC within this framework have relied on its interpretation of these provisions.

Given that the Government is only seeking to clarify the existing regime in the changes it will make, the ACCC does not have to wait for the announced amendments to be enacted. Instead, it could recognise now that its Statement of Regulatory Principles and current draft decisions need to be substantially reworked in order to provide the outcomes that are consistent with the original intent of the regulatory regime.

4.1 The ACCC's Statement of Regulatory Principles

In this section we outline the main areas in which the ACCC's Statement of Regulatory Principles adopts a framework that is inconsistent with the intent of the regulatory regime.

4.1.1 The approach to estimating revenues

The ACCC's interpretation of its role as in its Statement of Regulatory Principles is inconsistent with the intent of the regulatory regime:

"In assuming its role as the national regulator of transmission revenue in the NEM, the Commission's aim is to adopt a regulatory process which eliminates monopoly pricing, provides a fair return to network owners, and creates incentives for managers to pursue ongoing efficiency gains through cost reductions. In achieving these aims the Commission is aware of the need to ensure compliance costs are minimised and that the regulatory process is objective, transparent and as light handed as possible."[13]

It is apparent from the above that the ACCC believes that:

- its role is to <u>eliminate</u> monopoly pricing (ie. provide revenues which are "just sufficient" to ensure continued operation of regulated businesses). Note that the ESC felt obliged to remove precisely this interpretation of its role in its Final Decision in the 2003 GAAR;
- an outcome that eliminates monopoly pricing is consistent with providing network owners with a fair return. Indeed, applying the perfect market paradigm, there is only one outcome that can deliver both of these objectives simultaneously (ie. revenues that are "just sufficient");

[13] ACCC, Statement of Principles for the Regulation of Transmission Revenues: Draft, 27 May 1999, page ix.

- it is implicit in this view that there is one right answer and that this outcome is consistent with what one might expect to occur in a perfectly competitive market; and
- the attempt to replicate such an outcome is consistent with light handed regulation.

None of these views are consistent with the intent of regulatory regime. This would appear to undermine the whole basis of any decision that has been made by applying the Statement of Regulatory Principles. It is apparent that a similarly inappropriate framework is also applied to particular revenue building blocks.

4.1.2 Asset valuation

It is understood that:

- the Electricity Code provides that existing and new assets *can* be revalued at the regulator's discretion;
- *if* valuing assets, the ACCC must have regard to the COAG agreement that deprival value is the preferred approach to valuing network assets; and
- the ACCC has interpreted this requirement to mean that an optimised depreciated replacement cost valuation (ODRC or DORC) methodology should be used.

The ACCC explains the merits of the DORC asset valuation methodology in the following terms:

"The DORC of a network is the sum of the depreciated replacement cost of the assets that would be used if the system were notionally reconfigured so as to minimise the forward looking costs of service delivery. There are two definitions of what DORC attempts to measure:

- *One interpretation of DORC is that it is the valuation methodology that would be consistent with the price charged by an efficient new entrant into an industry, and so it is consistent with the price that would prevail in the industry in long run equilibrium.*
- *The second interpretation is that it is the price that a firm with a certain service requirement would pay for existing assets in preference to replicating the assets."*[14]

"As discussed above the economic properties attributed to the DORC valuation methodology make it suitable for determining the maximum value of the RAB. It is therefore important that procedures adopted by valuers when calculating DORC values are consistent with the preservation of these properties. In this section the DORC approach is reviewed with a view to making it quite clear that discretion needs to be limited if DORC valuations are to maintain the economic properties frequently attributed to them."[15]

The ACCC's approach implies that it believes that:

- asset revaluation (with the benefit of perfect hindsight) is appropriate for regulated businesses;
- the outcome that the ACCC is trying to replicate is that of a perfectly competitive market;
- regulators are capable of replicating the outcomes of a perfectly competitive market; and
- this process sets a cap on asset values and thus revenues.

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[14] ACCC, Statement of Principles for the Regulation of Transmission Revenues: Draft, 27 May 1999, page 39.

[15] ACCC, Statement of Principles for the Regulation of Transmission Revenues: Draft, 27 May 1999, page 42.

It is not clear that any of these views are consistent with the intent of the regulatory regime. It is not even clear that regulatory asset revaluation is consistent with the Court's interpretation of the Gas Code:

"If future investment in significant infrastructure, such as a natural gas pipeline, is to be maintained and encouraged, as the public interest requires, regard seems to be required to the need for both existing and potential investors to have confidence that the very substantial long term investment decisions which are required, and which were sound when judged by the commercial circumstances existing at the time of investment, are not rendered loss-making [our emphasis]*, or do not result in liquidation, by virtue of future governmental intervention…"*[16]

4.1.3 Cost of capital

In the Statement of Regulatory Principles the ACCC notes:

"The NEC says that in reaching a decision on an asset valuation methodology the Commission shall provide a fair and reasonable risk adjusted cash flow rate of return on efficient investment."[17]

As indicated above, the ACCC sees no inconsistency in interpreting "fair and reasonable" to mean a rate of return that eliminates monopoly pricing and is therefore just sufficient to fund the ongoing operations of the business.

In addition, in the Statement of Regulatory Principles, the ACCC:

- notes the dangers of providing a too high or too low return on capital, but does not note the asymmetry associated with these outcomes;
- makes no allowance for regulatory or commercial risks and notes that they should be incorporated into the cash flows, although it acknowledges that it is not straight forward to value all diversifiable risks;
- suggests that the estimation of the benchmark rate of return *"is based upon assumptions about the average investor and about an average or benchmarked firm. This implies that it is possible that the calculated rate of return may be above or below the regulated entity's true cost of capital."*[18] To the extent that the cost of capital is set by the marginal investor in the firm (ie. the last investor willing to contribute funds), an estimation based on the average investor is likely to understate the cost of capital.

None of these views appear to be particularly consistent with the intent of the regulatory regime.

4.1.4 Regulatory risk

The Statement of Regulatory Principles makes the following points in regard to regulatory risk:

"In a regulated environment, the action of the regulator could influence the assessment of risk and expected returns by introducing elements of uncertainty and risk. Regulatory uncertainty weakens existing incentives for efficient behaviour, so that a higher rate of return is required. In order to minimise regulatory risk, the

[16] Epic Decision, paragraph 149.

[17] ACCC, Statement of Principles for the Regulation of Transmission Revenues: Draft, 27 May 1999, page 18.

[18] ACCC, Statement of Principles for the Regulation of Transmission Revenues: Draft, 27 May 1999, page 76.

Commission is committed to achieving best practice regulation and has adopted a guiding set of principles that will underpin its regulatory framework."[19]

The ACCC would appear to have:

- recognised that regulatory risk is a material issue;
- taken certain steps to reduce it;
- acknowledged that some regulatory risk might still exist; but
- not sought to provide compensation for that risk.

There is no formal acknowledgement that regulated businesses should be compensated for bearing regulatory risk. This is particularly important in light of the scope the ACCC provides itself with to revalue assets, the risk of which is unlikely to be captured via the CAPM because it can largely be diversified away at the investor level. The ACCC's approach to regulatory risk does not appear to be consistent with the intent of the regulatory regime.

4.1.5 The cost of tax

The Statement of Regulatory Principles outlines the basis for adopting a post-tax approach, which seeks to estimate the 'cost of tax'. This approach requires regulated businesses to pass the benefits of accelerated depreciation to customers in full immediately. The post-tax approach is inconsistent with the intent of the regulatory regime on the following grounds:

- by requiring regulated businesses to pass the tax savings associated with accelerated tax depreciation to customers, regulators are seeking to replicate the outcome of a perfectly competitive market. By contrast, the available market evidence suggests that the benefits of accelerated depreciation are likely to accrue to investors at least in the short to medium term. This indicates that the regulatory assumption that such benefits are passed on to customers fully and immediately is highly simplistic;
- estimating the cost of tax is a complex task for a regulator who is not, by definition, an expert in taxation matters. Moreover, it inevitably sets up a regulatory dynamic which can only lead to the process becoming more complex and intrusive over time, simply because it provides both parties with an incentive for it to become so. The approach therefore has very poor incentive properties; and
- by requiring regulated businesses to pass on the tax savings associated with accelerated tax depreciation, regulators are retrospectively confiscating investors' entitlement to such benefits. Such action undermines the public policy intent of the Federal Government's initiative, which was to provide incentives for businesses to invest. Elsewhere, the ACCC has declined to interfere with Government policy (see section 4.2.5).

The post-tax approach is therefore inconsistent with the intent of the regulatory regime because it applies a perfect competition benchmark and provides a classic example of regulators being too ambitious in their search for one right answer. It also interferes with investment incentives.

[19] ACCC, Statement of Principles for the Regulation of Transmission Revenues: Draft, 27 May 1999, page 5.

Some similar issues arise in regard to the ACCC's approach to estimating the value of imputation credits and the basis upon which those assumptions are made (eg. assuming that all investors are Australian and that none of the other inputs to the cost of capital would change in such circumstances).

4.1.6 Capex and opex

The ESC argues that it has complied with the Court's interpretation of the Gas Code via the application of an incentive based approach. This approach relies on providing businesses with an incentive to reveal efficient costs, which allows the regulator to infer as much from reported costs. By contrast, the ACCC's approach in its Statement of Regulatory Principles seeks to provide similar incentives but the ACCC does not draw the same inferences.

For example, the ACCC argues in the Statement of Regulatory Principles that it has *"decided not to glide path capital expenditure because it believes that to do so creates a perverse incentive for the TNSP to systematically over-forecast capital expenditures."*[20] The implication would appear to be that in the absence of such a mechanism, TNSPs would have no incentive to overstate their capital expenditure requirements. This lack of incentive would appear to be reinforced by:

- prudency review at price reviews;
- the regulatory test (including the ESIPC assessment in the case of ElectraNet);
- a rate a return consistent with the "elimination of monopoly pricing"; and
- the threat of asset revaluation.

On this basis, it is not obvious that the ACCC should have any significant concerns with over investment. It is apparent, however, that it still does in many circumstances. By contrast, the Government has observed that the reverse might be the case.

In regard to operating costs, if the ACCC had confidence that its efficiency carryover provided the businesses with adequate incentive to reveal efficient costs, then this might permit an inference that actual costs incurred are for practical purposes efficient. This would obviate the need for the ACCC to attempt to re-establish efficient opex at each price review by a regulatory process of discovery (assuming this were in fact possible). It is apparent, however, that the ACCC does not have this confidence in many circumstances. This would appear to indicate, on the ACCC own standards, that it is providing insufficient incentives.

The ACCC's approach to capex and opex is inconsistent with the intent of the regulatory regime, and is inconsistent with how the ESC in Victoria argues it has complied with this intent.

4.2 The ElectraNet Draft Decision

Our review of the Draft Decision has identified numerous areas where it is, arguably, inconsistent with the clarification of the regulatory regime. This is hardly surprising given that the principles outlined by the ACCC in its Statement of Regulatory Principles are reflected in its ElectraNet Draft Decision. In other words, the efficient market paradigm is either explicit or implicit in virtually every major component of the Draft Decision.

[20] ACCC, Statement of Principles for the Regulation of Transmission Revenues: Draft, 27 May 1999, page xv.

Below we highlight the main areas of the ElectraNet Draft Decision which involve a misinterpretation of the intent of the regulatory regime and thus should be amended.

4.2.1 The approach to estimating revenues

The ElectraNet Draft Decision applies the "just sufficient" revenue paradigm and focuses on eliminating monopoly pricing.

4.2.2 Asset valuation

The ElectraNet Draft Decision includes some discussion in regard to adjustments to the asset base. However, the ACCC is precluded from a full revaluation of the asset base at the present point in time.

4.2.3 Cost of capital

In regard to the cost of capital the ACCC states in the ElectraNet Draft Decision that: *"The Commission's regulatory regime attempts to ensure that the return on capital allowance in the revenue cap is equivalent, <u>and only equivalent</u>* [our emphasis], *to the risk adjusted market rate of return required to maintain investment."*[21]

We understand that the ACCC has elsewhere implied that it has been 'conservative' in relation to some other parameters that make up the cost of capital (eg. beta). In our view (and in the view of noted academics and a consultant who advises a number of regulators - Prof Officer and NERA), that 'conservatism' was justified on its own merits, primarily because of the quality of the available recent market data and thus the confidence that could be placed in it.

4.2.4 Regulatory risk

The ElectraNet decision raises a number of asymmetric regulatory and commercial risks and treats some of them via self-insurance premiums in the cash flows, although there is a dispute as to appropriate amount (which is unsurprising given the ACCC acknowledge in its Statement of Regulatory Principles the difficulties with quantifying these risks). No allowance appears to be provided for regulatory risk.

4.2.5 The cost of tax

The Draft Decision incorporates the post-tax approach. It is perhaps worth noting that the ACCC's propensity to take a view on how accelerated depreciation should be treated contrasts rather starkly with its views on adjusting the asset base for interest during construction. In this case the ACCC concludes simply: *"The jurisdictional authorities adopted a policy of not including IDC on projects valued at less than $50m. The Commission considers that it cannot question that policy."*[22]

4.2.6 Capex and opex

The ElectraNet Draft Decision does not:

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[21] ACCC, 'Draft Decision: South Australian Transmission Network Revenue Cap 2003-2007/8', September 2002, page 20.

[22] ACCC, 'Draft Decision: South Australian Transmission Network Revenue Cap 2003-2007/8', September 2002, page xii.

- reflect the confidence the ACCC purports to have in the various mechanisms it applies to remove the incentive for businesses to overstate their capital program;
- does not place any faith in the ability of the ACCC's incentive mechanism to reveal efficient operating costs over time. This is essentially the reason the ESC now posits that its Final Decision in the 2003 GAAR is consistent with the Gas Code; and
- does not take into account the specific circumstances surrounding ElectraNet's forward looking cost requirements. Instead, it appears to take into account a number of irrelevant considerations (eg. its view of ElectraNet's ability to deliver the capital program, the selective use of consultants findings), while ignoring the circumstances that have rendered the program necessary in the first place. Those circumstances include the failure of South Australian governments during the 1980s and 1990s to adequately invest in generation and transmission infrastructure. The ACCC risks compounding the error in this Draft Decision with further under investment in transmission infrastructure.

The ElectraNet Draft Decision is therefore not consistent with the intent of the regulatory regime in the way it addresses capex and opex.

4.3 What the ACCC should do now

The ACCC should do the following.

- Review all of its outstanding Draft Decisions, including its ElectraNet Draft Decision, to ensure they are consistent with the correct interpretation of the regulatory regime (by applying a more commercial and practical benchmark). Moreover, in order to be consistent with the intent of the regulatory regime, the ACCC's Final Decision for ElectraNet should:
  - remove any reference to "eliminating monopoly rents" both from the approach to, and the outcome of, the Final Decision.
  - emphatically place greater emphasis than in the Draft Decision on the need to provide adequate incentives to invest. In KPMG's view this would be achieved most effectively by adopting a pre-tax real approach to the estimation of the cost of capital, and ensuring that the cost of capital used adequately addresses the commercial and regulatory costs and risks associated with infrastructure investment (consistent with the Government's policy). In KPMG's view this would involve providing a regulated return of at least 4.5% over the real risk free rate;
  - adopt an approach to regulation that regulates 'by exception' and only seeks to alter a business's proposals where they are demonstrably inconsistent with the outcomes that might be expected in workably competitive markets, or to remove demonstrably large rents; and
  - rely more heavily on the incentives qualities the ACCC attributes to its approach to capex and opex.
- Rewrite its Statement of Regulatory Principles to give affect to the Government's recommendations and the original intent regulatory regime (as highlighted by the Court in the Epic Decision).

The focus should be on ensuring that regulated businesses are provided with the incentives necessary to mimic the outcomes that are found in workably competitive markets.

Appendix D

Benchmark Economics report on Transmission Network Cost Structures

Transmission Networks:

A cost structure framework

October 2002

Benchmark Economics

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Benchmarking ElectraNet

> *"The usefulness of benchmarking as a guide to relative performance depends critically on an ability to compare like with like, or to make allowance for differences in operating environment that may be outside a utility's control"* Productivity Commission

In its Draft Decision on the South Australian Transmission Network Revenue Cap 2003-2007/08, the Australian Competition and Consumer Commissioner (the Commission) has made a number of claims in relation to the cost performance of ElectraNet SA. These are based on comparisons undertaken by Meritec to verify ElectraNet's cost estimates, and an examination by the Commission of a number of opex based ratios.

While there is no standard cost structure framework for comparing transmission network performance there are certain fundamental economic principles that do offer guidance. We would commend these to the Commission. These relate to:

- the distinction between costs and prices; and
- the role of economies of scale in natural monopolies.

Costs and prices

Taking first the distinction between costs and prices. The revenue cap determined by the Commission is based directly on the **cost** of providing the network assets; that is, the opex and return of, and on, capital necessary to provide the towers, wires, substations and transformers. In economic terms, notions of efficiency relate to these costs of production, not the prices charged.

For transmission networks, the cost of production is determined by the capacity of the network (MW), its length (km), the number of connections to generators and distribution bulk supply points, and level of reliability. These parameters are established by the nature of the franchise territory and customer base. In cost comparisons it is the cost of supplying these outputs that should be compared. This report will show that when costs, eg $/MW and not prices ($/MWh), are compared ElectraNet can compare favourably with similar networks.

Essentially, price represents the use of the system, rather than its cost. It is derived by spreading the total cost of the network across its annual usage.

ElectraNet confronts the lowest use of system in Australia. For each MW of capacity installed, only 52 per cent is used, on average, compared to around 73 per cent for Queensland, and 62 per cent for New South Wales. Naturally, it s average price will be higher.

Economies of scale

The second economic principle relates to economies of scale. Transmission networks have been classified as natural monopolies, and hence subject to price regulation, because of the presence of substantial economies of scale. Yet no real analysis has been undertaken to test the impact of these economies on the relative costs of the Australian networks. This report will demonstrate that economies of scale do exist and that ElectraNet is disadvantaged as one of the smallest networks. It should more appropriately be compared to Western Power or Transend than to Powerlink, which is at least twice its size in capacity around three times in energy transported.

Apart from these matters of economic principle, there is also the concern raised by the Productivity Commission about ensuring like with like comparisons by adjusting for differences in the operating environment. The Commission has rejected ElectraNet's claims in relation to its environmental cost drivers for opex. The reason advanced is that the Commission "considers" the claims are unfounded. To support this position, the Commission has used of a number of cost ratios on the basis that this can provide a useful insight rather than relying on a single indicator. This report will demonstrate that this view is misguided. There are substantial contradictions between cost outcomes depending on the normaliser used for the performance indicators (opex/MW or opex/km). Moreover the ratio for opex/assets depends on both the level of opex **and** assets (but no comparison was made of relative asset bases), and opex/MWh as a price is not appropriate for determining efficient cost.

Business conditions

Claims by the networks in relation to their cost drivers should not be dismissed lightly. ElectraNet is disadvantaged by its relatively small scale, its low level of average use relative to demand at the peak (load factor), and by a low level of energy density. Terms such as load factor and energy density are no more than simple engineering ratios that relate the amount of network resources required to convey one unit of energy. Opex/MWh will be affected by the peakiness of demand, as ElectraNet claims. While it may be faced (all else equal) with the same level of opex/MW as other networks, its lower level of network usage will mean that measured against MWh transported the level of opex will **appear** higher**.** The same principle applies to energy density. To transport 1 GWh of energy ElectraNet has to invest in 460 metres of network compared to 250 metres for Powerlink and only 160 metres for SPI Powernet.

This report outlines key cost relationships determined by scale, load factor and energy density. It considers the impact of these cost drivers on the Australian transmission networks. There are clearly defined patterns within this structure that should prove useful to those charged with the responsibility of estimating efficient costs.

Benchmarking in pricing regulation

Since the introduction of incentive-based pricing mechanisms, benchmarking has become an integral part of the regulatory landscape. It has two purposes. First, comparing network operating performance assists regulators to determine the potential for efficiency gains. Second, benchmarks for service standards are considered necessary by regulators to ensure that cost savings are not achieved at the expense of service and reliability.

In light of this growing role in regulatory price setting, it is surprising that benchmarking for transmission networks has received little critical attention. Issues fundamental to performance comparisons such as the impact of the network "production process" on relative cost outcomes are not well understood. Powerlink observed in its pricing submission to the Australian Competition & Consumer Commission that it was unable to draw on any industry standard for measuring cost performance. In the UK, a review of transmission operating and maintenance expenditures by Arthur Andersen found there was: *"…little consensus on the appropriate cost driver in respect of the operating…costs of transmission companies"*.

Without the guidance of an established and accepted analytical framework for assessing cost performance, regulatory benchmarking will be unable to adjust adequately for the different conditions that confront the network businesses. The importance of identifying the impact of the operating environment on costs cannot be stressed too greatly if benchmarks identified are to provide credible performance comparisons. In a recently released Staff Paper on cost factors in electricity prices, the Productivity Commission observed that: *"The usefulness of benchmarking as a guide to relative performance depends critically on an ability to compare like with like, or to make allowance for differences in operating environment that may be outside a utility's control"*[1]

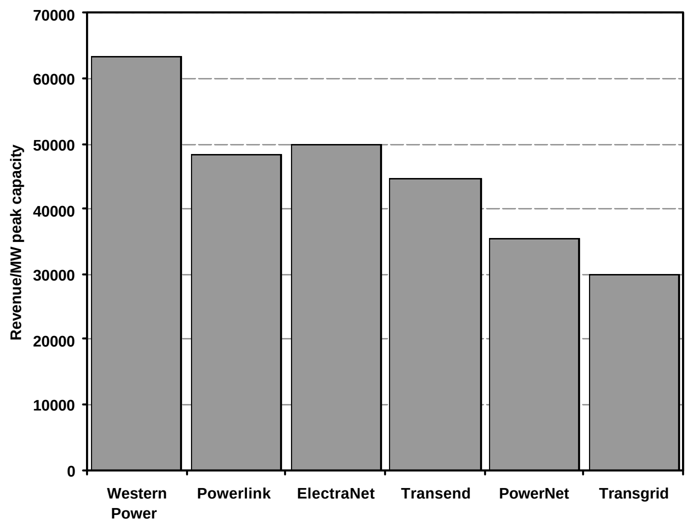
Like with like comparisons remain elusive. Performance comparisons by regulators to assess relative levels of efficiency have therefore drawn on an arbitrary assortment of indicators. In the UK, benchmarking has been based on annual rates of reduction in real unit costs among other *infrastructure industries*; and unit costs measured against line length and

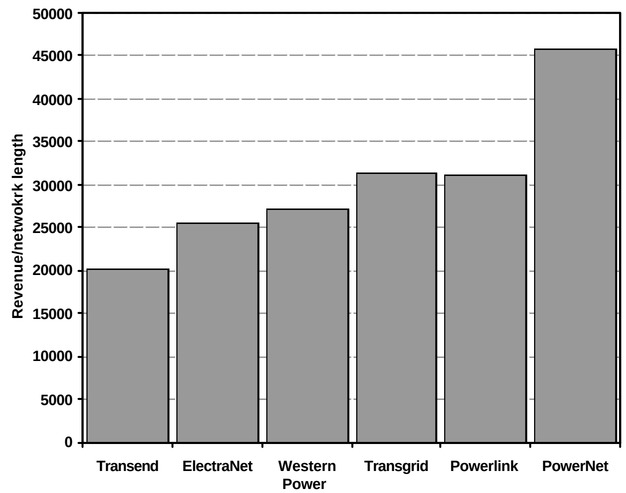
[1] Sayers, C. and Shields, D. 2001, *Electricity Prices and Cost Factors,* Productivity Commission Staff Research Paper, AusInfo, Canberra, August.

transformer numbers in other *countries*. In Australia, indicators have included: ratio of operating and maintenance costs to asset values; and ratio of operating and maintenance costs to perceived outputs including energy throughput (GWh), capacity (MW), and line length (km).

Little, if any, empirical evidence has been offered in support of this choice of indicators. Moreover, these partial productivity measures offer few advantages in benchmarking, since they do not control for differences in scale or business conditions. Nor do they allow for legitimate trade-offs between opex and capex. Depending on the normaliser selected, performance outcomes based on partial indicators can rank as "superior" or "poor", a contradiction that provides little information to regulators or other stakeholders. Judging best performance from the data in Figures 1 (a) and (b) would be

Figure 1 (a) Total costs per capacity MW **(b) Total cost per network km**





difficult since the rankings are largely reversed. Yet, to make informed decisions about regulated prices, regulators need to have accurate information on the performance of the regulated network businesses relative to their peers. To overcome the uncertainty created by conflicting outcomes of benchmarking studies Bauer, Berger, Ferrier and Humphrey[2] (1998) proposed a set of consistency conditions for regulatory analysis for use in regulatory analysis. Specifically, the consistency conditions require that efficiency scores generated by different approaches have: comparable means, standard deviations, and other distributional properties; institutions should rank in approximately the same order; and the same institutions should mostly be identified as "best practice" or "worst practice". The partial indicators in Figure 1 would not meet these conditions.

To assist in a better understanding of the major cost linkages for transmission networks this report presents a framework for a network cost model. It begins with a discussion of the notion of production costs. In the next section it describes the transmission "production process" and its implications for cost model specification. The following section provides an overview of the relative position of the Australian transmission networks in terms of scale and business conditions. Finally, presents a view on the major cost drivers for Australian transmission networks.

2 Bauer, Paul W. Berger, Allen N., Ferrier, Gary D, and Humphrey, David B. (1998) "Consistency conditions for regulatory analysis of financial institutions: a comparison of frontier efficiency methods", *Journal of Economics and Business,* 50, pp 85-114.

Production costs

Economic theory and the cost of production

Economic theory holds that the cost of production will vary systematically with the quantities of services provided (output scale) and certain business conditions. Accordingly, three types of variables are relevant when constructing a cost framework. These are:

Inputs - resources purchased by network businesses for conversion in the production process into outputs. Note, that as energy is not a purchased input it is not an output for transmission businesses. For transmission businesses, in physical terms, inputs are wires, towers, transformers and substations. In the context of the building block approach to revenue (cost) setting the inputs are, variously, operating and maintenance expenditures, capital expenditure, and the rate of return on, and of, capital.

Outputs - products or services provided by the network business. In terms of microeconomic theory, outputs are resourced by paid inputs; they represent the transformation of the paid inputs. Though simple in concept, this relationship is constantly misunderstood in analysing network cost structures. Though energy throughput is often referred to as an “output” of electricity networks, in no way could energy be considered a result of the transformation of wires and towers. A more accurate measure of the network product, in respect of energy, is the capacity of the system provided denoted by peak demand (MW), or more correctly for transmission networks, the amount of capacity provided (MW) to connect generators to the system, the two capacity measures may not necessarily match.

Business conditions - constraints faced by the firm that affect the cost of providing outputs. Unlike firms in competitive markets, regulated network providers are obligated to provide services within their franchise territory. Network cost is therefore sensitive to the generators connected, circumstances within the territories in which they operate, and the type of end-user connected.

Given the recognised link between production costs and output scale, the omission of considerations of scale in the comparative assessment of performance is surprising. Regulated pricing for electricity networks has been justified on the basis of their natural monopoly characteristics where decreasing costs provide such economies of scale that it is more efficient to have just one supplier for any given territory. That is, at the policy level it is accepted that larger scale networks will most likely enjoy lower costs and hence prices. Irrespective, performance indicators using normalisers based on scale (MW, km, GWh) are consistently used to compare cost performance. Use of these indicators, without adjustment for scale, appears to contradict the theory of economies of scale.

Distinguishing between costs and prices

The National Electricity Code, (clauses 6.2.2 – 6.2.5) states that transmission regulatory regimes must achieve outcomes, which (*inter alia)* are efficient and **cost** effective (emphasis added). Indeed, a focus on **costs** is central to the notion of efficient production. In its Draft Decision for the South Australia Transmission Revenue Cap (2003-2008) the Australian Competition and Consumer Commission (the Commission) noted that it must have regard to the potential for efficiency gains in expected **costs.** In further confirmation of this focus, the Commission engaged Meritec to verify that opex and capex **cost** estimates used by ElectraNet were realistic and appropriate.

However, in making efficiency comparisons, **costs** should be distinguished from **prices**. **Costs**, in regulated pricing, are determined by estimating the revenue streams necessary to "purchase" the quantity of inputs required to produce a given level of outputs. In the transmission industry these inputs are towers, wires, substations, transformers, etc and the related cost streams are opex, and return of, and on, capital. The unit **price** is the charge for using, not providing, the network. It is derived simply by dividing the cost of the network by the number of units transported.

This distinction is a critical one. Networks may have efficient costs relative to inputs provided, but factors beyond their control, including load factor and energy density, could affect the "price" outcome. The implications for performance comparisons will be discussed in more detail in later sections.

Leaving this issue to one side, it is believed that no single measure can adequately represent the bundle of outputs provided by transmission networks. Faced with this problem, this report has chosen to base its analysis on a series of XY charts visually linking certain cost categories to outputs and business conditions, for example, opex to network length. This approach has the advantage of not only identifying the overall trend of a particular cost relationship; it also displays the position of the networks relative to the trend, and to each other. It reveals a number of areas where conventional performance indicators fail to represent fairly the underlying cost performance of the networks.

Transmission production process

The network production process

Transmission networks provide a *connection* service between generators and the distribution network for the transport of electricity by others to end-users. Retail suppliers take delivery of energy in the wholesale market and transport it via transmission and distribution networks to their customers at varying locations within the network franchise. The connection must provide the capacity demanded by end-users at the peak demand. Network service providers must also reduce the voltage of energy delivered to the generator bus bars to the levels required at the distribution supply points. The essential nature of electricity also makes interruptions in electricity delivery costly to customers. Network businesses are therefore expected to design and operate networks to assure reliable deliveries.

Accordingly, network service providers transform capital and other inputs into the following outputs:

- *Connectivity* the extent of the network from the generators to bulk supply points;
- *Capacity* provided is two-fold: on the supply side it is the ability to accept the total capacity of generation installed, on the demand side it is the level of peak demand;
- *Connection points* at each end of the network; generators and bulk supply points; and
- *Reliability* ie availability and continuity of supply.

In contrast to most businesses, it can be argued that the level of output for franchised transmission networks is largely outside the control of management. That is, the scale of production is an exogenous variable; it cannot be varied by management to minimise operating costs or to raise prices. Likewise, business conditions, which affect the density of the load and the shape of the load curve must also impact on costs. Acceptable cost comparisons should therefore take certain business conditions to account:

- *Energy density*: network length required to deliver given quantity of energy; and
- *Load factor*: consumption pattern of end-users.

Cost model variables

Identifying products and services of the network production process is a necessary, but not sufficient condition for selecting those variables most appropriate for use in cost models. There are several reasons for this.

The first is the nature of network output. Reliable cost analysis depends on accurate measurement of specified variables. However, network services are not easily measurable, indivisible "products". Compared to other services such as a haircut or a medical consultation, network services are best viewed as a continuous stream of bundled services, not a discrete single event. This causes measurement difficulties. No doubt the amorphous nature of network services has contributed to the continued use of energy delivered as an output in many network **cost** models. However, as discussed in the previous section, revenue/MWh represents the price charged for the use of the network, hence TUOS (transmission use of system charge) not the **cost** of providing it.

Outputs and model variables

Scale:

- *Connectivity;* length of network in kilometres (km)
- *Capacity*; capacity provided to connect generators (MW) and capacity provided to meet peak demand (MW); and
- *Connection points*; generators connected and distribution connection points.

Reliability

- *Reliability*; system minutes not supplied. This is not ideal and research is underway to identify the most appropriate representation of this output.

Business conditions

- *Energy density*: MW/km and GWh/km; and
- *Load factor/capacity factor* (customer class): Annual throughput (GWh)/Peak demand (MW) * 8760 hours:

An overview: Australia's transmission networks

To aid understanding of the relative cost performance of Australia's transmission networks this section presents an overview of system characteristics as defined by scale and business conditions.

Scale

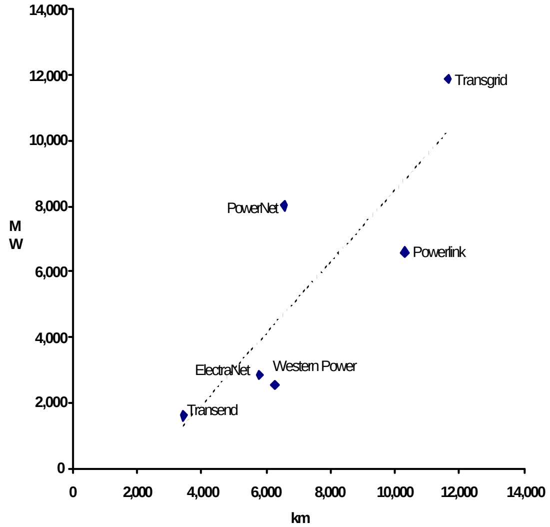
There is wide variation in the output scale of the Australian transmission networks.

Measured as length of the transmission connection (horizontal axis km) there are three distinct groups; large TransGrid and Powerlink (10-12,000 km), mid-size SPI Powernet, ElectraNet and Western Power (5-6,000 km), and small Transend (3,400 km).

Measured as peak capacity provided (vertical axis MW) there are also three different network scales: large: Transgrid (12,000 MW); mid-size Queensland and Victoria (6-8,000 MW); and the smaller networks of SA, Tasmania and Western Australia (2-3,000 MW) (Figure 2). Note however, that the position of the networks varies between the two measures.

As scale impacts on average costs it would not be appropriate to compare the performance of these networks without adequate adjustment.

Figure 2 Capacity provided (peak demand MW) and connection length (km)



Business conditions

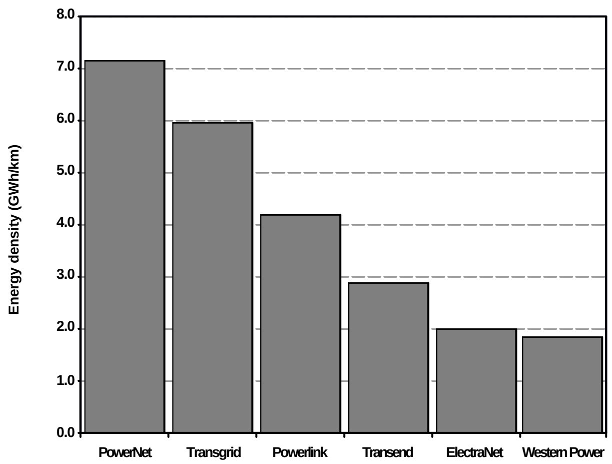
Energy density

Energy density has been identified in the empirical literature as one of the key business conditions affecting relative costs for electricity and gas distribution networks: a principle that applies equally to transmission networks. Density is affected by both by the size of the franchise territory and the location of the generators relative to the load (km), and by the type of customer connected (MW or MWh). For example, a network with a greater proportion of large energy intensive industrial customers (given network length) is likely to have a greater energy density than a network with a greater proportion of residential customers.

Relatively higher levels of energy transported over any given length of network lifts capacity utilisation of *line* related investment (ie wires, towers, etc). Rising capacity utilisation tends to lower average costs by spreading fixed costs across a greater number of output units. Put simply, it increases the productivity of the underlying investment.

Energy densities for the Australian networks are depicted in Figure 3. The range is substantial. SPI Powernet has the highest energy density, reflecting its small network footprint and large industrial load. ElectraNet has a low energy density, 70 per cent below SPI PowerNet. That is, with a network approximately equal in length to that of ElectraNet, SPI Powernet transports four times more energy. This has a significant effect on relative **prices**, which is discussed in a later section.

Figure 3 Energy density (MWh/km)



However, while density may lift the productivity of related infrastructure, it can also have a significant influence on the level of investment in that infrastructure. To meet its high energy demand, SPI Powernet must invest nearly twice as much per km as ElectraNet. Nevertheless, its higher throughput (Figure 3) enables it to achieve a unit price well below that of ElectraNet.

Load factor (Customer class)

Cost is also sensitive to the mix of end-use consumers. Different consumers have different levels and temporal patterns of demand and energy consumption (load factor[3]). For example, large industrial customers, especially those with 24/7 type operations tend to have high average levels of demand, and hence, load factors. In contrast, residential customers, especially those with a large air-conditioning demand, exhibit relatively low load factors as demand in peak periods exceeds average demand by quite substantial amounts.

Measured in terms of costs, a high load factor increases the productivity of capital installed since, on average, each unit of plant transports a greater throughput of energy. This benefit is not without cost. High load factors may exert upward pressure on maintenance and renewal costs, reflecting the wear and tear from greater utilisation of plant and equipment.

Table 1: Load factor

	Average to peak MW
Tasmania	69%
Queensland	67%
Victoria	64%
New South Wales	63%
South Australia	49%

Table 1 lists load factors for the Australian transmission networks. ElectraNet has the lowest load factor of the Australian networks. A relatively small industrial load and a high penetration rate for residential air-conditioning are largely responsible for this outcome. Moreover, there are signs that the rapid uptake of air conditioning over the past five years is contributing to further deterioration in this ratio.

Demand management is often cited as a viable response to this trend. However, it should be noted that the annual increase in peak demand for ElectraNet can reach as high as 200 MW, with a total air conditioning load at the peak of up to 700 MW or 25 per cent of

[3] Load factor measures the level of average demand relative to peak demand. A high load factor provides greater capacity utilisation for any given level of network investment.

total load. Loads of this magnitude exceed the normally accepted limits for demand management strategies such as controllable or interruptible load.

Transmission network cost structures

This section examines network costs by reviewing the relation between business inputs (asset investment, capex, and opex) and network outputs (scale, reliability), and business conditions.

Network costs: Assets

Networks are capital-intensive businesses: assets and capex account for approximately 70 per cent of total costs. Opex accounts for most of the remainder. It is to be expected, therefore, that factors influencing the demand for, and use of, network assets will significantly influence costs. Understanding the factors that drive asset investment is the key to successfully analysing transmission network cost structures.

Assets and output scale

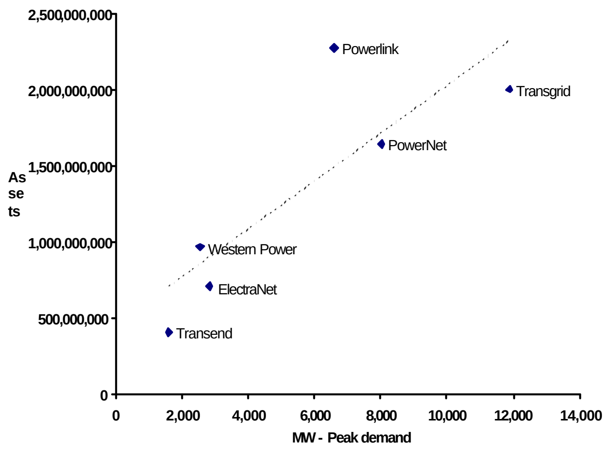
If the assumption of natural monopoly status for networks holds we would expect to find significant economies of scale in the provision of fixed capital. That is, outputs will increase faster than the demand for asset inputs, with declining unit costs, at least for a large proportion of output.

Figure 6 depicts the relation between regulated asset values and output scale, measured as peak demand (MW). To test for the presence of economies of scale the change in the value of assets associated with a change in capacity has been estimated. Based on the trend in Figure 4, Table 2 provides estimates of the decline in assets required, measured per 1000 MW, as network scale rises. On average the largest networks are only required to invest around $200M for each 1000 MW provided compared to around twice that amount for the smaller networks supplying only 2000 MW of peak capacity.

Though the estimates, at best, are approximate, and presented only as a guide, they do highlight the economies available to the larger networks. ElectraNet, one of the smaller Australian networks, is disadvantaged by the relatively higher level of investment that is required to provide its network service capability.

Table 2: Output scale and asset requirements		
Capacity provided: Peak demand MW	**Estimated total asset values**	**Asset investment per 1000 MW**
2000	$815M	$407M
4000	$1,130M	$282M
6000	$1,446,M	$241M
8000	$1,761M	$220M
12000	$2,392M	$199M

Figure 4: Asset values and peak demand (MW)



Assets and reliability

Reliability, defined in this analysis as system minutes not supplied, is related to the level of network investment. Features such as multiple circuits, voltage levels, and feeder length can significantly influence reliability and quality of supply. Figure 5 depicts the link between average investment levels and reliability. Multiple circuits, higher voltage supply, etc, however, represent a trade-off between reliability and the commercial viability of the required investment. Accordingly, high voltage supply, and hence high reliability is generally associated with those networks where higher levels of energy density provide the level of returns necessary to justify the higher cost (Figure 6). Figure 8 not only demonstrates the strong link between reliability and energy density, it also confirms the link between asset investment and energy density. Those networks with the highest levels of reliability are also those that have provided the greatest level of investment for each network length.

Figure 5 Reliability and weighted average voltage

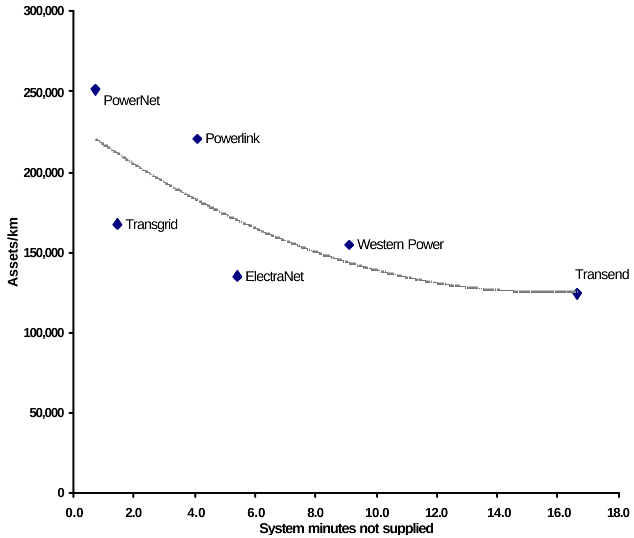
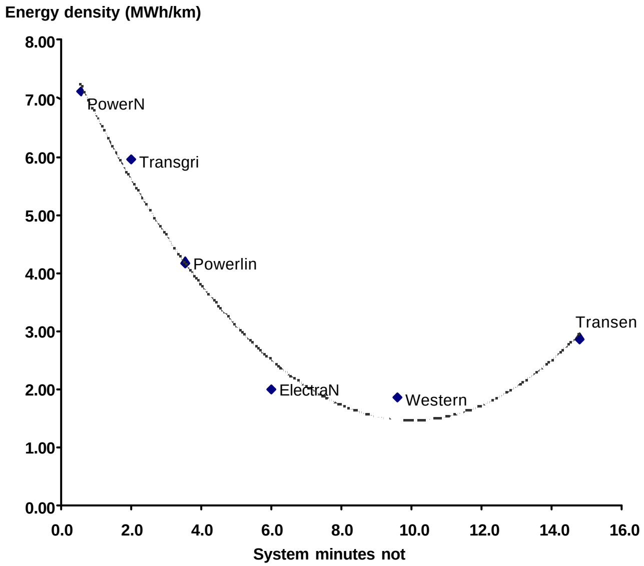


Figure 6 Reliability and energy density



For ElectraNet, reliability appears commensurate with its asset investment and its level of energy density. To achieve the reliability performance of the best performer, PowerNet, ElectraNet would need to lift its asset investment from around $120M per km to $220M, a level that appears unjustified by its energy density.

Assets: Business conditions

Energy density

Energy density has two, but contrasting, impacts on asset investment. In the first, rising density appears to reduce the level of average investment required for each MW of capacity provided ($/MW) (Figure 7). For example, fewer but larger substations and transformers can be accommodated in the larger networks. Quite substantial cost economies are associated with increasing transformer size. The second impact is to lift the level of assets required per line length. More complex systems and the greater reliability required in high density areas are contributing factors to the higher line costs.

Figure 7 Energy density (MW/km) and assets/MW

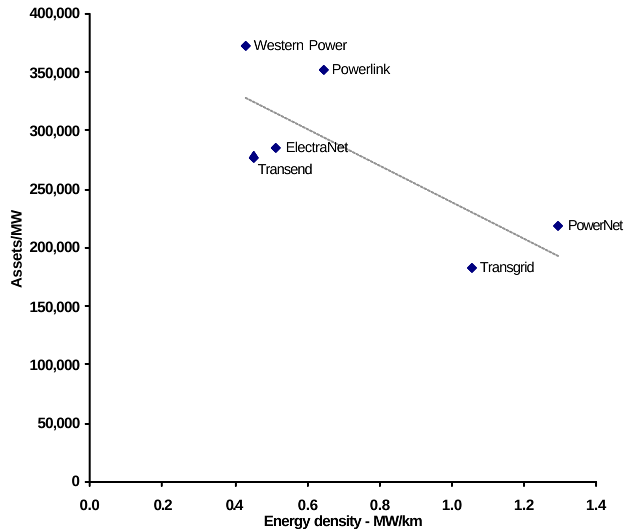
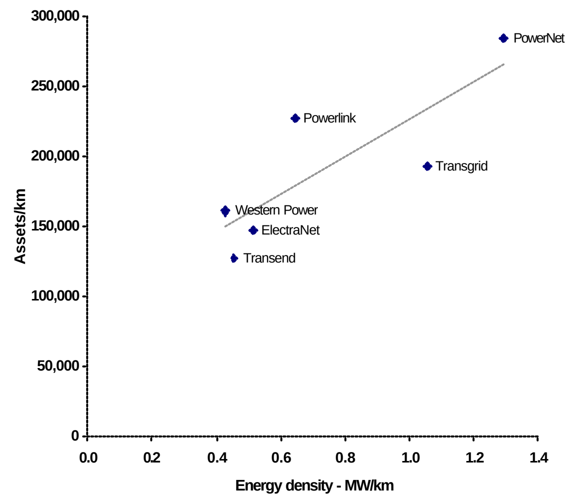


Figure 8 Energy density (MW/km) and assets per km



ElectraNet, with one of the lowest levels of energy density, benefits from lower average line costs (distance) but is disadvantaged by higher capacity costs (MW). Its final cost outcome, however, will depend on the total quantity of inputs required to deliver a given unit of energy. As an illustration, consider that for each GWh of energy transported ElectraNet must invest in 500 metres of line, compared with only 140 metres for PowerNet.

These contrasting outcomes highlight the problems confronting regulators, and the industry, in selecting appropriate indicators for cost comparisons. Choose one measure, and ElectraNet appears low cost, choose an alternative and it appears high cost. Without an adequate cost framework to provide guidance for the selection of appropriated indicators the outcomes have been, and will continue to be, misleading.

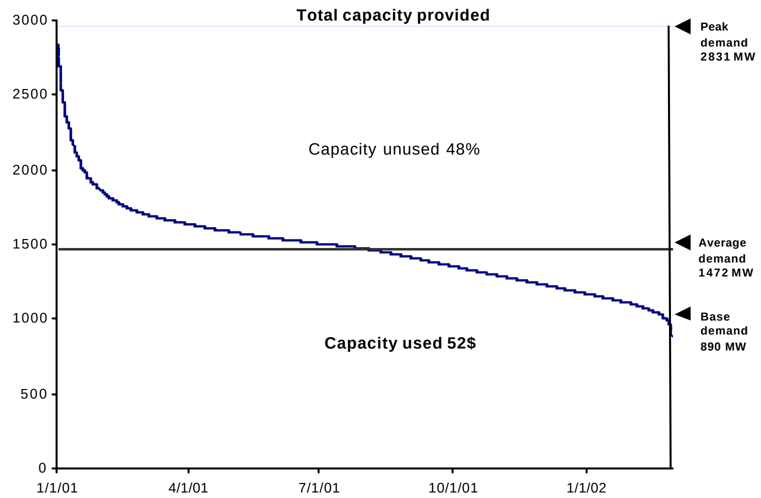
Load factor

The level of asset investment, and its utilisation, is also strongly influenced by a network's load factor. Recall that load factor represents the average level of demand relative to peak demand. Networks with high load factors are able to spread the costs of providing the peak capacity across a greater quantity of energy units transported.

ElectraNet supplies a peak demand capacity of around 2830 MW although end users, on average, only consume energy equal to 52 per cent of that capacity (Figure 9).

Not only does ElectraNet face relatively higher costs/MW because of its smaller scale, it also confronts the additional investment of meeting a peak demand that is nearly 50 percent greater than the average level of energy transported through that network (Figure 9).

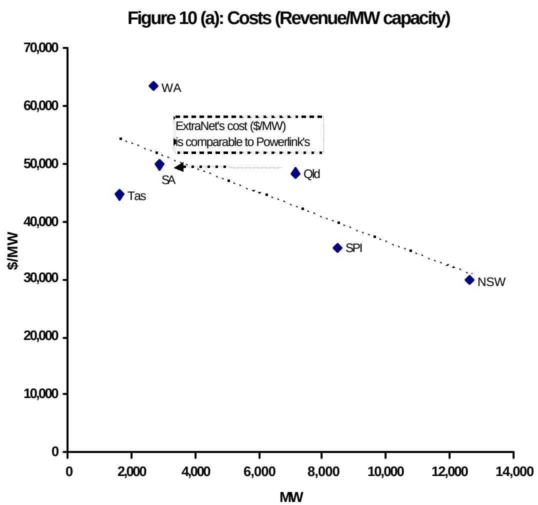
Figure 9: ElectraNet load factor

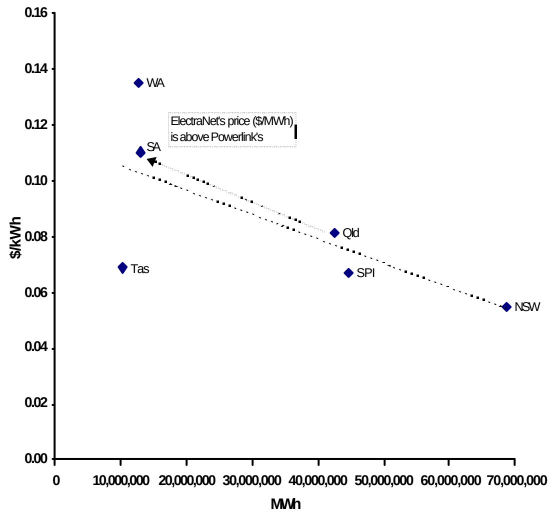


The impact of this low load factor presents a clear example of the distinction between cost and price. ElectraNet has a total cost per MW installed of around $43,000 compared to $48,000 for Powerlink (Figure 10 a), a comparison that does not lend support to the claim that ElectraNet has relatively high, and inefficient **costs**. However, when calculating the **price** (revenue per MWh transported), ElectraNet compares less favourably with a price around $3 per MWh above that of Powerlink (Figure 10 b).

The reason is straightforward. With a load factor of around 73 per cent, Powerlink transports around 5.9 MWh for every MW of capacity installed, over 35 per cent above the 4.3 MWh transported by ElectraNet for around the same average capacity investment. Holding costs constant and increasing the normaliser (MWh throughput) naturally brings declining prices. That is, ElectraNet must recoup the cost of providing the peak capacity demanded by end-users from sales of only 52 per cent of availability capacity. The problem of relatively higher prices in South Australia lies with the nature of its market, rather than the performance of the transmission network.

Figure 10 (a):Costs (Revenue/MW capacity) and 10 (b) Prices (Revenue/energy transported MWh)





Assets and Opex

Opex, which includes maintenance of the network infrastructure, could be expected to show a close link with the underlying asset base. Indeed, the opex/assets ratio is often used to assess the relative efficiency of network opex. However, caution is recommended in the use of this ratio as the outcome may depend as much on the value of the assets as the level of opex. An examination of network asset valuations suggest that different valuation techniques, asset ages, or some other unidentified factor have contributed to a wider variation than is explainable by scale or business conditions.

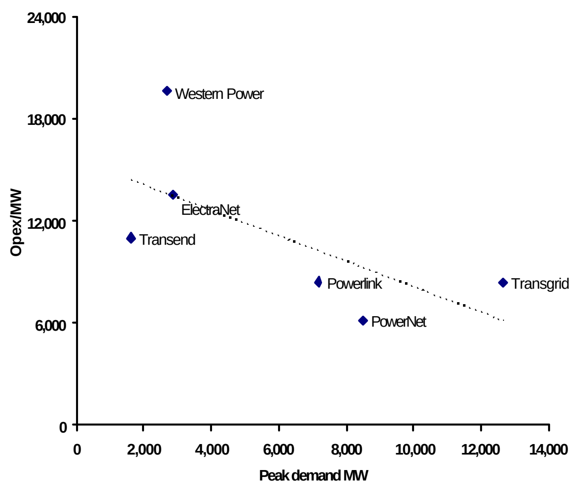
Network costs: Opex

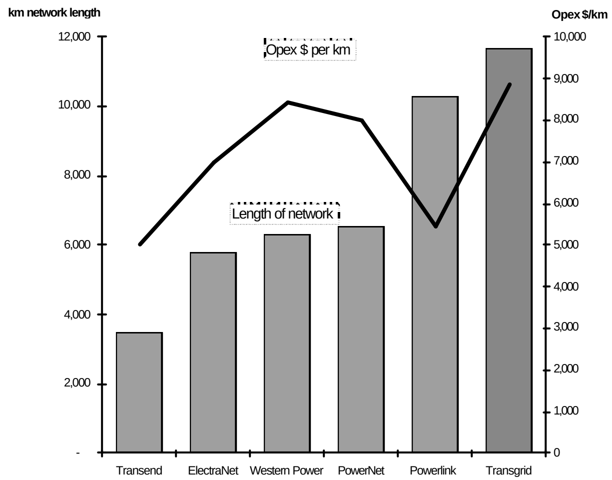
Scale

Opex is a major focus in determining efficient costs for transmission network service providers. This is due as much to its nature as the only short run variable cost as to its role in network cost structures. However, this restrictive target ignores the legitimate tradeoffs between opex and capex, as well as cost allocation issues that occur in all commercial practices.

Reflective of the underlying asset base, comparative levels of opex are also driven by scale economies, or the lack thereof. Average opex, measured per unit of capacity (MW) provided, declines with increasing network scale (Figure 11 a). In contrast, longer networks tend to face rising opex levels (Figure 11 b).

Figure 11: (a) Opex/capacity (MW) and scale (peak demand MW) Figure 11 (b) Opex/km and scale (network length km)





The reasons for the different cost outcomes between these two measures cannot be identified with great precision, partly due to the fact that the largest Australian networks also tend to also be those with the greatest density and load factors. Nevertheless, the degree of variance should be sufficient to create uncertainty as to wisdom of using these ratios for assessing relative operating efficiency. Given its small scale and a downward sloping average cost curve in Figure 11 a, the position of ElectraNet does not indicate a level of opex that is "too high" or inefficient. On the other hand, the South Australian network does not face the higher costs associated with operating and maintaining the more complex networks in the larger states.

Opex and energy density

In assessing efficiency or otherwise of capacity related opex it is again useful to consider the link between opex and the underlying asset base. Figure 10 a, which depicted energy density and asset investment per MW of capacity provided, revealed a marked tendency for average asset investment levels to increase as energy density declined.

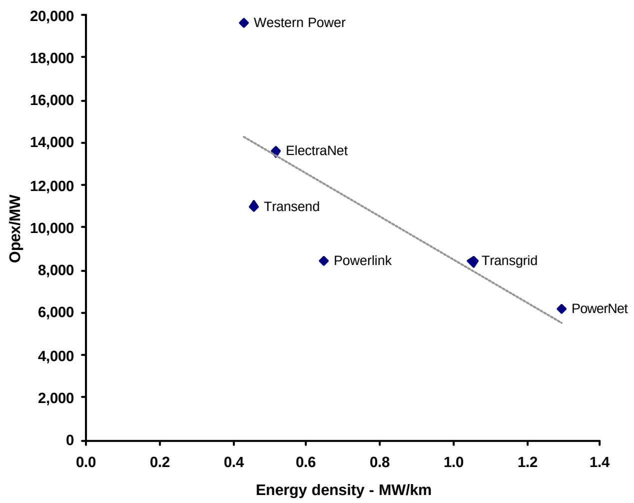
Figure 12: Opex/capacity (MW) and energy density (MW/km)	Table 3: Network length required to provide 1 MW capacity
	Western Power 2.48 km Transend 2.20 km ElectraNet 1.97 km Powerlink 1.57 km TransGrid 1.01 km SPI PowerNet 0.82 km

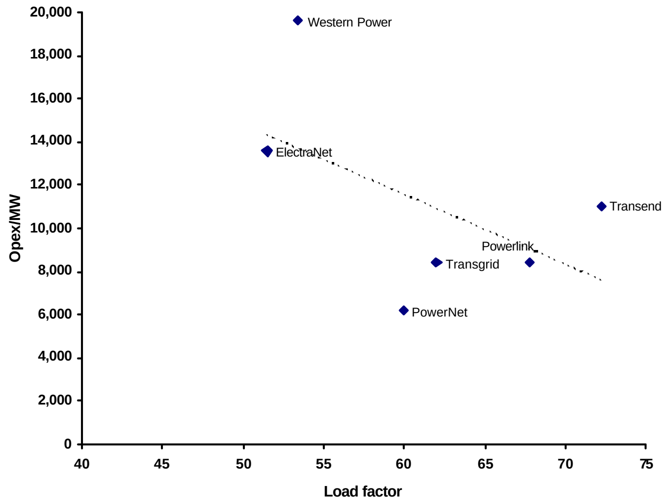
Figure 12 reveals a similar pattern between capacity related opex and energy density. Reasons for this outcome could include the need to maintain smaller, but more numerous plant that tend to be more typical of the smaller networks. However, Table 3, which shows the length of network required to be maintained relative to each MW of capacity provided, suggests that network length is a likely factor linking energy density to opex/MW.

Accordingly, assessment of the efficiency of opex relative to capacity provided should not be undertaken without giving due consideration to energy density. The radial nature of a significant proportion of ElectraNet's network could be a contributing factor as it significantly increases the length of the network relative to the amount of energy transported.

Opex and load factor

The link between relative opex and load factor is similar to that between opex and energy density, although in this instance it is the level of capacity to be maintained relative to the energy transported that drives the different cost outcomes.

Figure 13: Opex/capacity (MW) and load factor	Table 4: Network capacity required to provide 1 GWh



ElectraNet	0.24 MW
Western Power	0.21 MW
TransGrid	0.18 MW
SPI PowerNet	0.18 MW
Powerlink	0.17 MW
Transend	0.16 MW

Figure 13 indicates that, on balance, lower load factors are associated with relatively higher levels of opex/MW. Naturally, South Australia with the lowest load factor will be confronted with an above average operating and maintenance task.

Network costs: Capex

Factors influencing the level of capex are more numerous and complex than those driving either the original asset investment or its ongoing operation and maintenance. In the first instance it is necessary to distinguish between the two main classes of capex: refurbishment and replacement of the existing asset base; and augmentation to meet load growth and generator developments. Each type of capex, in its turn, is also influenced by a range of factors. For refurbishment and replacement these include age of system, its rate of use (ie load factor, or changes in load) and climate conditions. Augmentation is likely to be affected by load growth, generation projects, and interconnection possibilities.

Age of grid

There has been much debate about the relative age of transmission networks, with the focus on estimating the age of the network itself. A lack of suitable data has precluded quantitative based calculations although not quantitative assumptions. One possible alternative to assessing likely age profiles for the transmission grid is to use as a proxy the age of the base load generation. As network augmentation tends to proceed in step with generator construction this approach at least establishes the boundaries for the debate. The weighted average age of base load generation for Australia is detailed in Table 5.

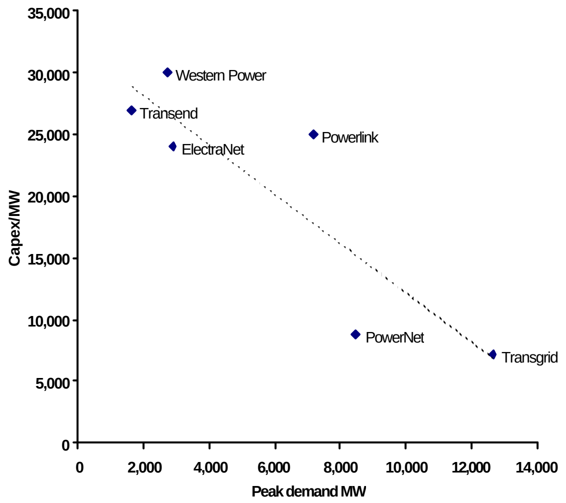
Table 5: Weighted age of base load generation

Tasmania	1972	Victoria	1982
South Australia	1980	Western Australia	1982
New South Wales	1980	Queensland	1986

Of course it is recognised that the transmission grid may pre-date the existing in-use generators and, accordingly, that this methodology will underestimate the age of the transmission network. However, the purpose of this calculation is to present some ranking of network age rather than an estimate of absolute age. South Australia has one of the oldest systems yet it must meet the second highest growth in peak demand, after Queensland. To maintain the existing network and to accommodate the ongoing load growth will require levels of capex adequate to meet this challenge.

Scale

Figure 14 (a) Capex/MW and scale – peak demand MW **(b) Capex/MW and scale – network length**



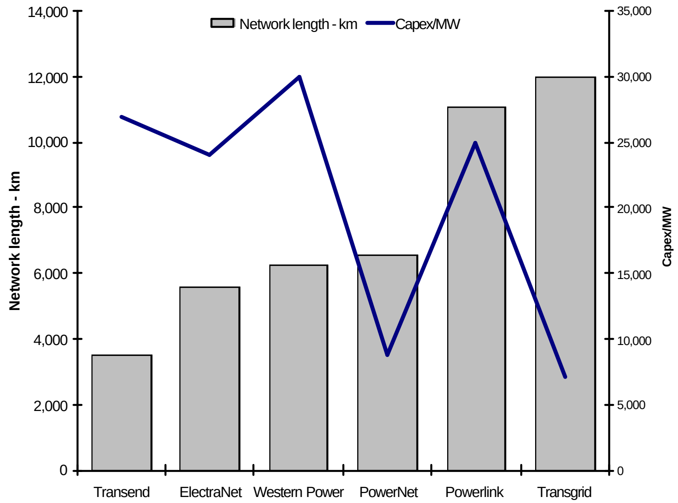


Figure 14 (a) depicting the link between scale (MW) and capex/MW indicates again the presence of economies of scale, reducing the average cost of investment for the larger networks. The pattern between network length and capex/MW is less clear. Although there is some suggestion that the smaller networks face a generally higher average cost of investment. ElectraNet with a small network with low capacity faces generally higher costs as it replaces and augments its network.

Energy density

Figure 15: Capex/peak demand MW and energy density (MW/km)

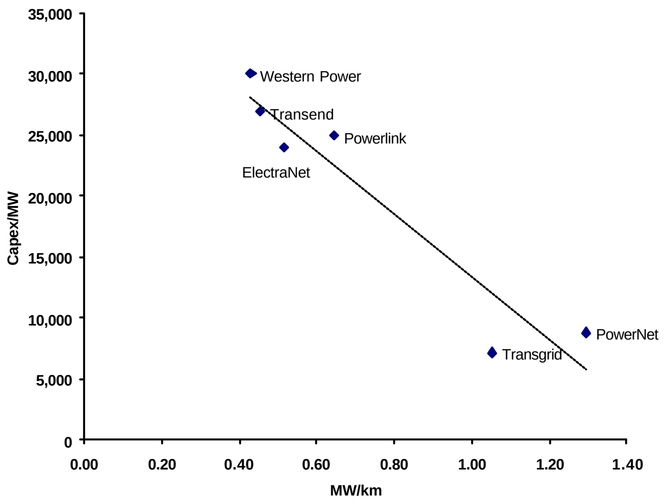


Figure 15 examines the relationship between energy density and Capex/MW. The sharp decline in costs with increasing density shows clearly the cost benefits achieved by the larger, more populous states.

Recall that Tables 3 and 4 highlighted the burden on the smaller networks. To support 1 MW of capacity the smaller networks were required to provide up to twice as many kilometres of line. They were also required to provide up to 50 per cent more capacity to transport a unit of energy.

With this additional asset burden per unit of output it is not surprising that their capex/MW is substantially higher. That is, not only do they lack the cost advantage of scale economies, they must also bear the cost of low load factors and low energy density.

Comparing profitability performance for regulated and competitive businesses

This report has analysed the overall cost performance of transmission businesses, the focus of regulatory efficiency studies and benchmarking. However, some benchmarking studies have sought to draw comparisons between the corporate profitability of these regulated entities and firms in the market sector. They have done so without recognising the different nature of infrastructure businesses and the way it impacts on their financial performance. The requirement for like with like comparisons is just as fundamental to profitability comparisons as it is to cost analysis.

Essentially, the comparisons have focused on business “profitability”, measured as earnings before interest and tax (EBIT). Citing an EBIT of around 50 per for the transmission businesses, compared to an average 8-9 percent cent for Australia’s top 150 corporates, as evidence of inefficiency and overcharging there have been strong calls for revenue rollback. The difference between these outcomes, however, is due to differing financial structures, and not to the relative efficiency of either sector.

Infrastructure industries, including transmission, are highly capital intensive. Indeed, electricity in general, and transmission in particular, is regarded as one of the most capital intensive industries in the world. Essentially a transmission business is an asset manager not a producer similar to the manufacturing industries. Manufacturing industries such as vehicles or computers may require large capital outlays, but these only form part of their costs. They also buy inputs such as steel, motors, and wheels, or mother-boards and micro-chips which they transform into individual products. In contrast, the inputs to a grid are not consumed with the sale of each product; the product is in fact the stream of services provided by the asset base itself.

Infrastructure businesses are defined by a higher assets/revenue ratio. Table 6 shows that for each dollar of revenue One Steel has one dollar in assets compared to $2.2 for WMC and $5.5 for ElectraNet. These business will always have a higher

EBIT/revenue ratio as interest payments on the higher asset base will lift EBIT above that of less capital intensive businesses. In contrast, they will have lower cost of sales/revenue ratios as capital represents the greater part of their cost base.

Table 6 presents a range of financial indicators for three market-based businesses and two network businesses. The objective is not to compare performances but to detail the quite different financial structures. The market companies are One Steel, which is a manufacturing company, BHP-Billiton and WMC, two capital intensive mining companies, and United Energy and ElectraNet.

The main point to note is the strong link between the assets/revenue ratio and EBIT. As the asset/revenue ratio rises from 1.0 for One Steel, to 2.2 for BHP-Billiton and WMC, to 5.5 for ElectraNet, EBIT rises from 1.5 per cent to 22 per cent to 54 per cent. Servicing $5 of assets for each $1 of revenue imposes a greater interest burden on the asset intensive companies. For example, while the market sector EBIT average may be 8-9 per cent, for WMC, an asset intensive mining company, the level is 22 per cent as the interest climbs to 10.5 per cent of revenue compared to only 2.3 percent for One Steel.

Table 6: Financial ratios - Regulated and market sector businesses

	Revenue	Assets/ Revenue $	Interest/ Revenue %	EBIT/ Revenue %	Cost of Sales/ Revenue %
One Steel	$2.8B	1.0	2.3	1.5	93
BHP-Billiton	$16B	2.2	2.8	19	78
WMC	$2.8B	2.2	1.05	22	78
United Energy	$170M	4.8	N/A	48	31
ElectraNet	$133M	5.5	1.30	54	30

A comparison of performance among these companies using these ratios is inappropriate.

Appendix A

Data used in this analysis

The quality of the data is a critical element of any quantitative analysis. To ensure comparability appropriate to regulatory benchmarking, where available, the data used in this analysis has been taken from revenue cap decisions by the Commission. For Transend and Western Power data has been taken from the jurisdictional regulatory reviews.

Building block data is for year ending June 2003. Network parameters have been taken from NEMMCO Statement of Opportunities and jurisdictional Statements of Opportunities (source ESAA Electricity Australia, 2002). However, network length is data for 2001. It would be preferable to use 2003 data but no publicly available source of updated network length could be located.

Opex data has been standardised as much as possible by excluding refurbishment and grid support.

Every care has been taken to ensure that the data are a true and faithful account of those data published by the regulators and other authorities. There will be minor variations since myriad adjustments to regulatory data can introduce complexity, and indeed, confusion. For example, smoothing, however desirable, can shift revenue from year to year.

It would assist analysis of network cost structures if a complete table of annual data including network parameters and agreed building block revenue allowances over the price re-set were published with each pricing Decision.

Appendix E

Drafting Comments on Draft Revenue Cap Decision

Drafting Comments on ElectraNet SA Draft Revenue Cap Decision

11 October 2002

Heading	References	Statement	Explanation of Issue/ Concern	Proposed Action
WACC	Section 2.5, 2nd paragraph, p12	"If the WACC is revised at relatively short intervals, then it may be more appropriate to use a shorter-term bond rate in deriving the WACC for the regulated entity. Thus, an appropriate term for calculating the risk free interest rate in the present context is the term between regulatory reviews…".	A maybe in one sentence turns into a fact in the next. Even reasons for the ACCC's position later, the draft decision does not properly substantiate the ACCC's position given the weight of evidence that has been presented by ElectraNet SA and others to the contrary.	The ACCC should change its position on the bond rate or substantiate its reasons for not doing so.
WACC	Section 2.10.1, 1st paragraph, p21	"ElectraNet's actual gearing is over 60 per cent. It does not believe that a 60 per cent gearing ratio would result in efficient financing".	ElectraNet SA's application actually said "60% gearing need not necessarily reflect efficient financing".	Correct or remove the statement.
Asset base	Section 3.3.2, last paragraph under Easements, p36	"Based on the SKM report, ElectraNet claims that $104.3m is an appropriate assessment of easement acquisition costs and should be included in the regulatory asset base as at 1 July 1999".	$104.3m was claimed in ElectraNet SA's supplementary submission at 1 July 2001, but this figure was later revised down to $87m based on updated number of easement ownerships (and reflected in Meritec report).	Correct the amount and date. Amount should also be corrected in Table 3.2.
Capex	Bottom of pxv	"Currently ElectraNet is under a performance incentive scheme administered by the SAIIR. Under the scheme, ElectraNet has reported improved service quality and reduced opex. As a result it obtained incentive payments. The Commission therefore considers that ElectraNet has demonstrated that it could achieve service improvements with its current level of asset base, capex and opex".	These statements have absolutely no relevance to the Commission's assessment of capex (it is in this context that the statements are made) and demonstrate a complete lack of understanding of capex drivers. The statements themselves are also incorrect. ElectraNet has not reported reduced opex. The definition of O&M for the purposes of the SAIIR PI scheme is NOT the same as opex (refer to ElectraNet response to SAIIR letter dated 6 September 2002).	The statements should be removed from the final decision.
Refurbishment expenditure	Subsection on p69	The subsection on "treatment of refurbishment…" includes comments made by ElectraNet SA in its response to Meritec's capex report.	The subsection doesn't include additional comments made by ElectraNet SA in its response to Meritec's opex report and these are not covered in the opex chapter either. A key issue that is missed altogether in the draft decision is accounting standards require that $23.5m of the refurbishment expenditure must not be capitalised.	The final decision should address the issue raised by ElectraNet SA.

Drafting Comments on ElectraNet SA Draft Revenue Cap Decision

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Heading	References	Statement	Explanation of Issue/ Concern	Proposed Action
Refurbishment expenditure	Second paragraph on p77	"Meritec disagreed with this definition stating that the effect of this policy if implemented could be that any replacement less than the unit of property would be able to be expensed and not capitalised".	This statement applies in any case and is therefore meaningless. The question is what is the appropriate unit of property?	Remove or amend statement.
Refurbishment expenditure	Top of pxiv and p78	"This above treatment is subject to the condition that: • ElectraNet undertakes appropriate regulatory evaluation procedures similar to those for other new investments before spending (for example the regulatory test) • Maintains records in such a way that the refurbishment can be identified to the asset"	The ACCC should not impose more onerous conditions on ElectraNet than required by the Code for treating refurbishment expenditure in the way proposed by the ACCC. The Code applies the regulatory test and public consultation procedures to network augmentation projects (which does not include refurbishment). The ACCC's draft decision appears to impose additional and impractical requirements on ElectraNet.	Change the wording in the final decision to remove the requirement for regulatory evaluation procedures before spending. Suggest that ACCC concerns for oversight of this expenditure would best be met by annual reporting of expenditure under the Information Requirements Guideline.
Refurbishment expenditure	Top of p97	"ElectraNet argues that the service standards set out in the South Australian Transmission Code are higher than those in other states. It notes that these are lagging indicators".	ElectraNet has argued that service standards are more prescriptive than in other states, not higher. No other state has prescriptive exit point reliability standards such as those in the SA Transmission Code. ElectraNet must comply with these standards as a condition of licence. Other TNSPs may have similar standards, but they are softer in allowing some discretion in how they are applied. This first sentence is not applicable or linked to the remainder of the paragraph.	Correct the drafting in first sentence. Then start a new paragraph. Either delete the second sentence or move it to the end of the new paragraph.
Opex	Comments by interested parties, pxvii	"The claimed opex is far higher than other TNSP's according to their own benchmarking"	Benchmarking by whom? Benchmarking presented by ElectraNet and Benchmark Economics shows that ElectraNet's costs compare favourably with other TNSPs when cost structures are properly taken into account.	Clarify the statement.

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Heading	References	Statement	Explanation of Issue/ Concern	Proposed Action
Opex	The Commission's assessment of opex, pxvii	"Therefore, the Commission has focussed on assessing a reasonable level of opex for ElectraNet. In doing so the Commission is mindful of ElectraNet's claims that it has achieved substantial cost efficiencies as a result of pursuing best practices".	This comment appears to imply that the claims of cost efficiency are inconsistent with requiring a higher level of opex. ElectraNet has claimed in its application that its operations are cost efficient. However, the volume of asset maintenance, monitoring and refurbishment activities needs to be increased.	Clarify the statement or remove it.
Opex	The Commission's assessment of opex, pxvii (and Table iii)	"At a late stage of the assessment, the Commission found that there were significant differences between the opex amounts in ElectraNet's annual reports and the amounts reported to the SAIIR by ElectraNet".	Opex reported to the SAIIR in regulatory financial statements is the same as "annual report" figures. The figures that are different are those reported for the purpose of the SAIIR PI Scheme. O&M for the purposes of the SAIIR PI scheme is NOT the same as opex (refer to ElectraNet response to SAIIR letter dated 6 September 2002).	Clarify the statement or remove it. Make appropriate changes to table.
Opex	Last paragraph on pxvii	"Opex reported to SAIIR should be normal recurring expenses incurred in providing prescribed services…"	This paragraph and the three for example dot points that follow are not relevant and misleading. O&M for the purposes of the SAIIR PI scheme is NOT the same as opex (refer to ElectraNet response to SAIIR letter dated 6 September 2002).	Remove the paragraph.
Opex	Section 5.9.1, 3rd paragraph, p102 (also pxviii, 3rd last paragraph)	"The Commission notes that opex has been relatively stable at $40m per annum, both before and after the change in ownership".	Not true. Opex has in fact risen during the period to refect stand-alone operation of the transmission business (previously part of vertically integrated ETSA Corporation). The 1997/98 and 1998/99 figures taken from Annual Reports and included in Table 5.3 include approximately $12m and $7m of ancillary services costs respectively. These costs were pass through costs for ETSA Transmission incurred as part of the pre-NEM SA market arrangements and not part of the business's operating costs.	This statement and ones like it should be corrected.

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Heading	References	Statement	Explanation of Issue/ Concern	Proposed Action
Opex	p103, below Table 5.3 (also pxviii below Table iii)	"Table 5.3 shows that, on average, historical opex for the transmission business is about $35m according to the amounts reported to the SAIIR, whereas ElectraNet's annual reports show about $39m. For the purposes assessing ElectraNet's opex allowance to establish its MAR, $35m is more appropriate as it excludes non-prescribed services and other non-recurring expenses".	There is an implication here that ElectraNet has misled the SAIIR. None of the regulated figures provided by ElectraNet include non-prescribed services. This needs to be corrected. $35m is not more appropriate. Refer to ElectraNet SA response to the SAIIR letter dated 6 September 2002.	Rewrite in the light of ElectraNet SA's submission on the draft decision and response to the SAIIR letter.
Opex	Second paragraph, pxix	"The Commission considers that Powerlink is more comparable to ElectraNet than the other Australian TNSPs. There are differences between the two – with some factors favouring ElectraNet and other favouring Powerlink. For example, lower voltage levels and topography may favour Powerlink, while a younger asset profile may favour ElectraNet".	Powerlink is more comparable than other NEM TNSPs (i.e. if exclude Western Power and Transend). None of the factors mentioned favour ElectraNet. Voltage levels are the same. Powerlink has a significantly lower age profile than ElectraNet. Key point is that ElectraNet has more assets to maintain for the equivalent level of service.	Add explanation from material submitted in ElectraNet submission on draft decision.
Opex	Section 5.9.3, 3rd paragraph, p104	"Meritec and a number of interested parties question ElectraNet's use of the Victorian distribution benchmarking study to assess the efficiency of its non-network costs. The Commission agrees and considers that such benchmarking is of limited use".	On what basis does Meritec and the Commission arrive at this conclusion? The Victorian benchmarking study involves network businesses similar to ElectraNet that have similar non-network cost structures. This study provided the most up-to-date and relevant non-network cost comparisons available to ElectraNet.	Remove or give valid reasons for why the study is of limited use.
Opex	Section 5.9.3, 4th paragraph, p104	"The Commission considers that there is a need to balance reliability and cost efficiency. It agrees with NRG that the ElectraNet application focuses primarily on reliability, at the expense of cost efficiency and value for money considerations".	On what basis does the Commission arrive at this conclusion? This statement is made without any reference to specific expenditure that is unjustified. ElectraNet SA is very aware of the need for cost efficiency. ITOMS benchmarking shows that ElectraNet SA's network costs are efficient. More than 75% of the company's total opex is competitively outsourced.	Remove statement from the final decision.

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Heading	References	Statement	Explanation of Issue/ Concern	Proposed Action
Opex	p108 1st sentence after bullet points – and last sentence in the same paragraph	"ENSA considers that line length/MW peak and substation per MW peak should be used to assess its network and proposed opex levels… The Commission considers that there is relatively little linkage between these ratios and required opex levels"	This is not true the way the ACCC have worded it. The ratios were used by ElectraNet SA (and interested parties) to explain that the SA operating environment requires more assets to deliver the same network capacity. More assets means higher opex costs.	Change words along the lines of "…to explain the cost structure of TNSPs" and remove or change the conclusion reached by the Commission.
Opex	Second to last paragraph in 5.9.3, p108	"Furthermore, the type of construction present in the TNSP's network should also be considered. The Commission understands that in SA the majority of 132 kV poles are made from steel and concrete, while in Queensland and Victoria the majority of poles are wooden. As such the Commission would expect that less maintenance would be required to maintain steel and concrete poles relative to wooden poles"	Why has the ACCC mentioned only one cost driver explaining differences between states? Why not mention SA's higher insulator washing costs because of its dry climate, longer distances between substations that incur higher travelling costs, older asset age profile etc. etc.	Remove this selective and misleading paragraph.
Opex	Last paragraph of 5.9.4, p109	"That said, the Commission has taken a total cost approach to assess opex. Therefore, it has not analysed individual cost components of ElectraNet's opex"	This statement appears to be at odds with the detailed "opinions" expressed in previous paragraphs.	Be consistent. Either comprehensively treatthe detail or remove all detailed comments (particularly those that are unsubstantiated).
Grid support	Section 5.9.6, p109	"An amount of $4m per annum is allowed for grid support. This amount of grid support will be monitored by the Commission and will be clawed back at the end of the regulatory period if the amount is not spent by ElectraNet".	Wording does not make it clear the understanding ElectraNet SA has with ACCC staff that additional grid support costs over and above the $4m per annum included in the draft decision will be allowed as a pass through.	Clarify wording to make it clear that grid support costs over $4m per annum during the regulatory period will be allowed as a pass through.
Total revenue	Section 6.6, p116	Tables 6.2 and 6.3	The revenue cap to apply in the first six months of the regulatory period from 1 January to 30 June 2003 is unclear in the draft decision.	Clarify in the final decision.

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Heading	References	Statement	Explanation of Issue/ Concern	Proposed Action
Opex efficiency	Section 6.5, p116	"The Commission applied an efficiency dividend of two per cent per annum to ElectraNet's overhead expenses".	The Commission does not appear to have applied an efficiency dividend in its other TNSP decisions. Applying one in this case appears to be driven by an incorrect perception that ElectraNet SA's costs are inefficient. However, 75% of ElectraNet SA's total opex is either fixed or based on competitive market prices. There is little scope for further efficiency improvements. The higher opex ElectraNet SA has requested is primarily about increased volumes of work required on the network.	Remove application of efficiency dividend.
Service Standards	Section 7.6.1, p124 – 136	Entire section.	The definitions of the performance measures and force majeure, historical data and targets, and performance characteristics are based on an early version of SKM's recommendations and do not reflect comments made by ElectraNet SA and other TNSPs since that time.	Final decision needs to reflect SKM's final report and recommendations. ElectraNet SA should be given the opportunity to review a revised version of the service standards chapter.
Service standards	Section 7.6.2, p126	The penalty/reward from this incentive scheme will lag by one year. That is the MAR in year two will include the penalty/reward for the performance achieved in year one. The MAR is calculated as follows: MAR t = AR t + AR t-1 x St-1	The implementation described won't work because performance in year one and hence St-1 won't be available until after the completion of the financial year, but MARt must be calculated and transmission prices published by 15 May (with the Code as it stands).	Determine St-1 from performance in the previous calendar year. For example consider performance in 2003 when calculating the MAR for 2004/05 (more desirable than introducing a two year lag)

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Heading	References	Statement	Explanation of Issue/ Concern	Proposed Action
Financial indicators	Section 8.1, last paragraph, p137 and last paragraph on p141	"More importantly ElectraNet has a revenue stream that is inflation indexed and almost guaranteed for the next five and a half years. This is unlike firms in the competitive market whose revenue stream can vary. This important difference limits the usefulness of the financial indicator analysis for TNSPs". "Once again the Commission would like to emphasise the limitations of applying a model that was designed for competitive businesses to TNSPs that have an almost guaranteed revenue stream".	These statements fail to recognise that the financial indicator analysis explicitly takes into account ElectraNet SA's business profile. The draft decision states "In interpreting the results of the calculations, the Commission considers that ElectraNet has a business profile lying between excellent and above average given the likely stability of its earnings and lack of competitors for the services provided". The Standard and Poors system of ratings is not limited to competitive businesses. It is applied to businesses and organisations with a whole range of risk profiles, including governments.	Remove these incorrect and very misleading statements.
Financial indicators	Top of p140	"…for the purpose of calculating ElectraNet's financial indicators and in the absence of more recent information, the Commission considers it would be appropriate to assume a positive dividend payout ratio and therefore has adopted a ratio of 50".	The ACCC normally estimates the dividend payout ratio based on the actual circumstances of the business, but in this case has assumed 50% in the absence of better information. The ACCC has not commented on or questioned the payout ratio of 86% provided in ElectraNet SA's application, which is based on actual payments the business is committed to make.	The ACCC should redo its financial indicators analysis adopting a realistic dividend payout ratio as provided by ElectraNet SA.