Submission
to

Australian Competition and Consumer Commission

Draft Decision

NSW and ACT Transmission Network Revenue Caps – Transgrid 2004/05-2008/09

BENCHMARK ECONOMICS

July 2004

Sydney
Tel: 61 2 9428 2079
Fax: 61 2 9418 3129
email: mbeardow@bigpond.net.au

1 Introduction

The Australian Competition and Consumer Commission (ACCC) released its Draft Decisions relating to Transmission Network Revenue Caps – 2004/05-2008/0 for Transgrid and Energy Australia, on 28 April. As part of its pricing determination the ACCC conducted a Public Forum to discuss its Draft Decisions on Friday 18 June 2004.

This submission by Benchmark Economics is in response to the Draft Decisions and the discussions during the Forum of 18 June. It provides comment on two separate but we believe, related issues. The first matter was raised by Mr. David Croft during Transgrid's response to the ACCC Draft Decision. Commenting on the proposed expenditure reductions, he stated that in his view there was insufficient understanding and knowledge of network businesses within the ACCC to make judgements as to efficient network costs. The second matter was raised by Mr. Mark Gell Chairman of the EMRF in his slide presentation. Specifically, the EMRF claimed that the WACC awarded to Transgrid by the ACCC was too high since it exceeded the average achieved by businesses in the competitive environment.

At face value these matters may appear unrelated. But examined more closely, we find that in each instance the fundamental issue is one of inappropriate comparison.

Turning first to the point raised by Transgrid, the Draft Decision proposes opex reductions based, in part, on comparisons of Transgrid's expenditures with those of other Australian networks and with its own past expenditures. To be effective, cost comparisons should be grounded in an informed view of the network business in order to distinguish between the influence of key cost drivers and potential efficiency gaps. However, in benchmarking the performance of Transgrid and EnergyAustralia, the ACCC has selected a suite of ratios that measures the affect of the operating environment on cost, not managerial efficiency. Combining these indicators provides little information.

Further, the choice of past expenditure patterns to guide future revenue allowances appears to overlook the future requirement for replacement investment.

In the second instance, the EMRF assessed the acceptability of the proposed WACC by comparing EBIT to assets for the transmission networks against an average for 300 large companies in competitive markets. Again, an inappropriate comparison since this ratio will depend on the asset value selected for the denominator and the nature of the industry in which the business operates.

To maintain an efficient and secure network requires regulated revenues appropriate to the specific operating conditions of each network. Obviously, a solid understanding of the financial structure of capital-intensive businesses and the interrelationship between network costs and operating conditions is essential to this outcome. Comparisons that lack this awareness may result in misleading assessments and revenue allowances that are insufficient to meet the challenge of Australia's aging transmission and distribution networks. Threatening the longer term sustainability of the grid, this must viewed with concern.

A dominant feature of the longer term is the aging of Australia's infrastructure. Speaking at a recent Conference, representatives of a number of Australian power utilities voiced their concerns pointing to the need to replace old technology substations, the overloading of old equipment due to changes in energy flows following the introduction of the competitive market, and the trend to use the redundancy once built into new equipment to now support old equipment; accordingly the security provided by that redundancy is no longer available.

As the network ages, failure rates are likely to rise; a security standard of N-1 or N-2, in reality, will depend on the age and condition of the equipment as much as the level of redundancy built into the system. Recognising that maintaining the integrity of the UK networks required substantial investment, Ofgem has proposed a 30 per cent increase in capex in its draft decision. In Australia IPART has approved increases of up to 80 per cent.

The next section briefly outlines the way in which business conditions can affect comparative costs outcomes. It also provides some evidence on the nature and timing of the replacement cycle. For the second point, it presents an analysis of the EBIT/assets ratio and its relevance to network businesses.

2 Operating and capital expenditures

Policy makers have introduced price regulation for the monopoly distribution networks as part of the broader restructuring of the electricity industry. Reflecting the intention of the reforms, industry regulators have focused on improving network efficiency by implementing incentive-based pricing mechanisms in preference to the widely discredited rate of return regulation. Structured around the CPI-X formula, this pricing framework allows firms to increase prices by the rate of inflation (CPI) less an efficiency factor (X). Offering businesses the opportunity to earn a higher rate of return by outperforming the efficiency target provides the incentive to reduce costs.

To assess the potential for efficiency gains, incentive-based pricing has made benchmarking an integral part of the regulatory landscape. However, to date, no satisfactory network cost structure model has been developed to assist regulators in the benchmarking process. In the absence of an integrated cost model, regulators have relied on partial productivity measures.

There are, however, theoretical problems with the use of partial factor productivity measures and they offer few advantages in benchmarking. Perhaps the most apparent is that they are simple to compute. An important disadvantage is that partial measures do not control for differences in most business conditions. Differences between businesses are often overlooked. Though the product may be similar, the firms may be varied; scale, technology, age of equipment, demands of end-users, and work practices can affect quite substantial differences in cost and quality.

To provide a general assessment of the reasonableness of the proposed operating expenditures the ACCC has undertaken its own benchmarking using a number of different ratios based on partial productivity measures. While recognising that partial measures are not very meaningful, the ACCC states that the use of a combination of measures "can help to assess whether a TNSP's opex is reasonable". As a further measure of reasonableness, the ACCC has also referred to past levels of expenditures. Neither approach, it is suggested, can provide the accuracy of information critical to the task of estimating appropriate funding.

2.1 Network costs and the operating environment

As part of its benchmarking process, the ACCC lists a number of partial productivity indicators in Table 2.3 of the Draft Decision for Transgrid, these include:

- Opex/GWh
- Opex/substation
- Opex/line length (circuit and route)
- Opex/MW peak

Additionally, the ACCC has made reference to the opex/assets ratio, stating that it considers opex as a proportion of the asset base "while having some limitations, is a more useful measure than the other ratios". No rationale for this assumption is presented, although it implies that network asset bases are standard and uniform in their maintenance requirements. This assumption should be treated with caution. Ratios consist of two parts. When used as an indicator of performance, it is necessary not only to examine the factors that affect the numerator, opex, but also the denominator, assets.

For example, a relatively high ratio could simply reflect a network's aging infrastructure. In these circumstances, higher levels of opex would be necessary to maintain the assets which, in turn, would be expected to have a relatively lower value reflecting the greater level of depreciation.

Asset values might also vary because of the different valuation practices adopted by the jurisdictions, with some states including the value of capital contributions in the asset base while others do not. Different asset management practices may also affect the level of maintenance. Capitalisation policies vary between jurisdictions and between businesses. Some businesses adopt a program of monitoring and reconditioning maintenance to extend the life of the asset base while others choose to replace assets at the end of their useful life to reduce maintenance costs.

Indeed, the Draft Decision appears to accept the possibility that some of these factors may affect the asset base when it states on page 29, in reference to Transgrid's proposed "maintenance unit", that this assumes a simple direct proportionality between opex and investment. In rejecting the proposal, the Decision then states:

> *"…it does not take account of the age and condition of assets;"*

It could be argued, therefore, that the opex/assets ratio is no more robust in conveying information as to relative cost performance than the other partial measures.

Recognising that partial indicators may not be particularly useful in assessing reasonable expenditure levels, the Draft Decision opted to use a combination of indicators as a guide to relative performance. However, investigation of the ratios selected for the "combined" comparison reveals that the rankings of the networks can depend on the particular indicator. The variations in the rankings of the networks can be substantial, and in the reverse direction. Lacking an analytical framework to explain and justify these contradictions, it is difficult to accept that combining the results of the partial indicators has improved the explanatory power of the underlying ratios.

As we shall detail in the following section, each of the ratios selected for benchmarking reflects the operating conditions for the particular network. Failure to make adjustment for these features in cost comparisons is distorting the expenditure allowances for the transmission networks.

As background to the discussion on network costs drivers, a selection of charts and pictures of network asset types is presented. This is to allow the reader to appreciate the difference between asset classes, and the implications for relative operating and capital expenditures.

Figure 1 presents a schematic comparison of high and low voltage transmission towers and distribution poles. Taken from a US network publication, there will be some minor differences between the voltages used in Australia and the US, but the effect on the towers and poles is minimal. There are several points of interest.

Firstly, the 330kV towers are not only 40 per cent higher than the 132kV towers, they are also more complex in their construction. The investment required to construct a given length of 330kV line could be expected to be greater than a similar length of 132kV line, all else equal. Additionally, given the differences in the construction of the towers, it is likely that the operating and maintenance costs would also be greater for the 330kV towers.

Secondly, the spacing between the tower types may vary. For example, the 138kV wood or steel tower has a spacing of 300 feet in contrast to the 138kV H-frame structure, which can span 600 feet. The number of towers per line length must also be an influence on costs measured by kilometre.

Figures 2 and 3 presents typical 330kV and 132kV transmission lines in the operating environment. Note that the HV lines are more likely to be constructed in remote areas as they connect generators located at the fuel source to load centres in urban areas

Figure 1: Relativities: HV – LV towers – Transmission through to distribution

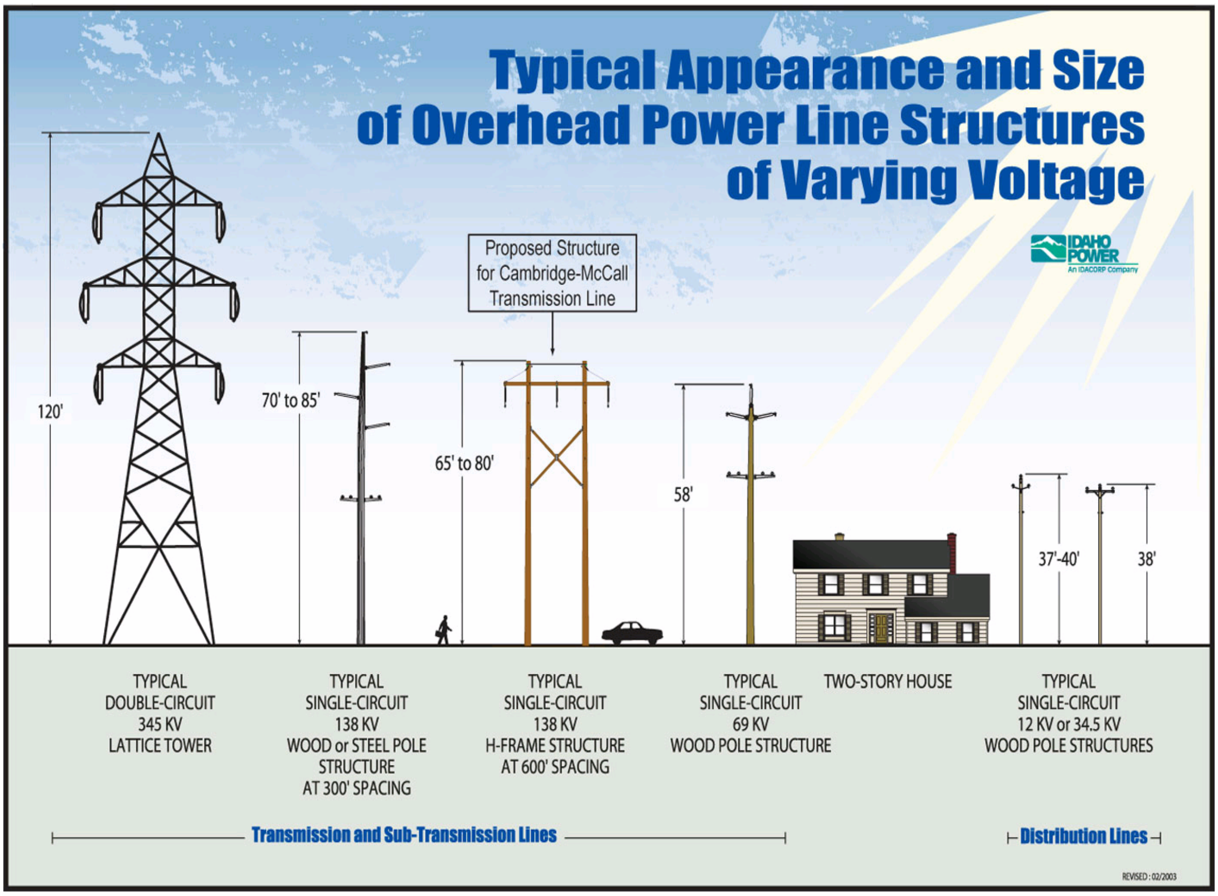


Figure 2: 330kV Transmission line[1]

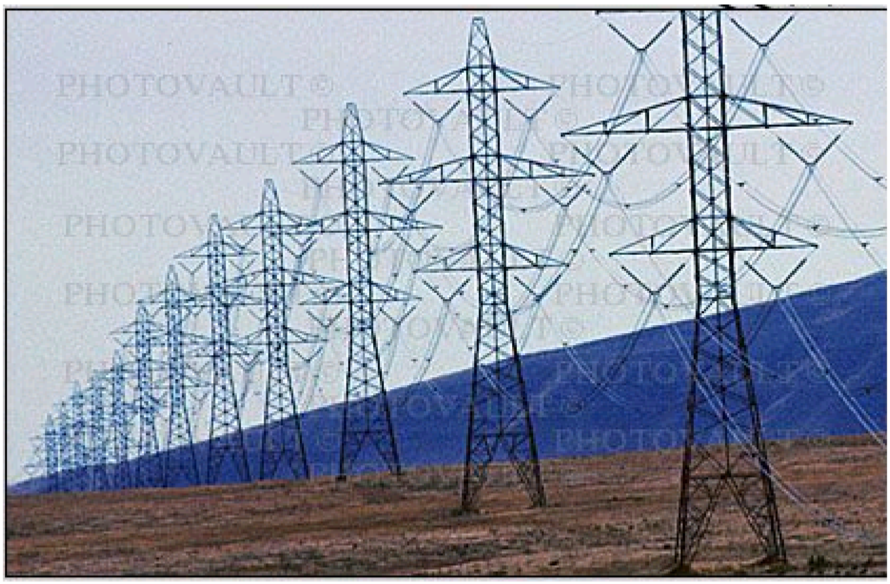


Figure 3: 132kV Transmission line[2]

The cost of maintenance would also be expected to vary reflecting the complexity and accessibility of the different line and tower types. By way of example, Figure 4 illustrates maintenance crews servicing a 132kV lines using a mobile cradle. In contrast, 330kV and 500 kV lines are less easily accessed and in certain circumstances may require helicopter-assisted maintenance. Cost differences can be substantial (Figure 5).

[1] Photovault , US 330kV transmission line
[2] Transgrid 132kV transmission line

Figure 4: **132kV Maintenance using mobile cradle**

Figure 5: **HV Maintenance crew**

Similar disparities exist between transmission substations. Variations are possible not only on the basis of the voltage of the transformation, but also on the number of transformers that may be accommodated within a single substation. Increasing the security of supply may require one, two, or even three additional transformers to provide the level of redundancy necessary to ensure high levels of reliability. For valid cost comparisons these critical differences should be factored into the analysis.

The proportion of each asset type; line voltage, tower type, substation size, number of transformers, etc will be determined by network operating conditions. These include the nature of the load (industrial vs residential), the location of the generators relative to the load, history of development of the network, and the terrain. The final investment decision will reflect a trade-off between technical parameters governing the physical network and the investment cost.

Victoria's network, with a large industrial load and relatively shorter distances has an average weighted voltage of 295kV. In contrast, Queensland, also with a large industrial load but with greater distances, has an average weighted voltage of 197kV. As the pictures illustrate, there are many reasons why we would not expect these two networks to have similar cost ratios.

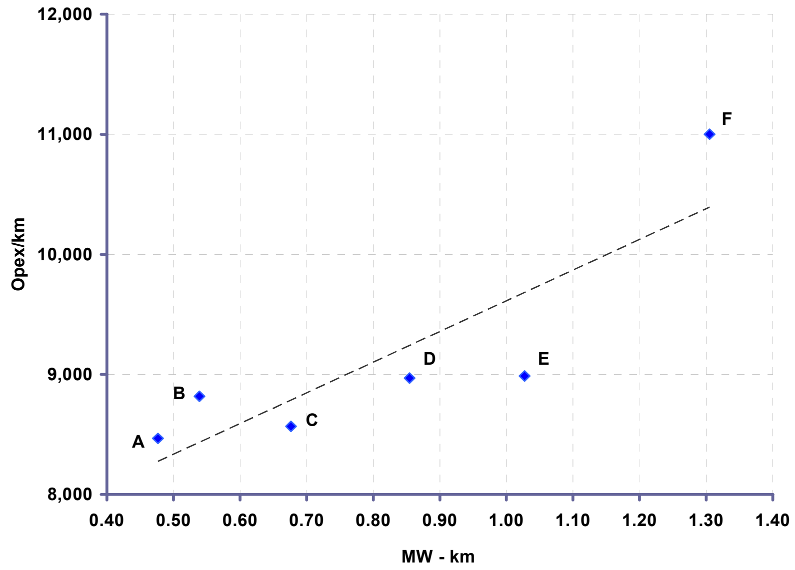
The next section examines each of the partial indicators used to benchmark cost performance for Transgrid and EnergyAustralia.

Opex/km: The major cost driver for opex/km is energy density. This outcome is a second order affect of the influence of load density on asset investment. The greater the load to be carried over a given distance the greater the asset investment per kilometre. For example, Victoria with an energy density of 1.31 MW/km has asset investments of $286,000/km compared to Queensland with a density of 0.68 MW/km and assets of $237,000 per km. Comparisons between these networks based on opex/km would be meaningless unless adjustment for the operating environment is incorporated into the analysis.

Given that opex, by definition, relates to the maintenance of the underlying asset base it would be expected that it would also be linked to the level of energy density. Figure 6, plotting opex/km against energy density, (peak demand MW per km) shows the overall trend between these two ratios.

The first point of interest is the positive trend line; as energy density increases the level of opex also rises. Network A with the lowest energy density of 0.50 MW/km has opex of only $7,000/km compared to Network F with the highest energy density, 1.3/km, which has opex of $11,000/km. Given the greater complexity of the underlying assets (illustrated in Figures 2 – 5) required to supply high density areas a positive relation between opex and density is well justified.

Figure 6: Opex/km and energy density (MW/km)

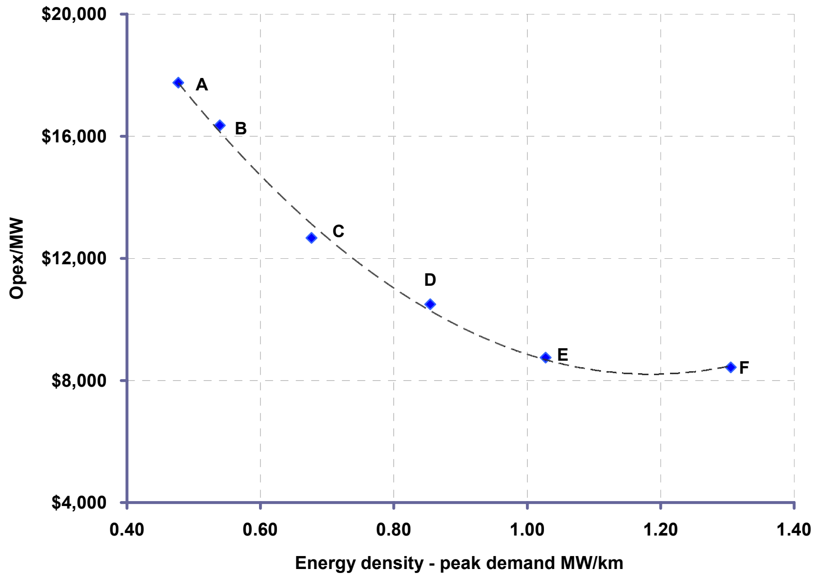


The next point of interest is the relatively close range among networks A to D for opex/km. This is less than would be expected given the dispersion of the asset values per km for these networks. In particular, Network E appears unjustifiably low. It does raise the question whether the regulated opex allowances are truly reflecting the level of the underlying asset base. A claim made by a number of the regulated entities.

Opex/MW - The relation between opex/MW and energy density is quite marked (Figure 7). However, in contrast to the positive trend between opex/km and energy density depicted in Figure 6, the trend between density and opex/MW is negative. Indeed, the position of the networks in Figure 7 is the exact reverse of that in Figure 6. The message is therefore conflicting. Though energy density emerges as a major cost driver, its influence on costs will depend on the normaliser selected.

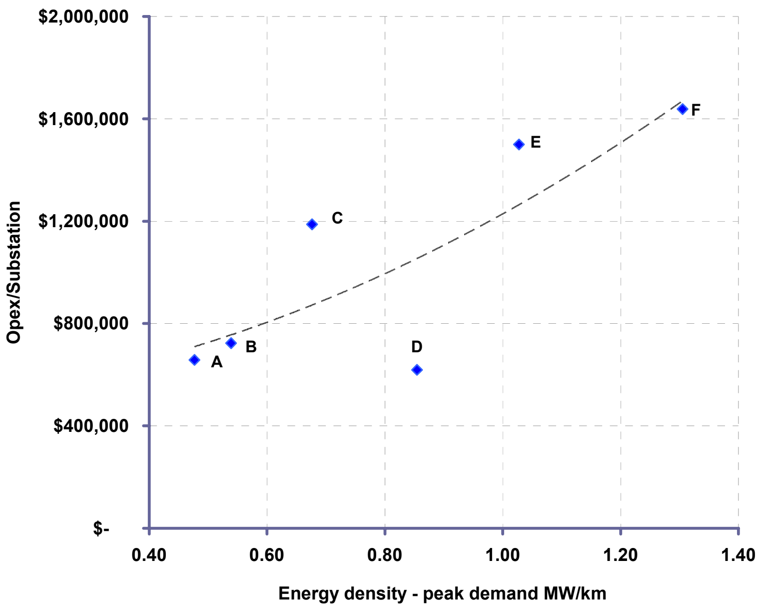
It could be argued that the sample of networks is too small to justify this analysis. However, examination of other networks, including electricity distribution and gas reticulation, both in Australia and overseas, provides strong support for these conclusions.

Figure 7: Opex/km and energy density (MW/km)



Opex/substation - The use of the partial indicator opex/substation is an attempt to extend the assessment of cost performance beyond the typical performance ratios. Costs would be expected to rise in line with the number of substations that must be monitored and maintained.

Figure 8: Opex per substation



Recall, however, that substations are not standard. They vary greatly depending on the voltage of the transformation and the number of transformers installed. Accordingly, those networks with higher energy density, and concomitant higher voltages and greater redundancy, exhibit higher levels of opex per substation (Figure 8)The link may be less robust than that depicted in Figures 6 and 7, but clearly networks with higher energy density will have higher costs per substation.

Opex/GWh: It is somewhat difficult to understand the use of the indicator Opex/GWh as a measure of cost performance. The ratio opex/GWh measures only the use of the system, not its cost of production: hence the term "TUOS"[3]. Energy (GWh) is not a product or output of the transmission network, it is a product of the generation sector of the industry. Transmission cost can only be assessed by comparing cost (total costs, opex, or capex) relative to **network outputs**: for example, length of network connecting generators to bulk supply points, maximum capacity required, and/or quality of supply.

For the transmission businesses, costs are determined by the value of the asset base, 70 per cent, and its operation and maintenance (30 per cent). The building block mechanism which contains only three revenue categories; rate of return on, and of, capital and opex, implies there is no marginal cost for an additional MWh of energy. Once the network is established, the revenue cap allowed by the regulator will be recouped by charging a fee broadly determined by the average rate of use of the system. With high fixed costs, increasing the flow of energy through the system lowers average revenue (opex/GWh) by spreading fixed costs across a greater number of throughputs.

Networks with a customer mix dominated by large commercial and/or industrial end-users will benefit from high load factors; that is, greater throughput relative to the capacity provided. The greater the average use of the system the lower the average revenue. Taking two extremes to illustrate this point. Powerlink, a network with a large industrial base and a load factor of around 70 per cent has the lowest average opex/GWh of 1.45 for the state-wide networks. In contrast, ElectraNet with a load factor of around 50 per cent has an average opex/GWh of 3.56, yet these two businesses have similar costs per substation.

As a measure of "price" and not cost, the opex/GWh ratio is simply not appropriate for benchmarking network cost performance.

Summary - Individually, the performance indicators are influenced by the operating environment. To overcome this problem, the Draft Decision has opted to use a combination of performance indicators. Collectively, the ratios are to provide a guide to whether the allowance "is within a reasonable range". However, from the analysis of the preceding ratios we find that the range of performance is established by the cost outcomes for the lowest and the highest

[3] Transmission Use of System charge

energy density networks, not by the most or least efficient. This range tells us nothing about where a particular network should be. Moreover, the fact that the rankings of network performance vary inversely between the ratios must further reduce the usefulness of this approach. Irrespective of the number of ratios used this will still hold true.

There is, however, a risk attached to this approach. Since there is no guide to the level of expenditure appropriate to the different network types, it is not possible to determine whether the expenditures allowed are adequate. Investigation of the data for the Australian transmission networks suggests there are instances where the regulated allowances are below those justified by the operating conditions. Benchmarking can therefore serve two purposes. It may signal cases of cost inefficiency but it can also identify those cases where additional funding is necessary and justified.

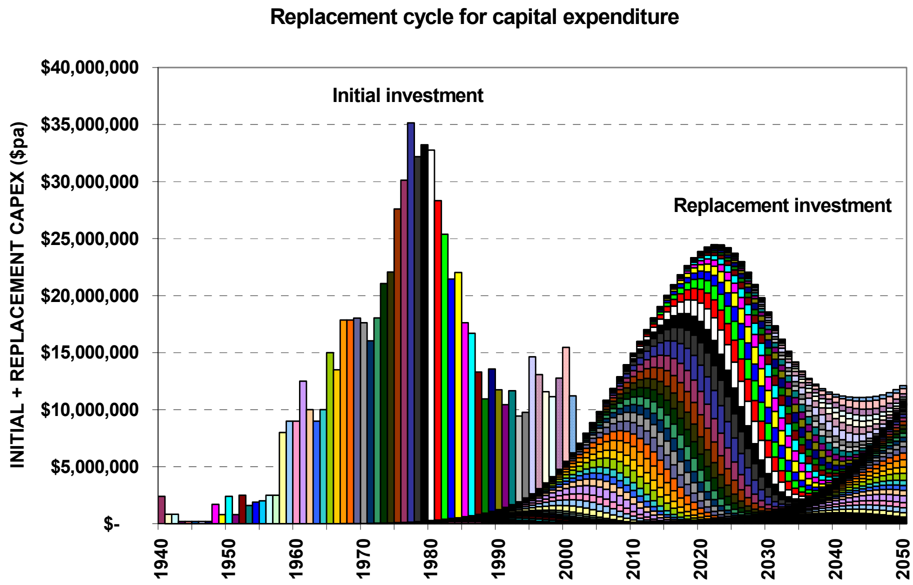
2.2 The past as a guide to the future

Australia's network infrastructure is aging. It is now entering that stage of its economic and or technical life where a growing proportion requires replacement each year. A number of substations for Transgrid are now 45+ years old. Not only are they aging but they are also old technology; designed for an industry quite different to the competitive electricity market we have today. On current estimates replacement expenditure for Australia's electricity networks will grow each year for the next two decades peaking around 2025.

It is possible to estimate the likely replacement schedule for the original investment. A number of techniques are available. The following analysis uses the Weibull distribution function.

The dominant wave of investment in Australia's electricity sector commenced in 1945 and continued into the early 1970's. The effect of this investment was to create an echo affect of equal proportion commencing around 1990 as the original investment required replacement. For example, assets installed in 1945 are now 60 years old. Some will already have failed and been replaced, others may last up to 80 or 90 years. But on average the life expectancy for transmission line and capacity assets is around 65 years. Figure 9, representing a generic network developed for analytical purposes, illustrates the annual rate of investment and the echo replacement cycle.

Figure 5: Generic replacement cycle: Initial investment and estimated replacement schedule



The wedge of the replacement cycle emerges in the 1980's and by the 2004 is equal to annual augmentation expenditures: in this example around $6 million each for replacement and augmentation.

The impact of aging infrastructure will be felt in two ways. Firstly, there will be a need for rising levels of opex to maintain the aging assets. Next, there will be a growing requirement for capex to replace plant and equipment that is no longer economic to maintain. Replacement of Australia's electricity infrastructure should have commenced sometime in the 1990s: the level of replacement and its timing depending on the network asset.

An examination of past expenditure allowances suggests, however, that there is little recognition of this growing investment burden. At each regulatory reset past expenditure levels have been used as a benchmark for future expenditures. The tendency has been to decrease opex expenditures over time rather than to allow for increases to maintain the aging assets. The draft proposals for opex for Transgrid exemplify this trend. This may not be a cause for concern if expenditure allowances for capex were increasing at a rate equal to the required replacement schedule. However, replacement capex is projected to be less than that required. Accordingly, it would be expected that opex would rise in line with the age of asset base. This does not appear to be the case.

2.3 Summary

The points presented in this section have touched only briefly on the problems arising in the benchmarking of cost performances for transmission networks.

The partial productivity indicators selected by the ACCC are driven by network operating conditions. Relative cost performance cannot be determined by reference to these ratios. This is irrespective of the use of an individual ratio or the range established by a number of ratios.

If regulators require the support of comparative assessments then it is necessary to develop a more rigorous model of network cost structures.

3 WACC and EBIT/Assets

In their presentation to the Public Forum the EMRF claimed that the WACC proposed by the ACCC for the two transmission businesses was excessive. To support their claim they submitted a chart showing the EBIT to asset ratio (a proxy for the rate of return on assets) for 300 large companies over the period from 1989 to 2002. The proposed 11 per cent for Transgrid was contrasted adversely with the average of 4 per cent for the competitive market entities.

However, an examination of the financial data for a number of large Australian corporations suggests there is some confusion over the appropriate definition of the asset base selected for the competitive entities. For transmission networks the regulated asset base includes only non-current "property plant and equipment" assets. The businesses may have other assets, including current and other non-current assets, but these are not included in the regulated asset base. The asset base upon which the EMRF calculated the rate of return for competitive entities, however, appears to differ.

Taking data from nine of Australia's largest companies we find that the ratio of EBIT to assets (defined as "property, plant, and equipment only" for the purposes of making like-with-like comparisons with the regulated entities) averages 26 per cent. This is far above the 4 per cent cited by the EMRF and more than double that proposed for Transgrid. It ranges from 5 per cent for Qantas, to 17 per cent for One Steel, up to 50 per cent for Wesfarmers (Table 1 – Column 1).

Given this large discrepancy, the possibility exists that the definition of assets used as the denominator by the EMRF is not the same as that used by the ACCC for estimating rates of return.

Table 1: EBIT to Assets (Property, Plant, and equipment) - 2003

	EBIT / Assets - Property, plant & equipment	EBIT / Assets - Total assets Current + non-current
AVERAGE	**25.8%**	**10.1%**
Transgrid	8.3%	8.0
One Steel	17.2%	7.8
Blue Scope	24.8%	16.1
BHP Billiton	16.6%	11.4
Telstra	24.9%	16.1
Lend Lease	45.0%	4.3
Qantas	5.0%	3.3
David Jones	7.7%	2.9
Woolworths	40.3%	16.1
Wesfarmers	50.6%	13.3

Using the data for the companies listed above, and analysing the range of possible asset definitions[4], the closest fit to the ratio put forward by the EMRF has been identified as that for EBIT to *total assets*. This is calculated as current plus non-current assets, before deduction of current and non-current liabilities. Averaging around 10 per cent for the sample used in this analysis, this ratio is set down in Table 1, Column 2. Using this definition, the outcome for Transgrid is considerably closer to the sample average, though still below it.

The difference between the ratios in the two columns appears to depend on the ratio of current to non-current assets. The inclusion of current assets in the denominator for the EBIT/assets ratio has the effect of reducing the ratio quite markedly. In general, all businesses have a mix of current and non-current assets. The ratio of "property, plant, and equipment" assets to the total asset base will be influenced by the contribution of current assets. The ratio of one to the other will depend largely on the nature of the industry in which the business operates. Capital intensive businesses with few inventories will have relatively low ratios while trading companies may have substantial receivables and inventories among their current assets. For Transgrid, the ratio of current to non-current assets is only three per cent. For Telstra, a non-trading entity with few inventories but higher receivables the ratio is 20 percent. At the other

[4] Current assets, non-current assets, total gross assets, total net assets.

extreme, trading operations such as Woolworths may have a ratio of current to non-current assets up to 80 per cent, reflecting the high level of inventories and receivables in current assets.

3.1 Summary

Comparisons of the costs of production or corporate profitability can only provide meaningful and credible results if they are based on appropriate data. Network operating conditions, the definition of the asset base, or even the type of industry within which the business operates can influence performance comparisons. The goal in these comparisons should be to ensure that the network business has appropriate but adequate funding, not simply to justify cutting expenditures or reducing profitability.