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# ENERGY NETWORK ASSET VALUATION

# IMPACT ON USERS

Prepared for:
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# CONTENTS




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## EXECUTIVE SUMMARY

Australian regulators have before them a range of decisions regarding access to electricity and gas distribution networks. Decisions have to be made regarding maximum allowable revenues and these in turn depend on initial asset valuations.

This paper considers a range of valuation methods; depreciated actual cost (DAC), depreciated optimised replacement cost (DORC), economic value, scrap value and deprival value.

The question then is which of these valuation methodologies is "best". In seeking to answer this question, the methodologies are evaluated against the criteria of efficiency, fairness and practicality.

As far as sunk costs are concerned, it is easily demonstrated that low asset valuations will generally be conducive to "static efficiency" — that is, maximising the use of existing networks. However, low initial asset valuations may threaten "dynamic efficiency" — that is, the capability of the market to deliver desirable new investment in the future. This could occur if regulatory decisions were deemed to be manifestly unfair to network owners. The conclusion which emerges from this is that the most efficient asset valuation will be the lowest, subject to the proviso that it not be unfair to the network owner.

It is instructive to consider the valuations that would prevail in a competitive market. The value of an asset in competitive markets is given by deprival value, which must lie somewhere between scrap value and DORC. There is no basis to say that DORC would prevail in competitive markets.

It is then argued that there is no single "fair" valuation for sunk costs. Rather, the regulator should be guided by the aim of not imposing an unfair valuation. An unfair valuation would be one which lies outside the range that a network owner could reasonably have expected when they made an investment, having a mind to the monopoly character of the network, the need for government intervention to facilitate the network, the potential public interest in price restraint on the part of the monopolist and, related to all these, the possibility for government intervention in the network owner's market conduct.

The charging history for the network asset may illuminate the question. Attention should be paid to past depreciation schedules and returns on capital to determine the degree of any sinking of capital in the past. A fair scheme might be regarded as one where users fully fund capital costs but only do so once.

Although there will sometimes be difficulties in deriving a DAC valuation for sunk costs, this cannot in itself create a presumption that valuations should be set at the top end of the range (i.e., at DORC). DORC estimates are inevitably subjective, and an information asymmetry exists between the regulator and the network owner.

After consideration of these factors, one is forced to the conclusion that there is no "right" answer for the valuation of sunk costs. However, in many instances a valuation below DORC is conceivable and there can be no presumption that DORC is right.

As far as new investment is concerned, given a sufficiently weak degree of competition, it appears to be possible to build an efficient and fair regulatory regime around either DAC or DORC valuations. However, DAC will almost certainly be simpler to implement. A DAC approach is implied in the Gas Code.

The approaches which are taken for valuation of sunk network assets have considerable implications for network users. High valuations will tend to prompt by-pass investments, including by potential network users, that are of an inefficient nature. Inefficient by-pass — interpreted in a broad sense to include the possibility of alternative energy sources or reduced demand — will be prompted when network charges rise above marginal cost.

The conclusion that flows from this is that although recovery of average costs may have dynamic efficiencies in terms of network investments, it will have dynamic inefficiencies in terms of investments by network users.

The Electricity Code and the Gas Code both allow for a deprival value approach to asset valuation. Deprival value is the CoAG's preferred valuation method. Because future revenues are indeterminate, all that one can say about deprival value is that it lies somewhere between scrap value and DORC. It would be inaccurate to say that the Codes support DORC as an initial valuation.

However, there is a tendency to interpret deprival value as meaning DORC. ACCC and ORG have indicated an intention to value initial assets at 100 per cent of DORC in some specific cases. IPART has indicated a willingness to discount initial valuations from DORC when it believes that the resulting network charges are too high.

At the end of the day there is no hard and fast rule as to what is the appropriate approach to asset valuation. Regulators have recognised a need to treat network valuations on a case by case basis and IPART has in some cases accepted that the desirable valuation lies below DORC. Comparison with overseas networks suggests that returns to some Australian networks are very high.

## 1. INTRODUCTION

SA Centre for Economic Studies has been commissioned by the Australian Cogeneration Association, the Australian Gas Users Group and the Energy Users Group to conduct a study of issues surrounding the valuation of assets for energy utilities. The focus is on asset valuation for regulatory purposes when energy assets have a monopoly character.

The study is intended to provide input to the deliberations of regulators who are currently grappling with a range of complex issues in the process of authorising access regimes under the National Electricity Code and the National Gas Code. Asset valuation is important because of the large influence that it can have on maximum allowable revenues.

It has implications for network owners because it influences the returns that they will receive from their assets. It also has implications for network users — upstream and downstream — who pay network charges (whether directly or indirectly).

Regulatory decisions have a large potential for redistributive impacts between network owners and users. To a significant extent these redistributions are a "zero sum game" — that is, one party's loss is in equal measure another party's gain. However, there are efficiency implications of the regulatory decisions which go beyond the zero sum game.

That is to say, although the regulatory decision is important in determining how we share up the cake, it also has potential to influence the size of the cake.

The purpose of this paper is to draw out economic principles which can guide regulatory decisions about asset valuation and to consider their implications for the contemporary debate.

The first section of the paper identifies the significance of asset valuation in the regulatory process. The second defines alternative asset valuation methodologies and then compares and contrasts them.

The third section looks at impacts on network users.

The fourth section considers how the competing interests of owners and users might best be resolved. This requires development of three central themes:

- the efficiency implications of alternative regulatory approaches;
- a framework within which fairness might be considered; and
- the practical application of valuation methods.

The fifth section turns to the contemporary context — the stipulations of the National Electricity Code and the National Gas Code. The sixth section looks at how regulators are approaching the issue of asset valuation in their pronouncements to date.

The final section draws conclusions.

## 2. THE ROLE OF ASSET VALUATION IN REGULATION

In markets with a high degree of competition and strong potential for new entrants, pricing disciplines on incumbents are relatively strong. However, this is not the case for some very large, long lived assets — energy transmission and distribution networks being a case in point.

Excessively high charges on essential infrastructure have the capacity to impede economically justifiable projects upstream and downstream of the essential infrastructure, and to facilitate by-pass projects that are not in fact efficient[1]. Monopoly behaviour can lead to a wastage of resources from a broad social viewpoint while at the same time maximising financial returns to a monopolist.

It is in this context that competition enhancing frameworks have been introduced for major commercial infrastructure providers in Australia. The focus of this paper is on the electricity and gas industries, but many of the principles involved are also relevant for other networks such as telecommunications and transportation.

Regulators typically constrain monopoly pricing through restraints on total revenue or average prices. The nature and level of the regulatory restraint has important implications for efficiency and for the commercial interests of network owners and suppliers/customers upstream/downstream of the network.

In a competitive market, an asset owner is constrained to set prices at a level generally no higher than the prices that a competitor would charge. One can, in principle, determine an expected future profit stream on this basis and by a process of discounting determine an asset valuation.

However, for the determination of a regulatory ceiling on a monopolist's revenue, this approach is problematic.[2] Two possible alternative approaches are to determine allowable revenue:

- with reference to past revenue levels;
- with reference to some cash flow target — for instance to finance new investment — a "cash flow" approach; or
- as a mark up on costs — an "accruals approach".

The first two approaches do not rely on an asset valuation, although an asset valuation can be derived as a residual. The third approach, the accruals approach, does rely on an asset valuation to build up to allowable revenue.

The cost elements for a network owner are categorised broadly in Table 1. The focus of this paper is on asset valuation for regulatory purposes. However, some brief discussion of the process by which allowable revenues are set is useful to put the valuation issue into context.

1 In a broad sense, by-pass need not imply duplication of an existing network — it could mean investment in some other technology that avoids the need for the network.

2 In continental Europe the approach of setting revenue constraints with reference to substitutes is sometimes employed (Rosellon, 1997). However, if the possibility of substitution is insufficiently strong to create effective competition for a monopolist, it will sometimes be difficult to determine relevant substitutes for the exercise.

TABLE 1
BREAKDOWN OF NETWORK COSTS

| | |
|---|---|
| Return on capital | Reflecting the opportunity cost of delayed consumption and a systematic risk premium |
| Depreciation | Sometimes referred to as "return of capital" or "consumption of capital" |
| Operation and maintenance | To some degree a substitute for capital inputs |
| Total | |

## 2.1 Return on Capital

Return on capital is determined by multiplying rate of return and asset values. Thus valuation of the asset base is of fundamental importance for this component of costs.

The allowable rate of return would typically be determined as the combination of a risk free cost of funds and an appropriate systematic risk premium — the outcome being an estimate of the "weighted average cost of capital" (WACC).

For instance, if a regulated network had an asset base of $100 million per annum and an allowable rate of return of 7 per cent per annum, then the return on capital would be $7 million per annum.

In an efficient capital market, risk premiums will only be paid for non-diversifiable risks. Investors can reduce exposure to diversifiable risk by portfolio diversification and any risk premiums in respect of diversifiable risk would therefore be bid away[3]. A risk premium is payable only in respect of systematic, or non-diversifiable, risk. Only risks at the very broadest level are non-diversifiable — generally they relate to global outcomes, such as the global GDP cycle.

Specifically, a risk premium is not payable in respect of:

- a highly competitive market structure — risks such as these can be diversified away for an individual by taking a small stake in all competitors; or
- regulatory risk — except to the extent that it is systematic, which would be negligible.

To the extent that competition and regulatory risk are believed to exist, they need to be taken into account in assessments of future cash flows. If downside risks of this nature exist, then "expected" cash flows should be correspondingly introduced. This would then immediately flow though into a reduced asset valuation. However, those risks have no implications for the systematic risk of the asset, and hence no bearing on the allowable rate of return.

## 2.2 Depreciation

Depreciation charges are included to reflect that most man made assets have a finite life. A part of the asset can thus be considered to be "consumed" in any particular period.

3 The principle of risk premiums only for systematic risk is widely misunderstood. It does not mean that investors will not discount the expected cash flows of an enterprise with a high risk of failure. What it means is that that discounting takes place within the cash flows (on a probabilities basis), not by adjustment to the discount rate. Estimates of WACC from historical stock market data are in principle consistent with this concept — the calculated discount rate takes into account successes and failures (perhaps imperfectly).

An economic depreciation concept considers how much of the assets future productive capacity is consumed in a given period, and depreciates accordingly.

Accounting and taxation treatments are sometimes more mechanistic, with depreciation expenses determined according to standardised formulas. They will not necessarily correlate with economic depreciation charges in any particular period, although over the whole life of the asset all of the depreciation measures must add up to asset value.

In terms of the example mentioned previously, the asset with a value of $100 million might have a life of 20 years. On a "straight line" basis, this would imply a depreciation charge of $5 million per annum over the life of the asset. However, depreciation might not necessarily occur on a straight line basis.

Because asset lives are difficult to predict, it may be that a depreciation schedule is revised during the life of an asset. For instance, following the example, it might be that after 20 years the asset still has 5 years of working life left and a value of $10 million. On this basis, one could argue that the asset depreciates by $2 million a year over the following 5 years.

This raises the possibility that an asset could be "depreciated twice" as a result of revisions to its depreciation schedule.

The capital intensity of networks makes depreciation an important item in cost structures. Asset valuations are therefore pivotal in this respect.

## 2.3 Operation and Maintenance Expenses

Operation and maintenance expenses are not directly driven by asset valuations. However, there is a degree of substitutability between capital expenditures and operation and maintenance activity.

Maintenance expenditure, for instance, has a clear influence on the rapidity of physical depreciation of an asset. However, it may not influence depreciation allowances determined under a mechanistic rule.

It will be important that regulatory frameworks do not distort choices between operating and maintenance expenditures and capital expenditures.

## 2.4 Indexed or Nominal Treatment

It is possible, at the outset, to set maximum allowable revenues with reference to nominal asset values, rates of return and depreciation, or with reference to indexed (ie inflation adjusted) asset values, rates of return and depreciation.

In fact the "CPI-x" formula which is often used in pricing brings about an amalgam of the two (if x is as large as CPI the two approaches converge).

# 3. DESCRIPTION OF ASSET VALUATION TECHNIQUES

Asset valuation techniques may be considered within four broad classes:

- methods based on assessment of construction (or development) cost;
- methods based on discounted future earnings — "economic values";
- deprival values, which are a hybrid of the first two but calculated according to a mechanistic rule; and
- "fair value" estimates, which also tend to be hybrid, but with a greater element of regulatory judgment.

## 3.1 Cost Based Measures

Cost based valuations are usually considered in depreciated terms. This is to take account of the fact that assets have only a finite life. Depreciation is usually carried out proportional to remaining life. Unless otherwise stated, the discussion that follows relates to asset valuations net of depreciation.

*Actual Cost*

Also referred to as historical cost. Actual cost is usually referred to in its depreciated form (DAC).

Under this approach, assets are valued at historical purchase price. The advantages of DAC valuations are that:

- they are relatively inexpensive to establish, if introduced at the beginning of an asset's life; and
- they do not involve a high degree of subjective judgment.

The disadvantage is that DAC valuation has no real connection with contemporary market valuations. It fails to take into account inflation or technological change (e.g., obsolescence) and will be less meaningful the older is the asset.

Because energy network assets tend to be long-lived (relative to telecommunications assets for instance), energy network valuations are particularly prone to wide divergence between DAC and current market prices.

Having said that, DAC is widely used for regulatory purposes overseas and clearly is workable.

*Inflation Adjusted Actual Cost*

This approach seeks to address the actual cost method's flaws with respect to inflation. This can be done by revaluing assets according to some suitable broad indicator of the price level (e.g., CPI). The price indicator is not specific to the asset.

Inflation adjusted estimates will generally be a more accurate indication of market values than historical cost. In addition, price indexes for broad based inflation are well developed and readily available.

This is not to say that inflation adjusted actual cost is necessarily a good valuation technique. Impacts of technical change and price trends in output markets are not captured by the current cost adjustment, and can be important (e.g., in respect of computer investments).

*Replacement Cost*

Replacement cost is an estimate of the cost of replacing the asset with some asset (not necessarily the same) which will deliver the same services and capacity.

Replacement cost is potentially useful in that it gives an indication of the **maximum** price that the asset could be sold for on a competitive market. No buyer would pay more than replacement cost, because they could instead purchase a like asset at replacement cost. DAC does not have this feature.

Replacement cost valuation is contemporary. Unlike historical cost, it will not be rendered less meaningful over time due to inflation and obsolescence. A technological breakthrough for providing a particular service, for instance, will often lead to a write down of replacement cost.

Replacement cost differs from inflation adjusted DAC, in a conceptual sense, by virtue of the price index used. Inflation adjusted DAC uses a broad price indicator; replacement cost (at least implicitly) uses a more relevant asset specific price index.

There are two main disadvantages of replacement cost:

- a greater degree of subjective judgment may be required than under historical cost — especially if assets are not available "off the shelf" — and this may be contentious; and
- replacement cost is not necessarily an indicator of what an asset could fetch on the market — market price could be less than replacement cost (but not more).

*Optimised Replacement Cost*

Optimised replacement cost differs from replacement cost in that it focuses on the useful services actually delivered by the asset. It does not factor in the cost of replacing inefficient excess capacity. If new technology exists which means that there is a cheaper way to provide a service than with the existing asset, this is taken into account by way of a reduced valuation.

In principle, the optimisation process can take into account the possibility of reconfiguring a network, rather than taking the current asset configuration as a given.

Thus ORC has the advantages of RC, but with the added benefit that the optimisation procedure takes the valuation closer to what would prevail in a hypothetical competitive market.

However, making a distinction between RC and ORC may be problematic at times. The capital cost of any particular network project is generally not directly proportional to capacity. Incremental capacity will often be relatively cheap, and for this reason it will often make sense to establish an excess capacity that may take several years to absorb. What degree of excess capacity can be judged to be efficient?

The drawbacks of optimised replacement cost are similar to replacement cost but, in addition, there is a more costly and more speculative judgement involved in determining what might be an optimal network configuration.

An important feature of DORC is that, in principle, it represents a ceiling valuation above which by-pass — in the form of duplication of the network or some part of it — becomes viable. If an asset owner set charges on the basis of an asset valuation higher than DORC, then a new entrant could offer lower charges and still profitably enter the market by purchasing a replacement asset which delivers the service in question in an optimal way[4]. DORC is useful then in that it represents the **maximum** asset valuation that could be placed on an asset in a competitive market.

### 3.2 Economic Value

We now turn away from valuations based on cost to valuation based on discounted future earnings — "economic values", as they are sometimes described.

Ultimately the owner of an asset is interested in the future returns that ownership of the asset would bring. These benefits might take the form of earnings achieved by the asset in the use for which it has been established. Alternatively, the benefit might be in the form of a receipt for selling the asset into some other use — known as scrap value.

Economic value is the greater of the net present value of future earnings (NPV) and scrap value (SV). A commercially motivated owner would keep the asset if NPV exceeds SV, but scrap it if SV exceeds NPV.

*Net Present Value*

To estimate economic value, one therefore needs to have an estimate of discounted future earnings. This requires some estimates of future profits and requires selection of an appropriate discount rate.

The formula for net present value is:

$$NPV = \sum_i \frac{E_i}{(1+r)^i}$$

Where:

$NPV$= Valuation placed on future earnings

4 With major infrastructure networks, the network owners would probably have to set charges significantly above DORC to induce new entry. Given the significant economies of scale in provision of network capacity, by-pass facilities are likely to be developed in significant blocks. Because the proponent of a by-pass could not be confident of capturing all of the potential market, and runs the risk of downward price pressure, duplication of the network would not actually become viable unless the valuation of the existing asset was significantly above DORC and likely to stay there. However, this qualification would not generally be an issue in a competitive market with free entry and exit.

$E_i$ = Expected earnings in Year i

$r$ = Weighted Average Cost of Capital

A valuation on this basis therefore requires that a view be formed of the outlook for earnings and the weighted average cost of capital.

However, this approach becomes problematic when asset valuations are derived with a regulatory objective. On the one hand, we wish to use the asset valuation to let us determine allowable earnings ($E_i$). On the other hand, we have to make some assumption about what $E_i$ will be to derive an asset valuation (under an economic value approach). Thus one finds oneself in the position of having to assume what $E_i$ is as a precursor to determining what it should be.

The process is thus circular, and unless other factors are taken into account the valuation and $E_i$ are indeterminate.

However, other factors can be considered, so as to determine $E_i$ — for instance by reference to the benchmark of what would pertain under a competitive market structure. Under such a benchmark, economic value for a natural monopoly might turn out to be less than DORC.

*Scrap Value*

Scrap value is the amount that could be recovered if the network assets were turned over to some non-network use. Typically this would be low or even zero.

The significance of scrap value is that if scrap value were positive and exceeded net present earnings in use, then it would make commercial sense to scrap an asset.

## 3.3 Deprival Values

Deprival value is the lesser of replacement cost and economic value (in turn the higher of discounted future earnings and scrap value). Optimised deprival value (ODV) uses optimised replacement cost instead.

ODV is conceptually relevant because it is a measure of the financial disadvantage which an owner would suffer if deprived of an asset.

If DORC exceeded EV, a deprived owner would not replace the asset. To do so would be irrational because the present value of future of earnings would be less than the cost of replacing the asset. The loss to the owner in a deprival situation would, therefore, be economic value (which might only be scrap value, or might be NPV of earnings).

On the other hand, if EV exceeded DORC, a deprived owner would replace the asset in an optimal way. The cost of replacing the asset is DORC and this is loss that the owner would face in a deprival scenario. Thus DORC is the relevant deprival valuation when EV exceeds DORC.

Deprival value captures the valuation that would be put on an asset in a competitive market. It has some appeal from this perspective, as well as its ability to avoid inefficient by-pass (DV is less than or equal to DORC).

In regulated markets, the regulator does not have available an estimate of net future earnings. All that one can say is that deprival value lies between scrap value and DORC.

In 1994 the Council of Australian Governments agreed that deprival value — not DORC — should be the preferred approach to valuing network assets.

### 3.4 Fair Value

King (1996) discusses the use of "fair value" techniques in the United States. Fair value calculations attempt to take into account cost based valuations and market values of firms. However, as King points out, market value calculations are circular, and ultimately indeterminate.

King reports that the method has evolved over time and now is an amalgam of historical and replacement cost.

"Fair value" asset valuation relies on what is determined to be a "fair" revenue. As such, it is a by-product of the regulatory process, not an input into it. King reports a formal statement to this effect from a US Supreme Court judgment.

# 4. ASSESSMENT OF ASSET VALUATION TECHNIQUES

This section compares alternative valuation methodologies in terms of criteria which are likely to be of importance to a regulator. The criteria considered are:

- the efficiency implications of alternative regulatory approaches;
- fairness to affected parties; and
- practicality of implementation.

## 4.1 Efficiency Considerations

Two important criteria for the regulatory regime are that it should promote:

- efficient use of the existing network — i.e. "static" efficiency; and
- efficient decisions about new network investment — i.e. "dynamic" efficiency.

*Efficiency in Usage*

The additional costs to a network owner when an additional customer uses the network will often be low. An additional user of an electricity transmission line with some excess capacity might impose some extra cost in the form of higher leakages, but these extra costs would be few. Likewise, an additional user of a gas pipeline at less than full capacity might impose some extra pumping costs, but not much else.

Alternatively, if the extra user displaced another user, then the cost to the network owner would be the revenue forgone from the displaced user.

In an immediate sense, these are the possible consequences of an additional user on a network. The extra cost burden to the network owner is described as short run marginal cost (MC). In the case where a network is at less than full capacity, MC will typically be low.

It follows that, if the owner of the network could charge the marginal user an amount equal to marginal cost, the network owner would not be left out of pocket on the extra transaction.

A marginal cost pricing rule would ensure that so long as a network user were willing to cover marginal costs of use, then they could use the network. In many instances, the benefit to the user would exceed marginal cost, so that usage of the network effectively creates a surplus — that surplus arising from the mutually beneficial transaction between the network user and the network owner.

However, if the network owner adopted a policy of recovering more than marginal cost from the user, then some mutually beneficial transactions are ruled out. This represents an efficiency loss — it leads to an under-utilisation of the network.

*Efficiency in Network Investment Decisions*

The problem with a marginal cost pricing rule is that often it will not allow the network owner to recover the sunk costs of developing the network infrastructure. No commercially motivated developer would construct a network without being confident that their charges would recover long run average costs (LRAC). LRAC differs from MC in that it allows for a recovery of capital. Typically LRAC would exceed MC although this is not always the case[5].

Before making network investments network owners will have to be reasonably confident that they have a fair chance of recovering LRAC. This usually will impose some efficiency loss by forcing charges above MC[6].

It needs to be emphasised that allowing LRAC may still involve a use of monopoly power. This is best illustrated by way of example.

If the transmission rights on an electricity link were split into separate parcels and allocated to independent owners who did not collude, then an economically rational response would be to sell the usage right at marginal cost. There would be no gain to the owner from refusing to sell - the unused transmission right would not generate any revenue. However, at times of low utilisation, returns to the owner would be low.

LRAC pricing could only be achieved by bundling all of the transmission rights into one parcel, and then exploiting whatever monopoly power exists.

With these considerations in mind, it is useful to consider the valuation which a purchaser would place on a network in terms of two income streams:

- incomes earned from the marginal cost component of prices;
- the monopoly rent which is earned by setting rates above marginal cost — particularly when marginal cost is low or zero at times of less than full utilisation.

Income of the first type is unambiguously efficient. Income of the second type brings with it potential inefficiencies in network usage.

*Implications for Asset Valuation*

These pricing issues have direct implications for asset valuation.

In terms of usage of an existing network, the most efficient asset valuation is the one which minimises the displacement of marginal usage. Without discriminatory pricing this would imply marginal cost pricing and a valuation based on the net present value of the future revenues. With effective discriminatory pricing a higher valuation could be used without causing distortions, but the implementation of this is bound to be imperfect in practice. Conceptual distinctions between valuation methods are not an issue from this perspective.

In contrast, charging strategies which recover capital costs will be conducive to new investment.

5 MC would exceed LRAC when a network was at full capacity and the marginal user placed high valuation on access to the network.

6 The scale of the efficiency loss can be ameliorated by price discrimination — setting charges low for marginal users and higher for users who gain a larger surplus from network use. However, provisions in Australian electricity and gas codes which promote upstream and downstream neutrality may limit the application of discriminatory pricing.

Of course one could establish a rule whereby existing networks were priced at MC and new investments allowed to charge LRAC (for instance by employing DORC valuations). However, to arbitrarily impose different treatments in this way is problematic. In one years time, why not revisit the new investments over that year and change to a MC pricing rule? Could a network owner be confident that this would not happen?

Clearly there is a dilemma for regulators. In the words of King (1996):

> *"Valuation of sunk assets may create considerable conflict between the regulators and the asset owners. Consider, for example, the ACCC evaluating an access undertaking that covers sunk, fixed-flow assets. If the ACCC wishes to maximise the economic benefits from access then it will want access prices to be as low as possible, subject to the relevant assets remaining in use. The optimal rate base is provided by scrap value ..."*[7]

Regulators will be reluctant to allow only a marginal cost pricing strategy for sunk assets. Arguments against marginal cost pricing would include:

- the inconsistency between the sunk costs and future investment; and
- if the treatment is "unfair", it may have a detrimental impact on future investments.

On the other hand, is it reasonable to suppose that network owners should always cover sunk costs? Certainly this is not the case in competitive markets. There may be an a priori expectation that investments will cover sunk costs, but eventual outcomes will sometimes differ from this.

Clearly the appropriate pricing strategy is ambiguous and a trade-off exists. Empirical resolution of these issues is likely to be difficult and often impossible (in particular with respect to fairness). However, given that a tradeoff exists, it will often be the case that the optimum decision lies somewhere between LRAC for sunk costs and MC — that is to say, that the optimum valuation for efficiency purposes will often be something less than DORC.

In their submission to the NECA Network Pricing Review, the American infrastructure economics specialists Putnam, Hayes and Bartlett argued that:

> "...PHB disagrees that the revenue requirement needs to provide a full return on the DORC of the existing networks.
>
> Lower initial valuations (down to scrap value) need not adversely affect efficient network utilisation, operations, long-term sustainability of the business, or efficient competition, whereas higher than necessary values can lead to inefficiencies ..."

7 Strictly speaking this should probably be qualified by noting that in the case where a network is fully utilised, marginal cost pricing would be desirable so as to ration access, even in the instance where this did bring about returns with an economic value exceeding scrap value.

To resolve the issue of what might be a suitable asset valuation methodology — and with particular reference to the appropriate treatment of sunk costs — it is useful to consider the case of a competitive market.

*Competitive Markets Analogy*

The two key questions considered in this section are:

- what valuation methods apply in competitive markets?
- what is the relevance of this to a monopoly market?

Turning to the first question, it is sometimes argued that DORC is a relevant valuation methodology because it is appropriate to a competitive market. This is not always correct.

First, economic principles suggest that competitive markets would use deprival value, not DORC per se. Deprival value lies between scrap value and DORC but is otherwise indeterminate for regulatory purposes.

DORC is no more than an upper bound for deprival value. Market asset values in competitive markets could be and often are significantly below DORC (for instance with respect to housing).

Secondly, it also needs to be recognised that DAC is widely used in industry — not just in network or other natural monopoly industries but industries which are subject to a high degree of competition. At face value this implies a theoretical contradiction (i.e., why would a value above or below deprival value be adopted?). It could be explained by the fact that, in some instances, DORC represents an excessive asset valuation and that DAC (coincidentally but not unusually) more closely represents economic value. In such a situation, DAC will be closer to deprival value than DORC.

This begs the question of why we might systematically observe deprival values below DORC. Why not some above DORC and some below, with DORC observed on average?

The answer lies in uncertainty about the future. DORC valuation allows for the influence of finite useable life and technological obsolescence on asset values. However, it does not allow for all of the factors which would affect asset values in a competitive market — in particular price trends in input and output markets. In a competitive market economic value will take into account price trends for outputs and inputs as well as finite useable life and technological obsolescence. Deprival value is, as noted earlier, the lesser of DORC and economic value.

The distinction is very important and we turn now to an example which can illustrate differences in valuation methods with particular reference to a competitive market environment.

**EXAMPLE: ASSET VALUATION FOR AN AGED TELEX SYSTEM**

**TABLE 2**
**DERIVATION OF ALTERNATIVE VALUATIONS**

| | | |
|---|---|---|
| Step 1 | Actual Cost — i.e., cost of system 10 years ago | $100 |
| | less | |
| | Depreciation — based on a 20 year expected life | $50 |
| Step 2 | equals: | |
| | DAC | $50 |
| | index for inflation over past ten years — multiply by 2, | |
| | i.e., approximately 7 per cent per annum inflation over ten years | |
| Step 3 | equals: | |
| | inflation adjusted DAC | $100 |
| | adjust for changes in the relative price of the asset in question | |
| | — say a $10 fall | |
| Step 4 | equals: | |
| | Depreciated replacement cost (DRC) | $90 |
| | allow for the opportunity to replace in an optimised way | |
| | — say a $20 fall | |
| Step 5 | equals: | |
| | DORC | $70 |
| | allow for trends in substitute inputs and outputs— | |
| | say a $20 fall | |
| Step 6 | equals: | |
| | Economic value | $50 |
| | Lesser of DORC and economic value | |
| Step 7 | equals: | |
| | Deprival value | $50 |

Table 2 shows valuations according to different methodologies and their derivation. For illustration, suppose that the asset in question is a telex system, with a useable life of 20 years.

The original cost of the system is $100. After 10 years of use DAC is $50.

Step 3 is to inflate DAC to current value — $100, based on an average inflation rate of 7% over the period.

Step 4 is to shift to replacement cost. Because goods prices tend to rise less slowly than prices of services, the replacement cost of the telex system might have risen by 10 per cent less than inflation. Thus the depreciated replacement cost is only $90.

Step 5 is to optimise. This is the most complex step. The replacement telex system can take advantage of new types of computer chips and programming languages and is cheaper on this count. Usage of the telex has fallen from 100 times a day to 5, but only a small saving (much less than proportionate) is achieved by having a slightly smaller system. Overall, optimisation reduces the cost by a further $20, so DORC is $70.

Step 6 is to recognise that the telex system will not be replaced anyway. The benefits of the telex system are worth less than $70 given that email is an increasingly viable communication system. In fact the owner of the system could only expect to achieve earnings of $50 with the telex system.

Step 7 is to calculate deprival value — $50 in this case. This is all that could be realised for the system on the marketplace.

The example shows how economic value can differ from DORC. It may be argued that the extra factor captured in economic value — a shift towards usage of email instead of telex — could be captured in the optimisation process, but this is not the usual practice. Generally optimisation is conducted in a fairly physical sense. For instance, Sinclair, Knight, Merz (1998) who conducted DORC valuations of the Victorian gas assets said:

> *"The Gascor/GTC methodology has been modified by changing the Gascor/GTC definition of "total economic life" to include such factors as natural gas reserves and trends in demand for natural gas. It is our view that such factors should be taken into account outside and not within, an ODRC valuation. These factors relate to recoverable revenue, are indeterminate and subject to change, making the resulting ODRC valuation something other than the usual firm number."*

In addition, the information requirements for optimisation are large. Given the asymmetry that exists between the technical knowledge bases of the utility and the regulator, how confident can one be that the optimisation process will go as far as it possibly can and that subjective judgments do not skew to the network owners' benefit?

The second question to be considered is just how important the competitive markets analogy is. Obviously the general presumption in favour of competition lends some favour at face value to the valuations that might arise in competitive markets. However, such an approach may conflict with other objectives — for instance, maximising the usage of existing infrastructure, or fairness objectives which are discussed below.

One therefore needs to ask "What are the implications if we don't replicate competitive market valuation techniques in network access regimes?" A DAC based valuation and pricing approach can yield exactly the same NPV to a network owner as a DORC approach when a new investment is introduced. The question then is to what extent (in the situation where it does differ from a competitive market valuation) a DAC approach would bring about inefficient outcomes.

A DAC methodology brings with it charges above DORC determined charges in the early life of the project and below DORC levels late in the project. In effect, DAC depreciates the asset more rapidly than DORC. The main potential risk would appear to be that, by front loading cost recovery relative to DORC, DAC could raise a risk of inefficient by-pass early in the life of an asset.

In principle the "super normal" return early in the life of a project acts as an inducement to by-pass. However, it needs to be kept in mind that networks such as these, and many of the by-pass options, have long lead times. In addition, the proponent of a by-pass would have to expect subnormal pricing levels later in the life of the asset. The main risk of inefficient by-pass relates to a potential over-exploitation of by-pass options with short economic lives. These would be competitive in the early life of the DAC priced network and gone later on.

There may also be some merit in DAC as a depreciation strategy as a means of handling increasing uncertainty of returns further into the future. Capital is recovered in the near future, a time at which the asset owner can have more confidence that recovery will take place.

To summarise then, DORC is only an upper bound to valuations that prevail in competitive markets. Deprival value is the applicable methodology, and this will lie between scrap value and DORC. Sometimes DAC will be a better approximation to deprival value than DORC will be. In addition, the potentially negative consequences of deviating from a competitive markets valuation approach (for a short period and offset later in the lifecycle of a network) may not be excessive and need to be set against the potential inefficiencies arising from inflated asset valuations.

### 4.2 Fairness Considerations

Fairness considerations involve unavoidable subjective judgments. Although economics cannot resolve these judgments, it can provide some insights.

It is useful at the outset to consider the framework within which we assess fairness. Zajac (1995) argues that the issue is not so much fairness as unfairness:

> *"... except for moral philosophers, few persons give much thought to what is fair. But they know when they have been treated unfairly ... the sense of unfair treatment typically comes from a perception that a contract, explicit of implicit, has been broken ..."*

In this context, confiscatory action by government might be seen as unfair. The IPA (1998) has argued that:

> *"... the dangers are that, in seeking to redistribute the 'static' gains, regulators and policy makers will close off opportunities for the more radical 'dynamic' gains. For the latter gains to be achieved, the innovator must be confident that government action will not deprive him of the profits of success. This means having secure property rights. If policy and regulation results in property rights being impaired, this compromises an essential plank on which competitive efficiency is generated ..."*

The important question then is what might be deemed to be a violation of property rights. It is excessive to say that any intervention in the charging behaviour of the network owner represents a violation of property rights. Network development generally involves facilitation by government in terms of access to other property and zoning exemptions. This facilitation recognises the potential public benefit of the network and there will often be an understanding — explicit or implicit — that the network owner will not have an unfettered right to set charges. Security of property rights does not imply an exemption from regulatory interventions which could reasonably be expected to go with the property right.

In addition, network owners and users, by virtue of their commercial interest in the regulatory outcome, will have a strong strategic interest in presenting the fairness issue in a way that is commercially advantageous to them. Declared positions are not necessarily a good indication of what will really be perceived to be unfair.

Indeed, it is no coincidence that the current fairness debate centres on the treatment of existing assets. The potential financial impacts of the ultimate decision are potentially large and the participants are not entirely motivated by altruism.

There are two potentially competing views regarding fairness:

- that network customers have, over a period of years, paid the capital costs of establishing networks and should not have to pay the costs again; and
- investors in network assets should be entitled to fulfil their reasonable expectations about the future income streams from those assets.

Resolution of the issue does not necessarily imply acceptance of one and rejection of the other — the challenge is to accommodate both.

These fairness notions are essentially backward looking. However, they may be deemed to have some forward looking importance in terms of dynamic effects — i.e., if regulatory decisions today are unfair, market participants will have less confidence to make decisions based on a presumption of fair treatment in the future.

A backward looking view of fairness needs to consider past pricing practices. The Australian Consumer and Competition Commission notes that:

> *"the application of a real rate of return to an asset base (and depreciation) which is inflated over time is theoretically equivalent to a historical cost accounting approach where the nominal rate of return applied to an asset base with values and associated depreciation based on historic costs;*
>
> *"the practical difference is that the time profile of tariff revenues under the CCA approach is flattened relative to the historical cost approach ...."* (Draft Gas Decision p. 16)

A conclusion that emerges from this is that where past pricing practices have been based on **nominal** required rates of return, the case for historic cost valuations has a firmer foundation in fairness than if past pricing practices incorporated **real** required rates of return.

The corollary is that DORC valuation will be stronger if past pricing strategies have recovered only real rates of return on capital.

Similar arguments apply with respect to depreciation. To the extent that past pricing practices have included depreciation charges, customers might be deemed to have paid for the assets and therefore have a case for lower valuations than otherwise.

However, it needs to be recognised that there may be major difficulties in identifying the basis for past pricing decisions. Often utilities will not have kept separate depreciation schedules for newly separated network components. There can be no presumption that network pricing was purely on a cost recovery basis. Network charges may have involved a degree of subsidy for various development objectives. They may also have included a quasi-taxation component, as network taxes are not necessarily an inefficient revenue mechanism in the context of the States' very limited range of revenue devices.

Certainly regulators should hesitate to implement de facto refunds of past revenue collections which reflect deliberate policy choices of owner governments.[8]

8 The ORG review of Gas and Fuel Corporation actually identified a historic subsidy to users.

A DORC methodology, with its reference to current market prices and estimated remaining life abandons this historical background. However, even if limited weight is given to the historical background, regulators will need to think carefully about the reliability of DORC valuations. Information asymmetry is a problem.

It may be argued that historical analysis is less relevant where there has been a change in network ownership. Past cost recoveries are of little relevance to a new network owner. They will have paid for an asset according to their view of its future earning capacity.

However, there is a contrary view. The purchasers' view of future earning capacity (which drives purchase price) involves some assumption regarding the future regulatory environment. Where the future regulatory environment is uncertain, the purchase price involves elements of a gamble, with an "expected" (in a statistical sense) revenue stream derived on the basis of an assessment of the likelihood of alternative regulatory regimes. Such a decision is made in the knowledge that the ultimate regulatory outcome could be better or worse than the central case.

With this in mind, it could be argued that a fair treatment of recent network purchasers requires that the regulator consider only the range of feasible regulatory outcomes which the purchaser could reasonably have anticipated based on the regulatory principles in existence. Within that range, there is little ground to argue that a low revenue regulatory outcome is unfair; the purchase price is in a sense a gamble on the ultimate regulatory decision.

The converse view, that the regulator has an obligation to validate the purchase price, has the effect of pre-empting regulatory decisions.

To keep fairness issues in perspective, it needs to be remembered that prices oversight for networks was introduced on the basis that it would generate efficiency improvements with part of the benefit flowing to users through lower charges.

## 4.3 Practicality

There will be difficulties obtaining data for some valuation methods.

DAC data is the easiest to maintain in principle. However, for many existing networks, a problem will arise because separate DAC data may not in the past have been kept for the now declared network.

DORC valuation is a complex exercise. It requires engineering consultants to consider the network configuration and available alternatives in terms of configuration and delivery technology. Judgments have to be made about what configuration will provide a like quality of service (including risks of breakdown). The costs of the infrastructure then have to be estimated, and in many instances the required items will not be available "off the shelf" so prices will involve guesswork.

There is a question about what degree of excess capacity is consistent with an efficient approach to network expansion. This expansion tends to occur in a step-wise fashion rather than simultaneous with demand.

As noted in the discussion on efficiency, there is a question about the "envelope" for the optimisation process. Would the optimisation process recognise that a fall in gas transmission costs makes cogeneration more viable and potential reduces the value of an electricity transmission network? Probably not, but to be consistent with competitive markets it should.

Whittington (1994) summarises the DORC approach for UK regulatory purposes ("Current Cost Accounting" in his terminology) thus:

> *"... the subjectivity of such valuations, especially for specific operating assets, such as plant and machinery, is likely to rule them out as standard practice for some time ..."*

On a forward looking basis, there would appear to be little doubt that a DAC methodology is much simpler than a DORC methodology. King (1996) compares the two in these terms:

> *"... the schedule of allowed returns under historic cost [DAC] only depends on the depreciation set by the regulator. In contrast the allowed returns under replacement cost [DORC] valuation will vary [or should] whenever relevant input prices or the prices of alternative technologies change ..."*

The significant uncertainties with DORC valuations create a potential for greater information asymmetry than the much simpler DAC approach. When subjective judgments about DORC are involved, regulators may find it difficult to find strong grounds to challenge network owners views, even if those views err towards higher asset valuations rather than lower. DAC can avoid all of this.

Makholm (1998) notes that:

> *"... in light of its inability to demonstrate a clear efficiency payoff for the costs involved, many noted writers in the economics of regulation ... after providing detailed discussion of the various complex issues surrounding the choice of rate base, refer to the ease of administration and the ability to attract capital (where fairness and efficiency provide only an ambiguous guide) as, in the end, the principal reason for choosing original cost as a workable standard for valuing the rate base ..."*

## 5. IMPACTS ON NETWORK USERS

The charges which a network owner puts in place have potentially important consequences for network users — both upstream and downstream — and for competing networks. Those charges will be determined with reference to maximum allowable revenues, but how the maximum allowable revenue is collected will depend on other provisions in the access arrangements. The way in which maximum allowable revenue is collected will have important allocative effects.

The choice of an asset valuation methodology is important in determining maximum allowable revenue. However, it cannot resolve the issue of how maximum allowable revenue is allocated across users. There are problems, for instance, with the allocation of TUOS and DUOS charges at the moment. They will only be resolved by changing their incidence; not by selecting the correct asset valuation.

The primary impact of inflated asset valuation will be an inflated maximum allowable revenue and inflated charges to users. Capital costs are a major part of network owners' cost structures, and consequently asset valuation decisions have a major impact on charges to users.

Inflated network charges will tend to:

- inflate prices to end users of commodities delivered via the network;
- depress prices received by suppliers of commodities delivered via the network; and
- create scope for higher charges on competing networks (to the extent that they exist).

The degree to which inflated charges fall on users or suppliers depends, in principle, on the range of substitution possibilities available in industries downstream and upstream from the network. For instance, if users face a competitive market for input substitutes, some of which do not use the network, then network charges will tend to be paid by upstream suppliers. On the other hand, if there are only limited input substitutes that are independent of the network, then charges will be borne by downstream users.

### 5.1 Sunk Costs of Users

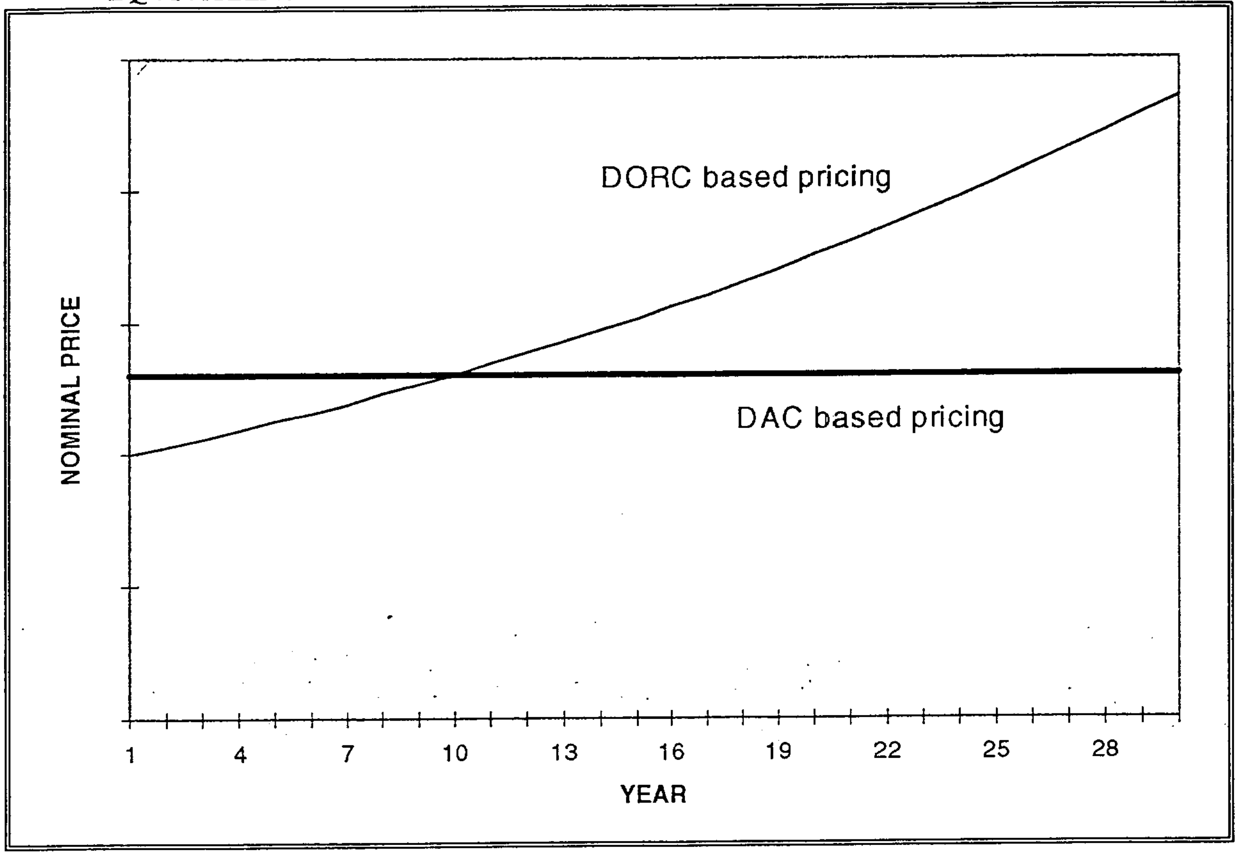
These impacts have important implications for network users with sunk costs. Higher charges to downstream users will jeopardise recovery of their sunk costs as they will not generally be able to pass all of the higher charges on. Lower payments to upstream users jeopardise their ability to recover sunk costs.

Regulators need to keep in mind that, while network owners have sunk costs, so do network users. Fairness has more than one dimension.

Unfair treatment of network users is likely to occur when the charging strategy shifts from a DAC approach to a DORC approach midway through the life of an asset. In this scenario, the users effectively pay some depreciation and return on capital charges twice.

Figure 1 shows, for a hypothetical network asset, pricing trajectories under DORC and DAC pricing schemes. A 3 per cent inflation rate is assumed. Net present values at the outset are equal for each pricing scheme. However, if the pricing regime is changed from DAC to DORC during the life of the asset, then the asset owner has a windfall gain at the expense of the network customers — customers pay capital charges twice. If the pricing scheme were changed from DORC to DAC during the life of the asset, then network users have the windfall gain and the network owner has the windfall loss — users never pay part of the capital cost.

FIGURE 1
EQUIVALENT NPV COMPARISON OF DORC AND DAC BASED PRICING




The current transition from long established network pricing practices clearly raises transitional risks for owners, and network users. Changes to asset valuation techniques — and hence pricing arrangements — midway through their life can have quite arbitrary and potentially unfair impacts.

### 5.2 New Investment Decisions by Users

The dynamic impact of regulatory decisions about sunk cost recovery was discussed earlier. However, there are dynamic influences on network users.

Inflated electricity network charges would, for instance, cause electricity users to put more emphasis on demand management. They would also cause users to look to other energy sources — including reticulated gas. They might be expected to encourage cogeneration activity, although the current allocation of TUOS and DUOS appears to negate this influence.

When upstream generators saw downstream users turn away from their product, they would need to consider alternative markets for their electricity. If no alternative markets existed, they would have to consider reducing prices. So long as prices received exceeded marginal costs, they would have scope to discount prices, and thus reduce the extent to which users rely on demand management and other energy sources. However, if prices were at marginal cost, then mothballing might occur.

Similar forces would operate in response to the setting of gas transmission charges. High transmission charges would tend to discourage upstream development, downstream development (including cogeneration) and lead to demand side responses.

Clearly network charging decisions have potentially major implications for levels of investment and the allocation of investment beyond the network — in terms of new investment and scrapping existing infrastructure.

### 5.3 Consistency

It is desirable that consistency exist between regulatory regimes for different networks — especially when there is some potential for substitution between the networks. This is increasingly so with electricity and gas networks due to the emergence of viable small scale gas fired generators.

The risk is that investment decisions will be driven by regulatory decisions which are to a degree arbitrary (unavoidably so) but inconsistent with each other.

For instance, decisions about mothballing transmitted generators and introducing cogeneration could hinge on regulatory decisions about asset valuations in electricity and gas transmission networks. This does not appear to be efficient. Efficient investment decisions outside the network would ideally be made in response to marginal resource costs — not driven by the (possibly different) treatments of sunk costs by regulators.

This highlights the potential for negative dynamic efficiencies outside the network as a result of setting network access charges above marginal cost. It is too narrow a focus just to consider dynamic efficiencies only within the network.

## 6. THE ELECTRICITY CODE AND THE GAS CODE

The regulatory frameworks for energy networks are specified in a broad sense in the National Electricity Code and the National Gas Code. These codes delegate the regulation of transmission activity to the Australian Consumer and Competition Commission (ACCC), and the regulation of distribution activity to State jurisdictions.

The two Codes are not access arrangements in their own right. Rather, they constitute guidelines with which access arrangements must comply. Network asset owners are required to develop their own access arrangements consistent with the relevant Code.

Chapter 6 of the National Electricity Code sets out the rules for transmission and distribution pricing in the National Electricity Market. These rules are to take effect at different times between 1 July 1999 and 31 December 2002 in the member jurisdictions.

Chapter 8 of the National Gas Code sets out the rules by which reference tariffs are to be determined for gas pipeline access.

The objectives of the Codes are broadly similar. Although the wording varies between Codes, both contain requirements that access arrangements:

- give market-based incentives for the service providers to improve efficiency;
- give pricing outcomes on the existing infrastructure which are consistent with the outcomes which would arise in a competitive market;
- foster efficient use of existing infrastructure;
- foster efficient investment decisions in the network and upstream and downstream industries;
- give service providers a fair rate of return on efficient investment;
- have regard to pre-existing views of asset values; and
- have regard to the reasonable expectations of persons under the regulatory regimes that applied prior to commencement of the Codes.

The objectives and principles require significant degrees of judgment, and in some instances could be said to conflict with each other. For instance, the requirement to give reasonable recognition to pre-existing valuations may conflict with the efficient use of existing infrastructure.

There are also some significant differences between the details of the two Codes.

### 6.1 Sunk Costs

*National Electricity Code*

The NEC requires that asset valuations for the regulatory base with respect to transmission activity *must not exceed deprival value* (6.2.3 (d) (iii)). However, asset valuations for the distribution base are to be determined by the State/territory regulators with regard to the COAG preference for deprival value and the specified objectives of the regulatory regime.

It needs to be emphasised that deprival value is the relevant concept — not DORC per se. There can be no presumption that deprival value will generally equate to DORC.

The NEC gives scope for regulators to revalue assets in subsequent access periods.

Overall, the asset valuation rules for electricity distribution activities appear to be less prescriptive. The regulator is to be appointed by each participating jurisdiction. Although the objectives of the pricing regulatory regime are broadly similar to the objectives for transmission regulation, there is no requirement to value sunk assets at deprival value although the CoAG's expressed preference probably carries considerable weight. In addition, account is to be taken of the valuation decisions taken by owner Governments prior to commencement of the regulatory regime.

*National Gas Code*

The National Gas Code requires that when a pipeline first comes under coverage, the initial capital base for the pipeline should be established with reference to:

- the actual capital cost (less depreciation) of the pipeline (DAC);
- the depreciated optimised replacement cost (DORC); and
- valuations from other well recognised asset valuation methodologies.

Consideration is to be given to the advantages and disadvantages of each methodology. However, the valuation should lie between DAC and DORC.

The approach in the Gas Code when a pipeline first comes under coverage is fairly consistent with a deprival value methodology (the difference being that a deprival value below DAC could not be accepted which is probably an unusual situation).

The explicit reference to DAC is noteworthy and reflects the acceptance of DAC within industry.

Under the Gas Code, the regulator has limited scope to revalue assets once the access arrangement has been established. Asset valuations for each access arrangement after the first are to be calculated according to the formula in Diagram 2.

**DIAGRAM 2**
**NATIONAL GAS CODE**
**DETERMINATION OF ASSET VALUATIONS IN SECOND & SUBSEQUENT ACCESS ARRANGEMENTS**

| | |
|---|---|
| | Capital base at end of previous access arrangement |
| + | New facilities investment or recoverable portion |
| — | Depreciation for immediately preceding access period |
| — | Redundant capital identified prior to the commencement of the access arrangement |
| = | Capital base at end of access arrangement |

In fact, the "redundant capital" provisions appear to be the only mechanism by which revaluation of a network might be achieved without transferring the cost of the writedown to network customers.

Even then, redundant capital which is reintroduced is brought back with capitalised holding costs.

## 6.2 New Facilities Investment

*National Electricity Code*

The Electricity Code is also flexible on valuation allowances for new assets, leaving the decision largely to the regulator. However, heed must be paid to the CoAG's preference for deprival value.

*National Gas Code*

In contrast, the arrangements for new investment under the Gas Code are much more prescriptive.

Unless a regulator is willing to define depreciation in an unusual way, the provisions of the Gas Code effectively require that new assets be added to the asset base at actual cost and allowable revenues determined according to a DAC methodology.

## 6.3 Depreciation

*National Electricity Code*

In respect of depreciation, the Electricity Code is, once again, flexible.

*National Gas Code*

The Gas Code has three specific requirements of the depreciation schedule (apart from a general efficiency requirement):

- to depreciate assets over their economic life;
- to adjust the depreciation schedule when expected economic life of an asset changes; and
- to depreciate an asset only once.

## 6.4 Key Differences

The regulators under the Codes are required to have regard to a broadly similar set of objectives relating to efficiency and fairness concerns.

Both Codes have scope for a deprival value methodology. However, when considering sunk costs at the establishment of a new access regime, the NGC requires the regulator to consider depreciated actual cost. No such obligation is imposed under the NEC, although such a course is not precluded.

Once a regulatory regime is established, the scope to revise asset valuations is very limited under the Gas Code, but flexible under the Electricity Code.

The Gas Code explicitly provides that depreciation schedules should be established in such a way as to ensure that customers do not pay depreciation twice.

The Gas Code also provides that where redundant capital is reintroduced to service, it should be valued at capitalised cost — effectively recovering charges forgone during redundancy. This greatly blunts (arguably removes entirely) any price signals to ensure that capital spending is not introduced too long before the assets are needed.

The overall impression one gains is that the Gas Code is crafted to provide certainty to both owners and customers once the regulatory environment commences. There is still considerable discretion for the regulator in determining the value of sunk costs for the first access period.

The Electricity Code, in contrast, allows a higher degree of discretion to the regulator for the first access period and subsequent access periods. Less emphasis is placed on certainty, and consequently regulators have more scope to address objectives such as efficient network use.

From a network user's point of view, the Gas Code appears to offer a more certain environment once the access regime is put in place. However, this makes the initial treatment of sunk costs even more important — there is no real scope for revisions down the track. With the Electricity Code, valuations can be revisited, although regulators may be reluctant to do this.

There appears to be little in the Codes which prevents the application of common regulatory principles in electricity and gas. While this is so, the Gas Code approach clearly locks the regulator in much more than the Electricity Code once an access regime is established because it does not allow asset values to be revisited.

One is left wondering why the pricing guidelines for electricity and gas networks are not exactly the same, even though it seems to be possible to handle access regimes according to a similar set of principles under the two Codes.

## 7. VIEWS OF REGULATORS

The Australian Consumer and Competition Commission (ACCC) has (or will have) regulatory responsibility for electricity and gas transmission. State jurisdictions have regulatory responsibility for distribution. There is also the scope for States/territories to refer their own regulatory responsibilities (primarily distribution) to the ACCC, although the take up is limited to date.

The regulators operate under the same Codes (Electricity and Gas) but there is some potential for differences of approach between regulators. Various statements and decisions give some indication of the factors that the different regulators see as relevant in determining asset values.

It should be noted that regulatory approaches are in a state of flux. Experience in network regulation in Australia is relatively limited, and there are a range of models to consider. Regulators are keen to preserve flexibility of approach at present, so as not to lock into approaches which might prove problematic at a later date.

### 7.1 Australian Competition and Consumer Commission

The ACCC was recently asked to endorse proposed access arrangements for Victorian gas transmission networks, but rejected some aspects of the arrangements. It has also recently published an Issues Paper regarding a proposed Statement of Regulatory Intent for the electricity industry. These recent actions give some insight into the ACCC's thinking.

*The Gas Decision*

The ACCC was asked by Energy Projects Division of the Department of Treasury and Finance to approve proposed access arrangements for the Principal Transmission System and the Western Transmission System, two gas transmission pipelines. It published a Draft Decision in May 1998 in which it indicated an acceptance of DORC asset valuations for the case under consideration. However, it also said that:

> *"no single asset valuation methodology will provide the answer that is appropriate in all cases"* (Draft Gas Decision p. 22)

The ACCC found that a cost based valuation method for the initial capital base is generally non controversial. This is true up to a point — DORC and DAC are each cost based approaches and must each be considered under the Gas Code.

However, the CoAG has chosen deprival value as a preferred valuation method (and as noted in the previous section, deprival value is stipulated in the Electricity Code). Deprival value is the lesser of DORC and economic value. Economic value is not cost based; instead it considers the future earnings of the asset. Although there are circularity problems in determining economic value, it does not follow that deprival value is equal to DORC.

The distinction between deprival value and DORC is not considered in the Draft Decision. There is a tendency to accept DORC as the deprival value whereas in fact scrap value is equally valid. One needs to consider the specific elements of fairness which apply before a valuation can be determined.

The applicant provided valuations based on three alternative methodologies for the ACCC to consider. These valuations are presented in Table 2

**TABLE 2**
**VALUATIONS OF TPA'S TRANSMISSION PIPELINE SYSTEMS ($M)**

| Valuation Methodology | Valuation |
|---|---|
| DORC of system | 357.2 |
| "Adjusted" DORC of system | 347.0 |
| Non-system assets | 16.7 |
| **Total DORC based** | **363.7** |
| **DAC** | **185.9** |
| **CCA** | **381.9** |

The service provider chose to use an "adjusted" DORC for its initial capital base. This involved a small downward adjustment from DORC to take into account some community service obligations.

The ACCC notes that the "CCA" valuation (in fact an inflation indexed DAC) does not lie between DORC and DAC and would therefore appear to be inadmissible under the Code.

The ACCC also notes that:

> *"... economic theory does not provide an unambiguous answer and that regard to notions of fair treatment and the effects on the different interest groups affected by the pricing approach to the recovery of sunk costs needs to be taken into account ..."* (Draft Gas Decision p. 20)

There are then a range of considerations which the ACCC takes into account in terms of the objectives and principles laid down in the Gas Code.

First, the inherent conflict between an efficient short run pricing rule (marginal cost) and a pricing rule to bring about efficient investment (recovery of long run average cost) is noted. Although the regulator might stipulate quite different valuation methodologies for sunk costs and new investments the ACCC is concerned that the approach taken on sunk costs will influence network owners' confidence in their ability to recoup new investments.

While this is valid, it does not imply that 100 per cent DORC is necessary. In essence the Gas Code provides for a DAC approach for new investments,[9] and if consistency is an issue then this would suggest a DAC valuation for sunk costs. However, consistency is

9 The ACCC says that the current cost accounting approach used in the proposal does not, on the face of it, comply with any of the methodologies permitted in S8.4 of the Code. However, it finds that the CCA approach complies as an "other methodology" under S8.5.

probably not the main issue. The real issue — in terms of confidence regarding new investment — would be seem to be one of fair treatment, rather than that the treatment of sunk costs be exactly the same as new investment.

Second, the ACCC notes a number of advantages and disadvantages with DORC and DAC. It argues (Draft Gas Decision p.21) that DORC:

- ensures broadly symmetrical pricing and incentive structures across regulated and competitive markets and therefore has intuitive appeal on general resource allocation grounds;
- reduces shocks to tariffs as replacement of assets becomes necessary; and
- represents a threshold at which by-pass can take place.

However, there are other issues which should be considered. Taking each point in turn:

- it is deprival value that is consistent with competitive markets, and this may be less than DORC;
- shocks to tariffs would not be large where there is a rolling program by which replacement of network components occurs, and in any case network users would rather have low prices and accept a price shock when it occurs;
- there is no dispute that DORC represents an upper bound; the question is whether some lower valuation is appropriate. While DORC may be the threshold at which network duplication could take place, valuations below DORC have the potential to induce inefficient investment upstream and downstream of the network.

With respect to DAC the ACCC says that:

- much of the attraction of DAC is based upon views of how tariffs have been determined in the past; and
- there are major practical difficulties in assembling DAC valuations.

While it is true that the "fairness" arguments for DAC are backward looking, the same is true in respect of the argument that it is "fair" to allow owners of networks to recover sunk costs (i.e., DORC instead of DAC). Network users also have sunk costs — they have in the past made major investments based on the availability of network access on reasonable terms. In some instances they will have effectively amortised most of the capital cost of networks under DAC based charging regimes. It is important that the fairness dimension be considered carefully for users as well as owners.

It is important as well to take into account that any recent network investments were made in the face of considerable regulatory uncertainty. The possibility of a wide range of approaches to asset valuation and allowable revenues could reasonably have been taken into account by network purchasers. For recent sales it seems reasonable to regard a fairly wide range of regulatory outcomes as being fair to them.

The ACCC considers an analysis of past cost recoveries for the Gas and Fuel Corporation. It should be noted that this is a case study, and does not establish a general principle. However, in this case the ACCC interprets the study as indicating that users have not covered costs of capital in the past, and rejects DAC on this basis.[10]

This would appear to imply that past charging practices do have a bearing on the ACCC's thinking when selecting asset valuations.

Third, although the ACCC recognises that "shocks" to either service providers or users are to be avoided, this cannot create a rationale for a continuation of excessive returns where these have been earned in the past.

The ACCC also notes that DORC tends to smooth the price path, whereas DAC could lead to more pronounced changes in prices. This is akin to suggesting that a customer should pay more now so that there is no apparent increase when higher charges are necessary in the future. Most customers would prefer to accept the lower prices now.

Would a homeowner with a fixed rate mortgage cancel the contract and shift to a higher variable rate sooner than necessary just to ensure a smooth rate path?

In addition, it is not at all clear that sharp increases in prices need even occur. Where a network is replaced on a rolling basis, there need be no sudden cost impacts.

Fourth, the ACCC notes that although it is required to have regard to the price paid for any asset recently purchased by the service provider, it is under no compulsion to accept the sale price as the regulatory base.

After consideration of these issues, the ACCC accepts a DORC valuation of assets for the Victorian access arrangements. However, that conclusion leaves open the possibility of another approach for other networks should their circumstances warrant it.

*Electricity Statement*

The *Statement of Regulatory Intent: Issues Paper* sets out some of the ACCC's initial thoughts on how it will regulate electricity transmission revenues.

The ACCC proposes to adopt an accrual building block approach to determining maximum allowable revenue. This is consistent with the broad approach specified in the Gas Code.

The ACCC notes that deprival value is CoAG's preferred approach to asset valuation, and that deprival value is required in the Electricity Code.

The ACCC noted concerns that deprival value could inflate asset values which had previously been based on DAC. Consequently, the ACCC intends to use its discretion in determining asset values. It will test the impact of asset valuation on maximum allowable revenues. However, any move away from a deprival value approach would need to be "well justified and be consistent with the code's other guidelines."

10 The study of Gas and Fuel Corporation has been challenged by Fitzgerald (1998). The Fitzgerald study shows that a historical exercise such as Gas and Fuel is potentially contentious, relying on arbitrary assumptions, and that the conclusion of such a study may be debatable.

*Revaluation of Capital Base*

Under the Gas Code, the initial valuation for second and subsequent regulatory periods is mechanistic. It is noteworthy that there is no indexation provision in the Code, and taken literally this would imply use of DAC and nominal WACC.

In its Victorian gas transmission decision the ACCC noted the mechanistic approach to valuations at the end of the first reference period and subsequently. However, it interpreted the Code as permitting a non-linear depreciation schedule, which makes it possible to use a DORC valuation basis on an ongoing basis. The methodology which is expressed in the Gas Code suggests (but, the ACCC argues, does not require) a DAC valuation methodology going forward.

The Electricity Code appears to leave the issue of revaluation more at the discretion of ACCC. The ACCC is keen to retain regulatory flexibility, while at the same time providing a reasonable degree of certainty to network owners. It has said that it will indicate the types of indicators that it will watch to assess the need for revisions to maximum allowable revenues.

## 7.2 Office of the Regulator-General, Victoria

The Victorian Regulator-General recently delivered draft decisions on proposed access arrangements for three distributors. The ORG and the ACCC consulted closely in the preparation of their respective draft decisions.

The Regulator-General regulates network charges in the Victorian electricity and gas distribution industries. A draft decision on access arrangements proposed by three distributors gives an indication of the Regulator-General's views on asset valuation[11]. The Regulator-General will regulate under the Electricity Code and the Gas Code as does the ACCC. Thus many of the issues faced by the ORG are similar to those confronted by ACCC, and significant elements of judgment are involved.

As was the case with the recent draft gas decision from the ACCC, ORG recognises positive features of both DORC and DAC but supports DORC in this instance. Furthermore, it is in accord with the ACCC view that no single valuation methodology will provide an appropriate valuation in all circumstances and that examination of indicators is desirable.

ORG indicates a reluctance to use DORC where it would result in sharp increases in user charges. It notes that to some extent this would be limited by redundant capital provisions.

In this decision ORG accepts DORC as the valuation methodology, with some revisions required.

11 Office of the Regulator-General, *Access Arrangements for Multinet, Westar and Stratus,* (1998).

### 7.3 Independent Pricing and Regulatory Tribunal

The NSW Independent Pricing and Regulatory Tribunal (IPART) has oversight of distribution activity in NSW. IPART has in the past shown itself willing to adopt initial valuations at a discount to DORC when it regards those DORC estimates as excessive.

IPART was recently asked to determine an initial capital base for AGL Gas Networks. IPART's decision was made under the Third Party Access Code for Natural Gas Distribution Networks in NSW, which closely resembles (and will be superseded by) the National Gas Code.

Consistent with Code requirements, IPART considered DORC and DAC valuations, and determined an initial capital base between the two (Table 3).

**TABLE 3**
**VALUATIONS OF TPA'S TRANSMISSION PIPELINE SYSTEMS ($M)**

| Valuation Methodology | Valuation |
|---|---|
| DAC | 870 |
| DORC | 1,450 |
| Initial capital base | 1,200 |

IPART favours a "range of indicators" approach for setting revenue caps. In this approach, asset valuation methodology is not determined from first principles, but from the impact that it will have on revenues. Although the presentational approach in the National Electricity and Gas Codes tends to emphasise asset valuation as a determinant of allowable revenue, in practical terms the range of indicators approach moves away from this. Asset valuations - be they DAC, DORC or deprival value — act more as limits on allowable revenues.

In an earlier draft decision, IPART considered the implied capital base arising from its assessment of a "sustainable revenue stream", and this valuation was adopted.

The approach has since been criticised. It is argued that:

> "The asset valuation has been set on the high side of the range between DORC and DAC. Other than the acceptance that the revenue stream dictates a higher value, there is little substantiation why the DAC valuation is not used."[12]

This highlights a fundamental problem with the use of a "fairness" approach - determining just what is fair. Of course a party with a different interest might argue that there was no ground not to use DORC.

Although IPART does not use a full DORC valuation, it appears to reject one of the key arguments for a DAC valuation, saying that:

12 Submission from Australian Papers to IPART.

> *"The Tribunal is not seeking to compensate customers for higher prices paid per unit in the past. Nor is it seeking to compensate customers for making additional payments that may have been labelled capital contributions. Therefore, the Tribunal has not taken capital contributions into account in determining reference tariffs."*

and

> *"Accordingly, the Tribunal believes it would not be appropriate to reflect past customer contributions by reducing the Service provider's capital base ..."* (AGL Gas Networks Determination p. 71)

IPART intends to review the initial capital base at the time of the first access review, and states that it will be a *de novo* review, rather than an indexation of the existing amount.

IPART has also released a consultation paper regarding its Review of the Delivered Price of Natural Gas in Albury Moama. In that paper, IPART notes the need for consistency between asset base and rate of return measure:

> *"... to be consistent a real rate of return should be applied to asset values recorded at current cost [DORC] ... and revalued over time. It is noted that under current cost accounting principles, current cost operating profit is calculated on a real term basis at the pre tax, pre interest level. Similarly a nominal return should be used with actual cost asset values ..."*

and goes on to say that:

> *"IPART is aware of the tensions that exist between alternative methods of asset valuation. In considering an appropriate return on regulated assets, IPART sees considerable merit in an approach that allows it the flexibility to reflect a meaningful economic value of services provided, while ensuring that appropriate price signals are given to the infrastructure owner to encourage ongoing investment in the system. These objectives may not be met by rigid adherence to a particular asset valuation methodology."*

In a 1996 judgment, IPART criticised upward revaluation of assets in the electricity industry, and made a determination which reduced the owners proposed (DORC) valuations by 40 per cent for rural distribution and 17 per cent for Energy Australia.

### 7.4 Overseas Regulators

A variety of approaches to regulation and valuation are used by overseas regulators. DAC is widely used in the United States. In the UK, sunk cost valuations have been determined with reference to stock market valuations at certain dates. Regulators have been more willing to employ this approach — which amounts to a validation of investor expectations about the regulatory regime — where market valuation is less than DORC.

Table 4 shows ratios of profit before tax to revenue for selected industries, drawn from a study compiled by Bardak Energy Services. It is apparent that the returns for Australian transmission networks are high compared with overseas transmission. The high return on capital component might relate to a more capital intensive industry structure in Australia but there is no evidence that this is the case. It could also reflect higher rates of return and/or higher asset valuations.

TABLE 4
RATIO OF PROFIT BEFORE TAX TO REVENUE (%)

| | |
|---|---|
| Australian Distributors | 12 |
| Australian Industry | 13 |
| Overseas Transmission | 18 |
| Transgrid (NSW) | 24 |
| PowerNet (Vic) | 37 |
| ETSA Transmission | 47 |

Source: Bardak Energy Services.

## 8. CONCLUSIONS

The focus of this study is the issue of asset valuation for network regulation purposes. The key conclusion to emerge from it is that there is no hard and fast rule for determining the best valuation method for sunk assets. DORC gives an upper bound for valuations but optimal valuations will sometimes be less than DORC.

Efficient use of existing networks will generally be promoted by asset valuations as low as possible and prices set at marginal costs. This will also promote efficient investment decisions upstream and downstream from the network.

Efficient new investment decisions in the network depend on network owners having confidence that they can recover sunk costs. A rule which sets revenue equal to long run average costs should achieve this.

It is possible that different approaches would be taken for the valuation of sunk assets and the valuations for new capacity. Certainly the Codes allow for this.

There is therefore a question about the need for consistency between the valuation of sunk assets and the charging arrangements allowed for new investments. Each of the regulators examined appears to attach some credence to the idea that decisions on the sunk assets component may have implications for network owners confidence that they will receive fair treatment from regulators in the future. This does not require a full DORC valuation. What is required is that the owners of existing assets not be treated in a way that is clearly unfair — after taking into account what they might reasonably have expected when they paid for sunk assets. In some instances this would allow for valuations below DORC.

None of the regulators have favoured a DAC approach to valuation in the cases to date. The ACCC and ORG have favoured a DORC valuation and IPART has favoured a valuation which represents a discount to DORC but is above DAC.

The regulators give attention to the question of what valuation methodology would apply in a competitive market and on that basis attach considerable weight to DORC. However, it is more accurate to say that deprival values will prevail in competitive markets and that DORC is an upper limit on deprival value. Deprival value appears to be operable in both the Electricity and Gas Codes.

Anecdotal evidence indicates that DAC based pricing strategies are common in capital intensive industry — both overseas and in Australia, and in natural monopolies and competitive industries. At first glance this is hard to explain, but a possible answer is that economic value of future earnings will at times fall below DORC and be observed to be close to DAC. What is really being observed is deprival value.

Although there are difficulties in determining the "economic value" component of the deprival value calculation, its absence should not create a presumption in favour of a valuation at the upper end of the range between scrap value and DORC. All one can really say is that deprival value lies between scrap value and DORC. For instance, if a substitute energy source which did not rely on a network experienced a decline in costs, this could cause asset values for the network to be written down if competitive pressure were strong. The DORC optimisation process fails to pick this up.

It should be noted as well that protection to network owners from by-pass may simply help them to avoid write downs from DORC to economic value when competitive market conditions change.

In determining an efficient valuation for sunk assets, regulators will need to go beyond DORC. The indeterminacy of a "right" asset valuation supports the approach of looking at a range of indicators to determine whether maximum allowable revenues and charges look reasonable. Analysis of benchmarks and indicators can help to determine when asset values should be less than DORC.

Given the potential for substitution between networks — electricity and gas in particular — it is important that consistency in the regulatory frameworks be achieved. Only in this way can investment be allocated efficiently to deliver energy effectively and efficiently to end users.

The regulators give considerable attention to notions of fair treatment, as they are required to under the respective Codes. Network owners right to recover at least some of their sunk costs is recognised. At the same time, there is an in principle recognition that it will not always be fair to set asset values as high as DORC.

Many networks are long established and network users will have amortised capital costs over a period of years under a DAC regime. Any thorough consideration of fairness cannot dismiss the case for continuation of DAC where this has operated in the past (in some instances implicitly).

Although the regulators' reluctance to enter into examination of historical pricing is understandable, it needs to be recognised that the fairness case for allowing network owners to charge more than marginal cost is also historically based. It would be inconsistent to dismiss a DAC approach on the basis that a regulator does not want to get involved in the "history" of pricing.

These considerations support the view that setting maximum allowable revenues is "more art than science". Regulators will need to consider asset valuation on a case by case basis. Efficient and fair asset valuations would tend to lie in a range between DORC and DAC.

# GLOSSARY

| | |
|---|---|
| ACCC | Australian Consumer and Competition Commission |
| DAC | Depreciated Actual Cost |
| DORC | Depreciated Optimised Replacement Cost |
| IPART | Independent Pricing and Review Tribunal |
| ODV | Optimised Deprival Value |
| ORG | Office of the Regulator-General |

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