The origins of ODV

Report to Air NZ

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NZ INSTITUTE OF ECONOMIC RESEARCH (INC.)

8 Halswell St. Thorndon

P O BOX 3479 WELLINGTON

Tel: (04) 472 1880

Fax: (04) 472 1211

Preface

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- and sometimes by external peer reviewers at the request of a client, although this usually entails additional cost.

Authorship

This report has been prepared at NZIER by Stephen Gale and Vhari McWha. The report has been reviewed by the Institute's Director, Alex Sundakov.

EXECUTIVE SUMMARY & CONCLUSIONS

The ODV method has been advanced for calculating monopoly prices

The so-called optimised deprival value (ODV) method has been advanced as a general solution to determining "fair and reasonable" capital charges for monopoly infrastructure services.[1]

The ODV of a group of assets is the smaller of:

- the lowest cost of replacing them with assets that would provide the same flow of services (this is the optimised depreciated replacement cost); and
- the economic value of the assets. The economic value of a group of assets is the greater of their disposal value and their value to users. The latter is measured as the minimum cost of an alternative means of providing the service required by the users.

Generally speaking, the ODV method sets prices at levels sufficient to finance bypass of the facility in question.

This study reviews the reasoning behind the design and original uses of ODVs in the electricity sector and assesses whether this reasoning would support the use of the method now for price setting in electricity or other sectors.

The method has its origins in Transpower

The method was developed in 1990 for the Electricity Corporation of New Zealand (ECNZ) and the Transpower Establishment Board to value Transpower when the grid was being split from ECNZ to operate as a stand-alone State Owned Enterprise (SOE). At the time the government was considering selling the new business to a "club" comprising ECNZ and the power companies.

The value was intended:

- to provide the commercial basis for transmission pricing by the new SOE (since transmission had previously included in the price of electricity delivered to power companies); and
- by subtraction, to determine the book value of the remainder of ECNZ.
- It was not intended to be the basis of ongoing formal regulation of Transpower.

Benchmarking electricity lines business costs

Electricity lines businesses were subsequently required to report their ODVs to assist in government monitoring of their cost performance. As it has turned out, cost benchmarking has not been possible, given the widely varying physical circumstances of the different lines businesses.

The method has carried over into lines business pricing

Presumably by analogy with Transpower, the (now) Ministry of Economic Development has taken the view that ODVs also indicate the limit of acceptable pricing

[1] For example, the Ministerial Inquiry into the Electricity Industry has recommended that the Commerce Commission adopts ODV rate bases for electricity lines business regulation. The method has also been promoted as an appropriate pricing guideline at ports and airports.

by lines businesses. As a result, some lines businesses have revalued their assets to ODV with a view to charging accordingly.

Reasoning behind the choice of the ODV method for Transpower

The criteria adopted for choosing a valuation method for Transpower reduce to requiring that the valuation method should yield prices that:[2]

- allow Transpower to attract private capital for all necessary replacements; and
- minimise the required regulatory oversight of the business.

The ODV method was judged to meet both of these requirements. The method sets prices at levels sufficient to finance bypass. Thus investors would see cash flows already in place sufficient for any replacements. Bypass was expected to break out if prices went any higher.[3] The ODV method was thus expected to impose a price cap that would provide incentives for efficient investment.

Prices based on historic costs were considered to be unsatisfactory because price rises would be necessary to finance replacements, a source of "shocks" to customers and uncertainty to financiers. Inflation-adjusted historic costs were considered inappropriate since they might include "gold plating".

An assessment of the reasoning

The analysis behind the choice of the ODV method for Transpower's value and pricing does not bear much scrutiny.

The level at which bypass could in principle be *financed* does not provide any real constraint on prices since there are often other substantial barriers to entry, such as the incumbent's likely response and access rights. Thus, even though the ODV method polices investment behaviour, it does not substitute for regulatory oversight.

As long as the government's declared regulatory stance is (as it is in the US) that prices can be adjusted to recover prudent investments, be they for replacements or upgrades, private capital will be forthcoming. In this regard, an historic cost value would have been as effective as the ODV in providing sustainability.

Consumers would almost certainly prefer low transmission prices rising (even in jumps) over time towards a longer run equilibrium, to high prices from day one.

All the available methods for setting Transpower's initial value and ongoing pricing require some scrutiny of the firm's investment choices. With an initial valuation based on historic costs, low on account of inflation over the 80s, it might have been tempting to let bygones be bygones, but customers and regulators would still need to test ongoing investment decisions. As discussed below, the ODV method is not generally sustainable, since the correct comparison for a past investment is not the modern equivalent asset *now*, but rather the modern equivalent asset at the time when the investment was made.

The ODV method was favoured because it mimicked a long-run competitive equilibrium (under a particular set of assumptions) but this benchmark has no claim to being efficient.

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[2] As a practical matter, the value was required to be consistent with the intended prices in a normal accounting framework.

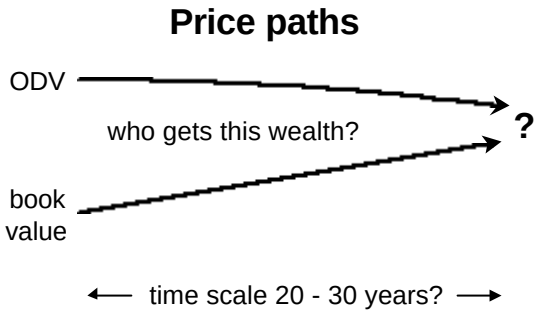
[3] "Bypass" refers to *duplication* of the network. In a competitive setting with no other barriers to entry, users would build a second network if Transpower's prices were consistently above ODV levels.

In summary, it is hard to see that the ODV method was genuinely preferable for reasons other than the government's reluctance to write off any of the overall value recorded for ECNZ.[4]

The options for valuation and pricing remain open

Given that the reasons for valuing up Transpower were not very compelling, Transpower's pricing is not a useful precedent for lines businesses. ODV prices have no particular claim to being efficient or fair. Whatever asset valuation is used, some degree of monitoring or regulation is required to restrain prices and discipline ongoing investment.

Policy makers have a choice between higher or lower prices in the short to medium term. In the long run, the methods probably converge to some degree. If valued up, providers gain at the expense of customers, and *vice versa*. Given that higher prices have the potential to distort the *use* of the services in question, asset values and prices should be kept as low as is reasonably possible.



If the businesses have been corporatised or privatised by government with the intention that they operate as normal companies, the establishment value or sale price should probably be taken as a *floor* to the deemed regulatory asset base at that time.[5] [6]

Pricing in other infrastructure sectors

In other monopoly settings such as airports, the roads and some port traffic, there is similarly no economic justification for increasing prices above the levels consistent with historic costs or book values established at corporatisation or privatisation.

This position has some support in official thinking and analysis. The courts have endorsed the idea that government sanctioned privatisation values are a reasonable basis for pricing. Recent road reform proposals provided for prices less than ODV levels only increasing in line with net investment.

In these sectors, the choice between book values and ODV is probably more important than in electricity because there is debate about the treatment in the ODV approach of very long lived or permanent assets that pre-date corporatisation or privatisation. The inclusion of the costs of previously recovered or written off land reclamations, hill side cuttings or breakwaters, has no basis in economics, accounting or equity.

The ODV method has so far been commercially sustainable in the electricity sector only because the costs of the technology involved are not declining quickly. In sectors where costs are coming down progressively, no new investment will be forthcoming if

[4] If Transpower's value had been lower, the residual value of ECNZ would have been higher, and there was every chance that the residual ECNZ book value was going to come under pressure with the advent of the competitive electricity generation and wholesale market at a time of power surpluses.

[5] If monopoly facilities later change hands at high prices, the regulator is not bound to honour the implied pricing hopes/plans. The regulator's view might be influenced by the apparent degree of government endorsement of the sale process, as in the case of the privatisation of Wellington International Airport.

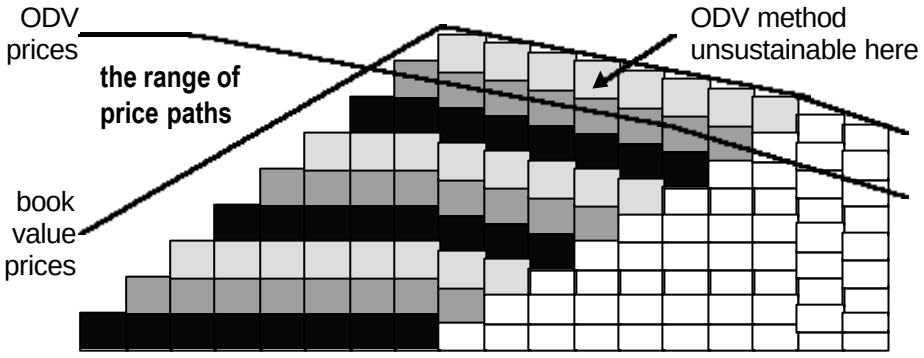
[6] The separation of Transpower from ECNZ was an opportunity to rationalise the values of the two parts without being constrained by the earlier composite valuation.

regulators will only allow recovery of the costs of the *current* modern equivalent asset, as opposed to the prudent modern equivalent asset at the time the investment was made.

This process is illustrated in the following diagram. The layers in the "stairs" represent the costs of different components of the infrastructure facility (expressed as annuities over the lives of the assets, with 8 year lives for drawing simplicity). The replacements for each component are cheaper (the paler shaded continuations of the initial layers of annual blocks). ODV prices (shown by the labelled solid line) will not allow the full recovery of capital costs. Investors will not participate on this basis. Prices based on the book value allow recovery of new investments as well as recovery of the starting point book value.

Price paths with innovation

The blocks represent annuitised costs, the lines represent prices. The time to cross over could be typically 20 30 years



Summary

Commercial providers of monopoly infrastructure services need to be assured of an attractive return of and on prudent investments—but no more.

If investors are to have confidence in the sector, implicit or explicit regulation should not expropriate the purchase price of assets prudently acquired.[7]

The ODV process is one way of providing the necessary vetting of investment behaviour but is not a general guide to efficient monopoly prices, particularly when very long lived assets are involved. The ODV method:

- is unduly generous, at least in the short to medium term; and
- is commercially unsustainable where technical progress is significant.

[7] Where the provider is a corporatised public entity, the establishment value was the "purchase price" for which directors took responsibility.

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1. AIM

The aim of the Air NZ project is to assess the ODV method of monopoly service prices. This paper contributes by reviewing the origins of the method in the electricity sector, the objectives it was supposed to advance, and hence its relevance or otherwise in other sectors.

2. INTRODUCTION

The so-called optimised deprival value (ODV) method has been advanced as a general solution to determining "fair and reasonable" capital charges for monopoly infrastructure services.[1] Generally, the method sets prices at levels sufficient to finance bypass of the facility in question.

Origins

As a possible outcome of privatising electricity lines companies, the depreciated replacement cost approach appears to have been discussed first in New Zealand in an NZIER report to the Ministry of Commerce in February 1990.

The optimisation feature was developed by Southpac in April 1990 for the Electricity Corporation of New Zealand (ECNZ) when Transpower was being split off from ECNZ to operate as a stand alone State Owned Enterprise (SOE) for possible sale to a club of electricity generators and distributors.

The approach was recommended to the Transpower Establishment Board (as the best approach to valuing Transpower) in a report by Oxford Economic Research Associates (OXERA) and Ernst & Young in December 1990, this report adding the "economic value" (EV) adjustment and coining the term ODV for the collection of techniques.

The ODV method is one way of establishing the regulatory asset base for natural monopolies. The regulated firm is allowed to recover the asset value through depreciation charges and to earn a return on the outstanding balance. (Thus capital charges are said to allow "a return of and on" the asset base.)

In the next section, we outline the analysis in the Southpac and and OXERA/EY reports, drawing out what objectives they were seeking to secure and, in section 4, we test their assessment of the pros and cons of the various methods available.

Sustainability

We assess the argument that the ODV method is required to secure the long term sustainability of the businesses concerned. We examine the earnings requirements of businesses subject to implicit or explicit regulation. We find that sustainability is assured if the firm is assured of being able to recover (with profit) the costs of prudent investments. There is no role for amassing cash reserves beforehand and sustainability does not require a level of income *now* that will be adequate to finance *all future* replacements and refurbishments.

[1] For example, the Ministerial Inquiry into the Electricity Industry has recommended that the Commerce Commission adopts ODV rate bases for electricity lines business regulation. The method has been promoted as an appropriate pricing guideline at ports and airports.

This section addresses the central issue in infrastructure regulation, namely the treatment of sunk costs. We outline our view as to the correct approach in sectors partially migrating from public to private ownership. The central conclusion is that investments by private firms or SOEs in sunk costs have to be recovered, but where sunk costs have been written off, there is no justification for reversing the process.[2]

Extension to lines businesses

Soon after the valuation of Transpower was completed, it was decided that the method would be re-applied routinely as the basis for "light handed" regulation of Transpower and that the approach would also be applied to electricity line businesses.

The method was set out in two Handbooks, one specifically for Transpower, the other for lines businesses (LB). The Handbooks provide implementation detail but no contribution to the conceptual basis other than to note:[3]

> *"The ODV methodology values the distribution assets of the LB at the level at which the business can be sustained in the long term, and no more."*

This adds some weight to the argument that the ODV method should only be applied to replaceable assets.

Ministry of Economic Development officials often indicate that the requirement from 1992 that lines businesses publish their ODVs was intended to provide the basis for yardstick regulation, not price setting.[4] Work by NZIER for the Ministry has concluded that customer density and topographical differences between networks cannot be modelled accurately enough to allow performance measures to be inferred.

Despite the Ministry's focus on costs rather than prices, the ODV framework has come to be interpreted as providing *de facto* rate of return regulation. This places the distribution companies in a different position to Transpower. Transpower was established with an ODV valuation and has proceeded from that basis. The lines businesses were generally corporatised with more modest book values relative to replacement costs so the subsequent revaluations for pricing purposes are more questionable.

Conclusions

Our conclusions are brought together in the Executive Summary.

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[2] With private ownership, what constitute "investments" should be clear; with public ownership, there is no obvious separation between consumers and owners.

[3] The New Zealand Electricity (Information Disclosure) Regulations, 1994, require that every (power)lines business (LB) reveals returns on an optimised deprival value (ODV). The required method of evaluating ODV is set out in the "Handbook for Optimised Deprival Valuation of Electricity Line Businesses" published by the Energy Policy Group of the Energy Resource Division of the Ministry of Commerce, 23 June 1994. There is an equivalent opening in the Handbook for Trans Power. The lines company Handbook has been updated with a new version published on 28th May 1998. However, the same statement of purpose is given in the new version. The Handbooks open with the quoted statement of purpose.

[4] e.g. *ibid* p28

3. ORIGINS

In 1990, the government owned New Zealand's electricity generation assets and the national transmission grid through the Electricity Corporation of New Zealand (ECNZ) and Transpower, a wholly owned subsidiary of ECNZ. In 1989, the Electricity Taskforce had recommended that Transpower be separated from ECNZ's generation assets and sold. As part of the separation process, it was necessary to value Transpower's assets. In May 1990, Southpac Corporation Ltd was commissioned by ECNZ to develop a method for valuing Transpower. Although the Southpac report focused on the optimised depreciated replacement cost (ODRC), their report was an important first step on the development of ODV. A second report, written in December 1990 for the Transpower Establishment Board, by OXERA and Ernst & Young, added the "economic value" (EV) component and coined the term ODV for the collection of techniques.

3.1 Why value Transpower?

The overall objective in establishing a value for Transpower was said to be to set out "the price at which a financial interest would change hands between a willing buyer and a willing seller, both being adequately informed of the relevant facts and neither being under any compulsion to buy or sell."[5] The value was intended to have three functions.

- The first and most important was that ongoing transmission charges were to be determined by the value chosen. Because electricity transmission is highly capital intensive, around three quarters of Transpower's required revenue stream is driven by depreciation expenses and the return on capital. Previously, the transmission charge had been bundled with the energy charge with local electricity retailers paying for delivered electricity.
- The second function (and the reason that significant effort was put into determining the value of Transpower) was to enable capital to be transferred to the new company, with the company potentially being in different ownership.
- The third aim was to use the valuation to create incentives for the firm to operate in an efficient manner, mimicking incentives in a competitive market.

Southpac's expressed purpose was thus to provide an *independent* valuation of the assets to be transferred in the sale process. However, the valuation required a *pricing policy*, not normally a valuer's domain.[6] Southpac recommended a pricing policy on the basis of an intended regulatory effect—price at a level above which facilities will be bypassed. We assess this choice presently. For the moment, it is enough to observe that this pricing approach was favourable to the residual ECNZ, which was facing the prospect of competition in generation. With higher transmission prices and a higher Transpower value, ECNZ was more likely to perform well against the residual asset value. Thus, it was not in the interests of ECNZ's management to challenge the Southpac approach.

Although Southpac did not explicitly set out criteria for selecting a valuation process, several principles are mentioned in their analysis. These are: efficiency, equity,

[5] Southpac (1990) p.10

[6] Asset values are usually determined as the discounted value of the future cashflows the assets are expected to generate. In setting prices for a monopolist, this process would be circular.

consistency over time, compatibility with an accounting framework and reducing reliance on regulation in favour of stakeholder monitoring of management and market incentives to control costs.

These align with the objectives and criteria for valuation that were later made explicit in Ernst & Young's valuation methodology report.

3.1.1 Stakeholders

Ernst & Young developed objectives for the valuation in consultation with five stakeholders. The five stakeholders identified were:

- end-users of electricity, who presumably wanted low prices for as long as possible;
- the government, which had an interest in ensuring that consumers are not overcharged (but also not "faced with unnecessary price shocks"), and, which was (and is) responsible for providing an environment for continued and improved efficiency in the electricity industry;
- ECNZ as the current owner of Transpower, a user of transmission services and, at that stage, a potential future owner of Transpower;
- the Electricity Supply Authorities as users of transmission services and potential future owners of Transpower; and
- the management of Transpower who required a financial structure in which to operate.

3.1.2 Objectives identified for the valuation

1. **Efficient prices**. The valuation was to be consistent with an efficient price level, described by Ernst & Young as one based on the lowest cost of supply.
2. **Sustainability**. The valuation should ensure that Transpower is sustainable, that is it should be consistent with a price at which economically justifiable replacement or expansion of assets can occur.
3. **Capital raising**. Related to sustainability, the valuation was to ensure that investment could be attracted, both in terms of debt raising capacity and the rate of return on equity. With given cashflows, the higher the required rate of return, the lower must be the valuation. This means that at a given price the valuation should be at a level that enables shareholders to realise a normal commercial return for the risk associated with the investment.
4. **Consistent accounting**. Any valuation was to be consistent with a reporting and accounting framework that allowed the performance of management to be monitored, giving Transpower the incentive to operate and invest efficiently. By defining the method by which the network was to be valued, shareholders and users were to have an objective basis from which to measure the performance of the company.

Other criteria for the choice of valuation method were that the method should be based on the best and most up-to-date valuation concepts. It should be consistent with the "proposed form of ownership and regulatory regime for Transpower".[7] (Self regulation was proposed through ownership by ECNZ and ESAs.) The measurement of components of the valuation were to be able to be undertaken objectively, that is on an

[7] Ernst & Young (1990) p.12

explicit and defensible basis, in a way free from manipulation and distortion. Finally, any method was to be practical and able to be implemented.

3.1.3 Assessment

We broadly agree with these objectives. A normal commercial framework was required for Transpower if it was to privatised. The sale price had to be consistent with subsequent pricing and the main efficiency concern in this and other infrastructure sectors is with investment ("dynamic efficiency").

The questionable objective is number 2, setting prices at levels which automatically finance replacement investments. This cuts across dynamic efficiency concerns. If there is an understanding amongst stakeholders that investments will be accompanied by price increases, and the firm after all has the power to raise prices, the business is every bit as sustainable and the investments are likely to be scrutinised more carefully.

We will discuss presently whether the ODV method does contribute to providing incentives for efficiency.

3.2 Southpac recommended ODRC

The value of a firm is given by the present value of future projected cashflows. In normal circumstances, the firm operates in a contestable market with exogenously determined prices. However, Transpower operates in a non-contestable market and, if given discretion over its charges and levies, in effect would set its own value. A policy is required to set both price and value.

3.2.1 "Underlying values"

Southpac argued that the value should be determined by the "economic price" of the sunk assets employed by the firm with future cash flows and transmission prices determined accordingly. There are four parts to the meaning of "economic" in the sense in which Southpac use it:

- The assets must be optimally configured.
- The assets must be valued at their current replacement cost.
- The remaining economic life of the assets must be taken into account.
- The impact of technological change must be provided for.

The Southpac report considers historic cost as a basis for valuing sunk assets, but discards it on the basis that it does not reflect the true "underlying economic value" of the assets and that insufficient funds will be set aside to "preserve the operating capacity" of the assets. Even where the historic cost is inflation adjusted (so-called modified historic cost) the adjustment was said only to account for changes in the value of money, not the "specific changes in value of the assets themselves". Because a valuation based on historic cost is unlikely to reflect the cost of replacing the network with assets that are optimally configured, historic cost was said not to reflect the "true" value of the firm.

From an economic perspective, it was recognised that most transmission assets are sunk. Once in place they have little value in alternative uses. For an efficient outcome going forward, the firm only needs to recover avoidable costs associated with maintenance, operating, replacement and expansion, the sunk assets can be valued at their scrap or disposal value. But, Southpac argues that excluding sunk costs:

- ignores equity considerations relating to who paid for the assets in the first place;

- allows late-comers to free-ride on new investment in fixed assets;[8] and
- ignores "the impact on the incentives and monitoring of the management of Transpower."

On this basis, Southpac recommends the use of the optimised depreciated replacement cost (ODRC) of assets to value the asset base. In a nutshell, the ODRC is the cost of replacing the existing asset with a modern equivalent asset that would produce the same flow of services at the least cost over its lifetime. A potentially significant implication of ODRC valuations is that changing technology may see an asset valued by reference to a completely different replacement asset. Some assets may attract a zero value if they are judged to be redundant on the basis of forecast demand.

3.2.2 Provisos

Southpac described the following implications of ODRC valuations.

- Consumption decisions could be distorted at the margin (allocative inefficiency). As explained above, the transmission assets are sunk. If the recovery of sunk costs in transmission feeds through into c/kWh retail prices, then the retail price is higher than the actual incremental cost of supply. An efficient level of consumption occurs when the price of a service is equal to the incremental cost of supply.
- Dynamic efficiency may also be impaired. Inefficient bypass and premature new investment may result since producers with a marginal cost of supply that is lower than the price including variable charges for sunk assets, but higher than the marginal cost of supply of the incumbent, will find it profitable to enter. It is efficient for only those producers with a lower marginal cost of supply than the incumbent to enter.

Southpac noted that their recommended approach would only be efficient if fixed costs were passed through largely as fixed charges.

Southpac emphasised one particular advantage of the ODRC method. By putting a cap on prices, management was said to be given an incentive to contain costs in order to maximise the return to shareholders; in other words, productive efficiency was expected to be enhanced. Monitoring management is easier as the control of management over prices is broken. This means that financial performance ratios are more meaningful than in a framework that gives management control of prices as well as costs.

Southpac also argued that ODRC is more equitable than valuing assets at less than ODRC as current users share all costs associated with the assets including replacing them when the time comes. It is a consistent method that can be extended to incorporate new investment and replacement assets. It reduces the need to rely on regulation in favour of rates that reflect the markets' willingness to pay. Finally, they argued that it is attractive from an accounting perspective as the accounting rate of return (ARP) and cost of capital measures are approximately equivalent.

3.2.3 Assessment

We will set out our assessment of the whole ODV method (including the ODRC core) after reviewing the Ernst & Young case next. At this stage, it is worth noting our view that the Southpac idea of the true "underlying economic value" of Transpower's assets

[8] We cannot make out the argument here.

seems more guided by notions of equity than economics. The pre-existing assets were inescapably sunk. In our view, equity decisions should be made by government.

3.3 Ernst & Young: ODRC + embellishments = ODV

3.3.1 Deprival

Deprival value is a concept that has been around since the 1920s when it was developed for use in insurance and damages estimation.[9] A deprival value is defined as the amount that the owners of an asset would lose on deprival of that asset (hence its application in insurance). From this definition it can be seen that a deprival value can be derived as the present value of actual projected cashflows on the basis of existing tariffs. The original intention was thus that the rate base should be used to determine the deprival value, not the other way around.

In the Transpower case, Southpac had recommended that the projected future cashflows associated with an asset be determined on the basis of the cost of replacing the asset with one that could produce the same services. The cost of (optimally) producing the stream of services is the amount that could be charged, in a competitive market, for those services. Hence, the deprival value, or the present value of future cashflows, can be determined from the cost of replicating the service.

OXERA and Ernst & Young pieced together the "optimised deprival value" method in December 1990, expanding on the approach recommended by Southpac. The ODV of an asset to the business is formally defined as the smaller of:

- ODRC; and
- the "economic value" of the asset.

The economic value (EV) of the asset is the greater of:

- the value to the user of the asset; and
- its disposal value.

Hence ODV is a combination of ODRC and EV. ODRC is the cost of meeting current and projected demand with the technically efficient design and configuration of assets. The EV of an asset to the user is the minimum cost of replacing it with a more economic alternative. If the ODRC is less than the EV then the ODRC is the appropriate ODV value since if the system was deprived of the asset, it would replace it with the technically optimal equivalent. If the EV is less than the ODRC then the EV is the appropriate measure of the ODV since it would be replaced with the economically preferable alternative.

3.3.2 From criteria to design conditions

From the criteria that it developed in consultation with the stakeholders that are listed above, Ernst & Young developed a framework for evaluating alternative methods. Like Southpac, Ernst & Young recognised that because Transpower faces few restrictions in the price it can charge, the discounted value of expected revenues is not a useful way of valuing the business without determining appropriate prices. The objectives that they identified were intended to lead to appropriate charges.

[9] Simon Terry Associates, 2000 *"Lining up the Charges: electricity line charges and ODV"*

Ernst & Young associated their four objectives with features of competitive markets and hence used the price said to prevail in a competitive market as the principal benchmark for Transpower pricing.

Three properties of competitive markets were identified against which candidate methods were measured:

- Competitive markets have free entry. The implication is that the value of the firm (the expected present value of future earnings) must be equal to the cost of entry. In this case, the cost of entry is the current optimal start-up capital cost. Equivalently, Transpower prices should be close to entry (bypass) prices.
- In a competitive market, all customers who value the service at least as highly as the incremental cost of producing it are supplied. This means that the value of the assets should not exceed the value to users, leading to the EV idea.
- In a competitive market, firms are also free to leave and will do so if the value of their assets (the expected present value of future earnings) is less than the net realisable value of the assets. Hence the value of the assets is bounded below by their net realisable value.

Ernst & Young measure seven valuation methods against these three conditions. The seven methods fall under three broad headings: historic cost-based, replacement cost-based and deprival values.

3.3.3 Historic costs

Historic costs were rejected on the basis that the prices they gave rise to are unsustainable; when new assets are added, a shock in the transmission price occurs. Such a valuation was also considered inequitable over time as the service did not change with the price change. The final objection was practical; although potentially the most objective and lowest cost method, Transpower's records cover a long period and were thought to be somewhat inconsistent.

3.3.4 Replacement costs

Replacement cost methods were considered to be the only ones to replicate the entry conditions of competitive markets. *Optimised* depreciated replacement costs were identified as the relevant measure on the basis that entering firms would not replicate sub-optimal service patterns. Although optimisation introduces some discretion, assessments of replacement costs are routinely undertaken in any event and they could be combined and extended to form a reasonably objective ODRC.

3.3.5 Incorporating economic values

The ODRC method was recognised as deficient to the extent that the cost of supply exceeded the cost of alternatives such as local generation. Optimisation only determines the best way to deliver the existing stream of services, not whether the existing stream of services is optimal. For this reason, the EV refinement was added, the collection of techniques being termed ODV.

This completes our outline of our understanding of the reasoning behind the development of the ODV method for Transpower. We now move on to assess whether the conclusions drawn were correct, and the implications for the use of the method in price setting for lines businesses and other infrastructure facilities such as airports, ports and roads.

4. ASSESSMENT

In this section, we set out our reactions to the criteria adopted by Southpac, Ernst & Young and OXERA, sift out what we see as the main legitimate concerns, and assess whether the ODV method really is better than traditional rate base approaches to price monitoring.

We do not take issue with the decision to use an accounting framework. The whole idea of corporatisation and privatisation was to draw the activities into reporting processes familiar to private business. It is ironic that accounting principles appear to bar price increases based on rate base revaluations.[10]

Our conclusions are that the "competitive" price benchmark may have some long term relevance where technology is stable, but there is still a choice facing regulators as to whether to allow a jump to this level now, or simply to allow prices to increase from levels applying at corporatisation or privatisation as and when necessitated by new investment. With long lived assets, the natural transition to could take decades. The gradual process is economically more efficient and is perfectly sustainable for owners. Whichever path is taken, the same scrutiny of investment decisions is required.

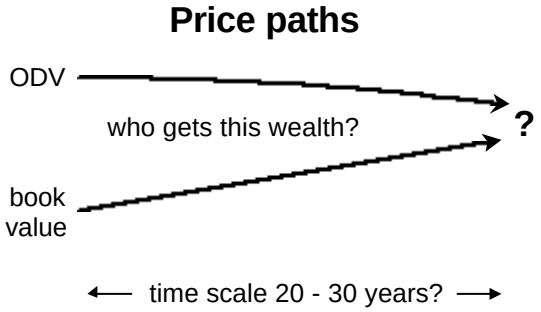
4.1 Price caps and price paths

The hopes expressed by both Southpac and Ernst & Young that their recommended pricing policies would obviate regulation have turned out to be disappointed.

The level at which bypass could in principle be *financed* does not provide any real constraint on prices since there are often other substantial barriers to entry, such as the incumbent's likely response and access rights.[11] Thus, even though the ODV method provides valuable scrutiny of investment behaviour, it does not substitute for regulatory oversight.

Consumers would almost certainly prefer low transmission prices rising (even in jumps) over time towards a longer run equilibrium, to high prices from day one. Southpac was aware of the hazards of higher transmissions charges being converted into variable (c/kWh) charges and distorting consumption and substitution decisions. In our view it is clear that if there is a choice between high prices and a lower path that meets the same regulatory objectives, then the lower path is preferable. The transmission cost component of household and business costs is far too small to be taken seriously as a source of disruptive price "shocks".

Policy makers have a choice between higher or lower prices in the short to medium term. In the long run, the methods may converge to some degree but there is no need to anticipate the long run solution.



[10] Simon Terry Associates, 2000 *op. cit.*

[11] If the monopolist is vigilant, it can deter bypass by pricing carefully in the vulnerable areas.

4.2 Investment scrutiny

All the available methods for setting Transpower's initial value and ongoing pricing require some scrutiny of the firm's investment choices. With an initial valuation based on historic costs, low on account of inflation over the 80s, it might have been tempting to let bygones be bygones, but customers and regulators would still need to test ongoing investment decisions. This is a common feature of rate-of-return and price cap regulation.

Investors will only participate if they can expect to recover prudent investments. Like other common approaches to regulatory monitoring of investment, the ODV method cuts out past *over*-investment ("gold plating") so investors remain responsible for some errors of judgement. Nevertheless, as discussed below, the ODV method is not generally sustainable, since the correct comparison for a past investment is not the modern equivalent asset *now*, but rather the modern equivalent asset at the time when the investment was made.

4.3 Sustainability

In this section, we consider what it means to be a successful sustainable company in the infrastructure sector.

Sustainability can equate to cost recovery when the costs being recovered relate only to assets that will in fact soon be replaced. However, where there are long time periods between the relevant major re-investments, pricing for distant and uncertain future re-investments is not appropriate. This is particularly so where there is only a small number of key customers.

This highlights the issue of sunk costs. From the point of view of efficient pricing, one can forget *all* past major investments and *contract* with users to finance any necessary refurbishments when they come due. If the commercial and regulatory framework is to remain credible so that private investment can continue to be attracted, one should not write off the prudent investments of infrastructure owners. Otherwise, dealing with sunk costs (determining who gets the economic value they represent) is essentially arbitrary.

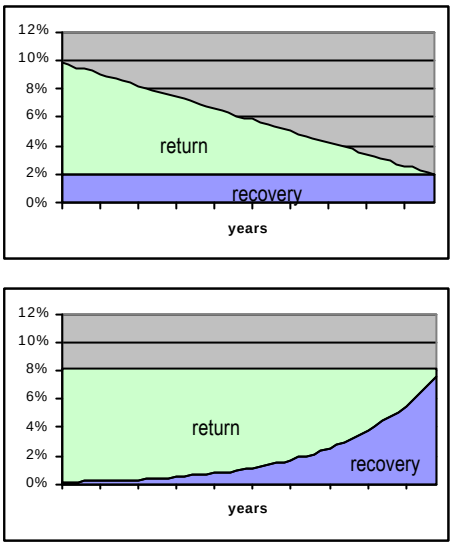
4.3.1 Successful sustainable companies

To continue in operation, companies need to earn enough revenue to cover their costs, most obviously, short term operating and maintenance expenses. If the company has assets that could be sold, then rational owners would insist on being paid a return on the resale value of those assets – like a rental – so that it remains more attractive to keep the business operating rather than sell the assets and close down.

From time to time, the business may also need to replace items of capital equipment that have become worn out or are no longer appropriate to the production process. These capital costs are essentially like operating expenses except that they are intermittent and generally larger. While operating costs must be met continuously to keep the company in operation, capital expenditures allow the business to continue for a period, typically some years. Accordingly, a capital cost does not have to be met completely in the year that it occurs: it can be recovered over the life of the asset involved. For investors to make the money available for the item of capital equipment, the repayment over subsequent years will need to incorporate a return or profit element, a "rental" for the use of the money.

The actual pattern of capital repayment could have a variety of profiles. Two examples are shown in Figure 1. The top so-called "straight line" profile involves a constant rate of recovery of the principal (the lower portion) plus a percentage return on the unpaid balance which declines over time. The lower pattern, familiar with table mortgages, involves a constant annual amount (an "annuity") that achieves the same result (the lower "recovery" amount being the repayments of principal, and the return portion being the "interest" on the outstanding balance).

Figure 1 Cost recovery profiles



To summarise, for a firm to be "successful", for it to have a "sustainable" business, it must be confident that it's products or services can earn sufficient revenue to cover operating expenses, to provide a return on assets that could be used elsewhere, and to repay capital used for re-investments and developments.

4.3.2 Pricing and cost recovery

In cases where the firm is involved in a relatively continuous process of replacing items of capital equipment, with each item a modest proportion of the total, and technology not changing rapidly, there will be a rough correspondence between the income level that will be required to sustain the business when new equipment is needed and the current level of income that is being used to meet current costs and repay investors for *existing* equipment.

As an example, suppose an existing piece of equipment costing $1 million requires a repayment (interest and principal) of $150,000 each year over its life (i.e. following the lower pattern depicted above). If there is sufficient income to cover this outgoing, then it is likely, other things being equal, that when the item wears out at around the time of the last payment, it can be replaced and the $150,000 income level will continue and finance the *new* $1m set of assets.

The same principle will apply with the "straight line" repayment pattern if the stream of capital reinvestments is relatively orderly. The average effect will be a more or less steady revenue requirement.

This correspondence between cost recovery (a backward looking concept) and being successful or sustainable (a forward looking concern) is the reason why pricing guidelines for stable infrastructure businesses are often discussed in terms of cost recovery when the key *economic* concern is future viability.

ODV prices are credible in the longer term, given stable technology

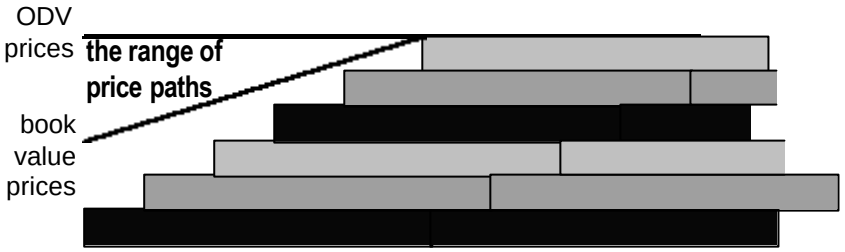
The correspondence also explains why one might expect prices to converge towards ODV levels over time if technology is stable.

If the technology in the sector is stable, the book value of assets will grow from a lower initial value to the ODV over the life cycle of the components involved. The time taken to reach the long run level might generally be of the order of the average life of the assets involved.[12]

Prices set on the basis of the ODV will generate surplus cash in the intervening period. The "book value" track will allow the initial book value to be recovered (including a normal profit) and will increase revenue only in line with the financing requirements of the new assets. The two limiting tracks are shown in Figure 2. The layers represent different components of the infrastructure facility coming due for replacement over time.

Figure 2 Price paths with stable technology

The blocks represent annuitised costs, the lines represent prices



ODV unsustainable where innovation is relevant

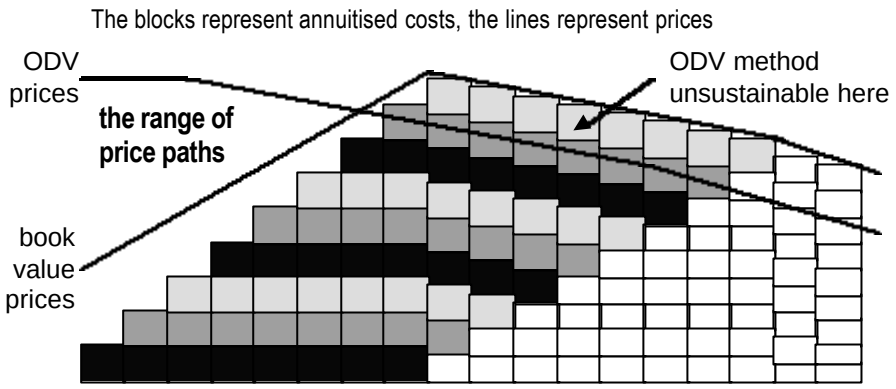
In sectors where technological improvements are lowering the costs of the service, ODVs do not provide a sustainable regulatory asset base. The investor must expect to be allowed to recover prudent capital commitments. The ODV method specifies values in terms of modern equivalent assets. These modern equivalents will generally appear part way through the life of past investments. The ODV will thus decline faster than the book value even if the infrastructure provider takes up each new alternative when the old component wears out.

This process is illustrated in Figure 3. As above, the layers represent different components of the infrastructure facility (with 8 year lives for drawing simplicity). In this case, the replacements for each component are cheaper (the paler shaded continuations).

The result is that the ODV method will not allow the full recovery of capital costs. Investors will not participate on this basis.

[12] If replacements happen in an orderly fashion over the years, then the asset value will steadily approach the long run level. Of course, other patterns are possible, from total replacement soon to a major investment "holiday" for 30 years.

Figure 3 Price paths with innovation



This problem would not have been seen as significant in the case of Transpower since the pace of technological improvements has been and is slow. Moreover, the ODV method was developed for Transpower as the basis for its establishment as an SOE and in anticipation of a possible sale, not as a basis for formal regulation.

It's clear that the method is untenable in a sector like telecommunications.

4.4 Sunk costs

The different approaches to identifying an initial regulatory asset base differ mostly in respect of the treatment of earlier sunk costs, i.e. those costs incurred in the past, prior to the establishment or sale of the company.

In our view, there is no justification for incorporating any allowance for these costs into the price of services.

In the case of New Zealand power companies, it appears to have been recognised that no useful purpose is served by incorporating major sunk cost features in asset bases. Features like easements (rights to use a property "corridor" for power lines) require no replacement or maintenance and (apart from the opportunity cost of the land) involve the power company in no economic choices as regards continuation or withdrawal. Such pre-existing rights of way etc are excluded from the asset base and hence from power prices.

Indeed, it seems likely that it is now recognised that simple replacement cost pricing is sensible only if most assets involved actually *need* replacing over time at broadly the same cost as in the original construction. Otherwise it is open to the monopoly facility owner to "use" the replacement cost method to obtain revenue entirely unrelated to the actual costs incurred in providing the service.

Another example is provided by the recent road reform proposals. The draft regulations prepared for valuing the new regional road companies made no allowance for incorporating into initial asset values, past major one-off costs such as reclamations, cuttings, the draining of swamps etc. The initial values were to be set so as to provide initially a continuity of income but only be allowed to grow with new investment (net of depreciation). Thus even the replaceable capital was to be written down so that existing revenue provided a full capital charge.

Signalling of new investment

This suggested treatment of pre-corporatisation sunk costs does not extend to indicating that infrastructure service providers should be prevented from earning a return on *future* investments involving sunk costs.

Where infrastructure users have choices, the service provider will make such investments in full knowledge of the risks involved. Where there are captive users, one would expect the provider to consult users over major upgrades (and facilities no longer required).

Competitive neutrality

One line of argument sometimes heard is that *competition* is somehow impaired unless *all* the past expenditures are incorporated into the monopolist's value. The idea is that a lower price may prevent better options from appearing.

In fact, to the extent that the extra revenue gained through higher prices above the minimum sustainable level recommended here, does promote competition, the result is a *loss* of economic efficiency: bypassing the facility is economically efficient *only if* the costs of doing so are less than the costs that will be avoided as a result of bypass in the operation and ongoing refurbishment. Sunk costs are irrelevant.

5. APPLICATIONS OF THE ODV METHOD

5.1 Transpower has proceeded with ODV prices

The ODV method was adopted for Transpower and prices have since been set accordingly. The specifics of the method were enshrined in a Handbook, as mentioned earlier.[13] The Handbook records the methods, and details the optimisation process, mechanisms for identifying standard component replacement costs and economic values, and the calculation of depreciation on the ODV (required in order that the accounting rate of profit can be monitored). The processes are described in Appendix A. The Handbook sheds no new light on the conceptual basis for the method; it is simply an implementation guide.

Nevertheless, because it is a basis for pricing, there is money at stake for Transpower and its customers. As a result, definitions have been tightened over the 90s and conventions established about such issues as the assumed asset lives.

5.2 Lines business benchmarking has been illusive

Since 1992, lines businesses have been required to report their ODVs. Under the Electricity (Information Disclosure) Act 1994, the local electricity line companies have been required to disclose a range of information about their financial and operating performance. Theoretically, this information should be useful in "benchmarking" the performance of the line companies against each other.

When talking about benchmarking and performance, it is important to distinguish costs and prices. A well performing company should keep costs low. When considering prices, the term "performance" is a bit more ambiguous.

[13] "Handbook for Optimised Deprival Valuation of Transpower" published by the Energy Policy Group of the Energy Resource Division of the Ministry of Commerce, 7 July 1994.

The Ministry of Economic Development has been at pains to indicate that there has been no requirement that prices should be set according to the ODV method. If ODVs were to be used for assessing costs, then the ODV in isolation would have been of no use; the ODV would need to have been compared with the depreciated replacement cost of the facilities actually in place. To our knowledge, no comparisons of this kind have ever been attempted.

A recent study undertaken by NZIER for the then Ministry of Commerce showed how hard it is to identify what local electricity distribution *ought* to cost using econometric analysis, even when there are 35 lines companies to compare over four years. This analysis had to use ODVs as the measure of capital cost, thus assuming away capital inefficiencies.[14]

If the ODVs were intended to be used as the basis for assessing whether prices and profits were excessive, then this was clearly a fairly generous ceiling, and an invitation to the more commercially-oriented lines businesses to move towards the *de facto* limit.

And indeed, lines businesses have moved their recorded asset values up substantially—much further than can be explained by the amount of capital investment since corporatisation.[15] According to Simon Terry Associates, lines businesses' asset values have moved up from $2b to $4b in eight years. It is not clear that the revaluing process has finished yet.

Current levels of replacement investment appear to be around $180m pa. If the average asset life is 30 years, this expenditure rate suggests a long run sector value of around $5.4b (assuming no significant technical progress). With assets fairly uniformly spread in ages, one would not expect to reach $4b in less than 11 years.

5.3 Pricing in other infrastructure sectors

In other monopoly settings such as airports, the roads and some port traffic, there is similarly no economic justification for increasing prices above the levels consistent with historic costs or book values established at corporatisation or privatisation.

This position has some support in official thinking and analysis. The courts have endorsed the idea that government sanctioned privatisation values are a reasonable basis for pricing. Recent road reform proposals provided for prices less than ODV levels only increasing in line with net investment.

In these sectors, the choice between book values and ODV is probably more important than in electricity because there is debate about the treatment in the ODV approach of very long lived or permanent assets that predate corporatisation or privatisation. The inclusion of the costs of previously recovered or written off land reclamations, hill side cuttings or breakwaters, has no basis in economics, accounting or equity.

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[14] The background to the study was that electricity lines business performance was being assessed to single out firms with unduly high costs or profits. NZIER was asked to advise on the practicality of *normalising* observed lines company costs to allow for circumstances outside the control of the businesses.
We found that a significant amount of the variability between firms in total costs per customer can be explained by density; that is, firms with fewer customers per square km systematically exhibit higher costs per customer. Although a good portion of the remaining variability between firms can be explained by the load per customer and the degree to which cables are underground, it is also clear from the study that there may be other reasons for cost differences that are not able to be quantified, e.g. different degrees of exposure to extreme weather and different terrain.

[15] Simon Terry Associates *op. cit.*

5.4 Other commentaries on ODV

Commentaries on ODV *pricing* have focused on the effects on electricity demand and on practicalities.

Transmission and lines business tariffs feed through into final c/kWh electricity prices. Even though the tariffs have substantial fixed elements, capital charges tend to get incorporated in variable charges. Even though the sensitivity of electricity demand to price changes is muted overall, in 1993 London Economics highlighted the inefficiency of unnecessarily high prices for particular industries dependent on electricity.[16]

More recently, Simon Terry Associates have drawn attention to the lack of any foundation in *accounting* for increasing prices on the basis of revaluations of assets. They also make the point discussed in this report, that there is no economic justification for raising prices towards ODV levels before new commercially based investments make it necessary.

When the initial proposal to apply the method to electricity lines businesses was announced, it was clear that preparing ODVs would be a major undertaking for many firms. At the time, many lines businesses did not apparently have comprehensive asset registers or asset management plans. Thus, there was some overlap between the work necessary for corporatising the lines businesses and the ODV process. Even so, lines businesses recognised that both processes were quite subjective. [17] In the event, the lines businesses were corporatised on the basis of existing earnings.

ODV pricing has been challenged in court proceedings between Westgate, the port of Taranaki and its major customers. The dispute and initial litigation lasted several years before a settlement was reached.

We have not searched exhaustively for specific commentaries by overseas writers on the use of the ODV method in New Zealand.

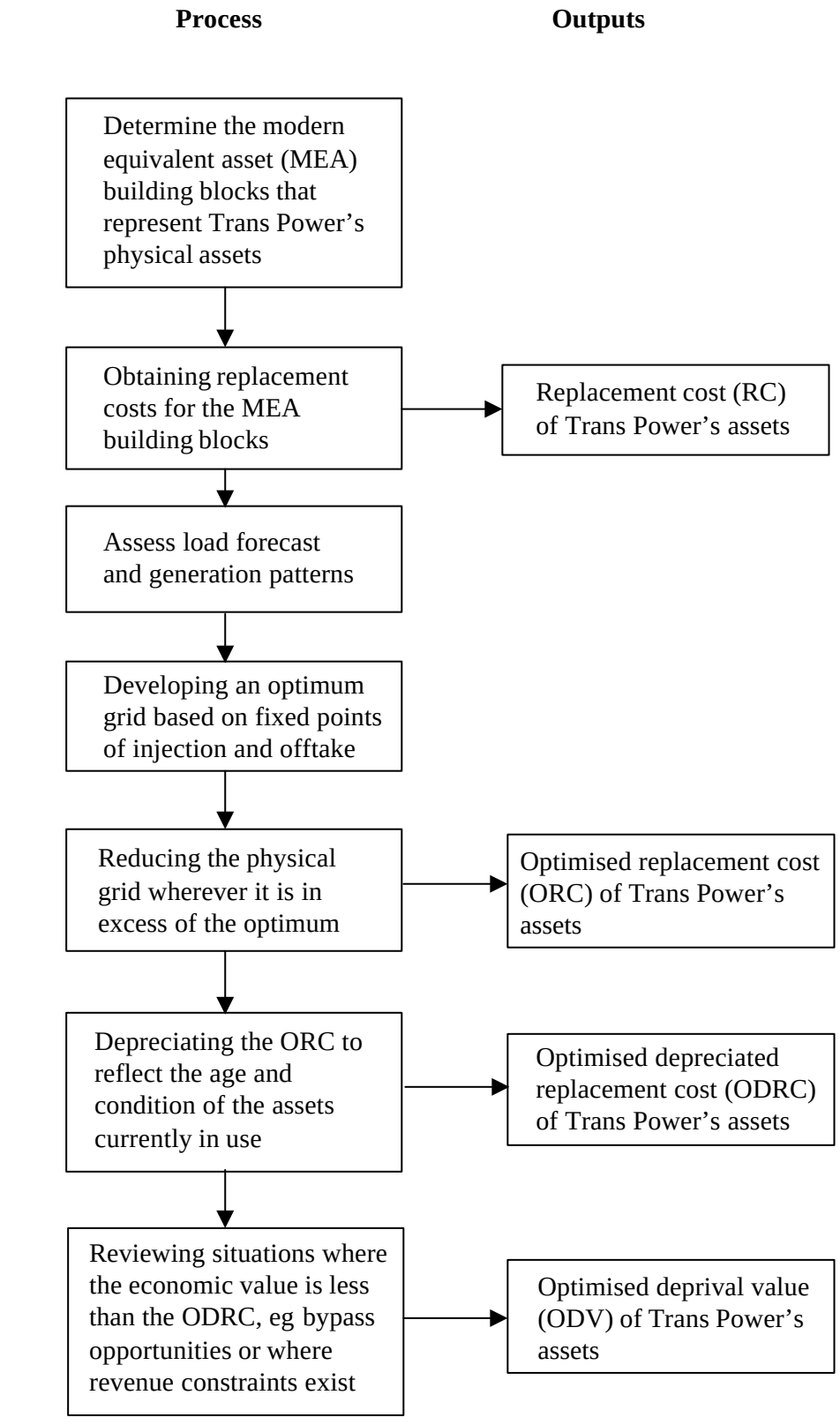
[16] London Economics *A review of the valuation of Trans Power* - A report prepared for the Major Electricity Users' Group November 1993

[17] Starnes, Colin *A commentary on the proposed methodology for valuing Transpower assets and the implications of this methodology for electricity supply authorities* (prepared for Tasman Energy) undated—probably 1990.

APPENDIX A: PROCESS OF ODV

Figure 4 below provides a useful overview of the valuation process and its outputs.

Figure 4: The Transpower valuation process and outputs



Source: Transpower

First, all the current physical assets of the company should be identified, excluding easements. No value is attributed to easements unless these were specifically purchased by Transpower after 1988. The reason for excluding easements was that prior to 1988 Transpower could claim an automatic right to access to transmission system assets. Since anyone wishing to replicate the grid would have to purchase all easements, the true replacement cost would be higher than is identified in the ODRC calculation. The cost of an equivalent replacement asset is determined for all the other assets.

The network is then adjusted to an optimal size and configuration, taking account of the users' requirements in terms of load and security or reliability, and the overall integrity of the system. Load forecasts are based on econometric estimates of future energy consumption. The forecasts are driven off economic growth and are produced to a nodal level. The overall cost of installing the optimal assets is determined using present day labour charges and modern efficient technology and work practices. The optimisation process takes the connection points to the grid as fixed. This was done because it was argued that users required retention of existing connections as any more radical optimisation would require modifications to the local network. Examples of optimisations that have been undertaken in valuing Transpower include downgrading the voltage or rating of lines, reducing the number of cranes and workshops in substation buildings, standardising the configuration of substation switchgear and reducing transformer ratings. Transpower states that "the fundamental criterion in the technical optimisation is: what would be an electrically effective and economically efficient system configuration and asset specification to meet the forecast load (up to the year 2008) given the security criteria agreed for the [distribution line businesses] supply points and for direct supply customers?"[18]

The potential to rationalise connection points is assessed when the EV of the grid is determined. Economic valuation compares the real delivered electricity price with the economic price of an alternative. In general terms, the EV focuses on the opportunities for bypass of the grid, or local generation and looks for any instances when externally imposed constraints on revenue imply that the EV is lower than the ODRC. Candidates were initially identified from submissions from the local retail companies and an analysis of Transpower's cost allocation model to identify potential high-cost supply points.

A.1 Depreciation

The ODV handbook for electricity lines businesses recognises that assets must be depreciated when their remaining life is less than the normal life that would be expected from a new asset.

The total expected economic life (TL) of an asset is the normal, or average period before which it is necessary to replace or totally refurbish an asset. Maximum TLs are set out in the handbook, although if normal asset lives are shorter that shorter TL can be adopted. The residual economic life (RL) of an asset is the difference between the TL and an asset's actual age, that is it is the portion of the asset's life yet to expire. In general, the asset's age should be known, however where it is not an engineering estimate of the remaining life of the asset may be made.

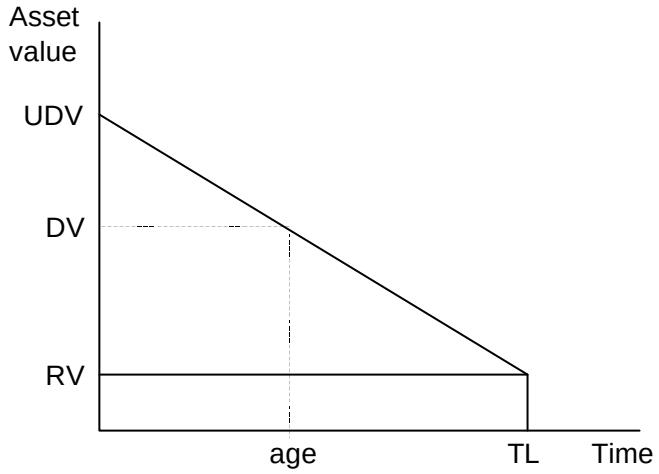
The ODV handbook explicitly disallows accelerated depreciation on the basis of potential redundancy. This means that the identification of an asset as likely to be

[18] Transpower 1998 Optimal Deprival Valuation Report.

retired early as part of network development does not mean that the remaining life of the asset can be shortened for depreciation purposes.

Assets are depreciated on a straight line basis. The asset's value is written down by the same amount each year. At the end of the total normal economic life of the asset, its value should be equal to any residual value net of recovery costs (RV). The RV of the assets is likely to be zero in most cases. Where the asset is refurbished at the end of its life rather than being totally scrapped, the RV is the difference between the replacement cost of the asset and the cost of the refurbishment.

The depreciated value (DV) of an asset of a certain age that is depreciated on a straight line basis is shown in the diagram above. This asset has a positive residual value at the end of its economic life. Depreciation is represented on the diagram as the distance between the undepreciated value of the asset (UDV) and the depreciated value (DV). To calculate the DV the firm works out the proportion of the asset's life that has passed and then subtracts that proportion of the total cost of the asset (net of its residual value) from its undepreciated value.



The formula is:

$$DV = UDV - \frac{age}{TL}(UDV - RV)$$

This collapses where there is no residual value to:

$$DV = \frac{RL}{TL}UDV$$

APPENDIX B: ED-82

ED-82 was released by the Institute of Chartered Accountants of New Zealand (ICANZ), in March 1998, for consultation prior to finalisation of a new Financial Reporting Standard (FRS) relating to accounting for property, plant and equipment. ED-82 is a draft version of the FRS and is accompanied by a discussion paper.

ED-82 deals with revaluation of property, plant and equipment. It does not make revaluation mandatory, however where the items are being accounted for on a revalued basis, they must be revalued at least every three years.

ED-82 proposes that revaluations be based on the market value *for existing use* of the asset, i.e. market value assuming that a potential purchaser would use the item for the same purpose as the current use. This apparently presupposes competitive conditions.

Where no market value can be determined because the asset is a specialised item that is rarely sold on the open market except as part of the sale of a business "in occupation", then ED-82 suggests that the asset should be valued using depreciated replacement cost. In the context of ED-82, depreciated replacement cost incorporates the concept of optimisation as allowance is made for "all relevant forms of obsolescence and optimisation" in the case of land, and "technical and functional obsolescence" in the case of plant and equipment.[19]

Although the document does not discuss the uses to which such valuations might be put, several possibilities are apparent:

- The valuation could be used as an initial indication of value should an occasional sale be undertaken. The parallel might be the GV on a house. Of course, the valuation is not binding on the participants.
- The ODRC could be used by shareholders as an indication of the firm's viability. If current incomes cannot make a return on ODRC, then shareholders need to be confident that incomes can be raised as replacements become necessary so that the firm can be viable in the longer term.

No mention is made in ED-82 of the use of the method in regulated settings.

In December 1999, ICANZ issued an Invitation to Comment on the "Basis for Revaluation of Property, Plant and Equipment". The primary stimulus for further consultation on the issue was a change in relevant Australian and International standards to fair value, rather than existing use value.

In most cases, fair value and value in existing use equate. Only where the asset is employed sub-optimally will the value in existing use be less than the fair value. Fair valuation focuses on the asset; how much would an identical replacement asset cost? The value in existing use focuses on how the asset is used; what would be the cost of a replacement asset that could be used for the same purpose as the existing one?

ICANZ sets out some of the arguments for each valuation method. Fair value reflects the opportunity cost of the assets. It is considered by the Institute of Valuers to be more reliable as they consider that existing use would be determined as an adjustment to fair value. It is also consistent with International and Australian valuation standards. Existing use on the other hand, is the market's assessment of the expected recovery of

[19] ED-82 ¶4.8

the asset, based on its existing use. Fair value overstates recovery. Valuation based on existing use is applied in the UK.

ODV valuation is inconsistent with fair valuation, as ODV is based on replicating the service stream produced by the existing assets using an optimal process. The reason for using an existing use valuation is presumably that one wants to determine the revenue stream from the ongoing business; the additional revenue that is recognised as part of the fair value will never be realised if the business continues to operate. However, fair valuation does not seem completely incompatible with the concept of a deprival value since if a person was deprived of an asset they would lose the opportunity to use the unutilised potential of the asset as well as the actual service stream.

If fair valuation were adopted, ODV valuations would have to be adjusted to include a premium for any assets that would earn a higher return if put to another use.

Conclusion

The recent discussion of valuation standards appears to have little relevance to infrastructure *price setting*. In our (non-accounting) perception, the basic requirement that a firm's published accounts reveal the value of the business would still require a monopoly infrastructure service provider to outline the present value of expected future cash flows. The expected future earnings are those allowed explicitly or implicitly by the regulator. It is up to the regulator to ensure sustainability when sustainability is economically attractive.