The Allen Consulting Group

Review of Asset Values, Costs and Cost Allocation of Western Australian Urban Water and Wastewater Service Providers

General Principles and Methodology

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Report to the Economic Regulation Authority, Western Australia

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Introduction

The Economic Regulation Authority is currently undertaking an inquiry into the prices for water and wastewater in urban Western Australia. The purpose of the inquiry is to inform the Government's decisions on the level and structure of water prices in the 2006/07 financial year. The water service providers that are covered by the inquiry are the Water Corporation, Aqwest and Busselton Water.

As part of this project, the Authority is seeking to determine the following for each of the specified water and wastewater service providers:

- an appropriate regulatory asset value for each of the service providers;
- the efficiency of forecast operating expenditure;
- the efficiency of proposed capital expenditure;
- the appropriateness of the cost allocation methodologies used by each service provider; and
- an estimate of the short-run marginal costs and long-run marginal costs of water and sewerage service provision.

The Authority commissioned the Allen Consulting Group to provide advice on these matters.

The Allen Consulting Group is providing the requested advice in separate reports for each of the three water business, and a report describing general principles and methodology applied in the studies for all three service providers. This report comprises the "principles and methodology" report.

This report is structured in chapters relating to each area of advice requested by the Authority and listed above.

Chapter 2

Regulatory Asset Values

2.1 Introduction – the purpose of a regulatory asset value

In simple terms, the underlying principle of regulating prices is to set maximum prices for services that will permit the business providing those services to recover the cost incurred in constructing assets, to earn a commercial rate of return on the unrecovered cost of assets, and to recover the costs of operating and maintaining the assets. That is, regulated prices for water and sewerage services should bear a formal relationship to the costs of providing those services (and changes in those costs).

The task of setting an initial regulatory asset value for the assets used by a business in providing water and wastewater services involves determining a notional cost associated with the business's existing assets for the purpose of reflecting this cost in prices that the business is allowed to charge.

2.2 Regulatory asset values and accounting asset values

The water and wastewater service providers that are the subject of the current study of prices have not previously been subject to rigorous, cost-based regulation of prices. As a consequence, these businesses have not established the accounting systems (in particular the keeping of regulatory accounts) that are the norm in other utility industries where cost-based regulated has been implemented, for example in the gas pipeline industry, electricity transmission and distribution in the eastern states of Australia and telecommunications networks. While these businesses may have asset values established for accounting purposes (i.e. written down book values), these asset values are not necessarily the appropriate basis for the valuation of assets for regulatory purposes. To see why this is the case, it is necessary to differentiate between the different sets of financial accounts that a firm may maintain, and the purpose of asset valuations in the different sets of accounts.

A water-services business will maintain statutory accounts. A for-profit business will – and a government-owned or community-sector business may – also maintain taxation accounts. Where the prices of the business are regulated, the business may also maintain regulatory accounts.

Each of these sets of accounts will include values ascribed to asset values, revenues, costs, and allowances for depreciation. However, the values of these items, including the value ascribed to the business's physical assets, may (and indeed may properly) differ between the three sets of accounts. The reason for this is that the accounts are maintained for different purposes and according to different accounting rules and conventions.

- The purpose of statutory accounts is to make a representation to share holders – and other stakeholders in the business – of the financial performance and financial status of the business. Assets values are entered in the accounts according to accounting standards that seek to make a representation as to the value of the assets to the business. This may reflect, amongst other things, the value of each of the assets of the business in terms of its income generating potential or its market value. The value of assets may be written up or written down according to changes in these valuations.
- The purpose of taxation accounts is to present an assessment of the net income of the business and the liability of the business to pay taxation. Costs that are of a capital nature may be entered as a cost and netted against gross income over several time periods according to standard depreciation schedules established especially for taxation accounting. Asset values in taxation accounts represent the residual, or undepreciated, value of capital costs that may be netted against gross income in future time periods.
- The purpose of regulatory accounts is to ensure that prices are set at a sufficient level to allow the business to recover the cost of providing the services, but no more than this cost. In incentive-based regulation involving the use of price caps, costs are (in principle) the forecast "efficient" costs of providing services, which may differ from the actual costs that are ultimately incurred by the business, and include allowances for a rate of return on assets (calculated on the basis of a forecast cost of capital) and a recovery of capital (depreciation). Asset values in regulatory accounts represent unrecovered amounts of initial investment, based on initial asset values and recovery of costs according to a pre-determined depreciation schedule. More particularly, regulatory asset values are typically initially set with regard to a range of considerations, and then changed over time in a manner consistent with ensuring that prices reflect an opportunity for the businesses to recover a commercial return on initial regulatory asset value and subsequent capital expenditure, and a return over time of the value of those funds invested over time of the initial regulatory asset value and subsequent capital expenditure (through regulatory depreciation).

As asset values in statutory accounts, taxation accounts and regulatory accounts are entered into each of the sets of accounts for different reasons and in accordance with different accounting rules, there is no necessary or desirable equivalence between the asset values in each of the three sets of accounts. This is not to say, however, that there is not some interrelationship between the different sets of accounts in respect of asset values. For example, where cost-based regulation is imposed, the regulatory asset value first established will affect the prices that the business is able to charge and the revenue that the firm is able to earn. This may cause the firm to write-down or write-up the asset value presented in statutory accounts. As a further example, asset values indicated in regulatory and taxation accounts will both be affected by new capital investment.

As already indicated above, none of the Water Corporation, Aqwest or Busselton Water maintains regulatory accounts. The purpose of the analysis of regulatory asset values in this study has therefore been to provide an opinion on what the appropriate regulatory values of assets would be if cost-based regulation of prices were to be introduced for these businesses.

2.3 The problem of determining an initial regulatory asset value

It is not uncommon for a regime of price regulation to be imposed on an established business. In such a case, and as indicated above, the task of setting an initial regulatory asset value for the assets used by a business in providing water and wastewater services involves determining a notional cost associated with the business's existing assets for the purpose of reflecting this cost in the prices (or maximum prices) that the business is allowed to charge. Capital expenditure made after the initial valuation may be entered into regulatory accounts either at cost, or at a deemed efficient cost if there is some doubt as to the necessity, prudence or efficiency of capital expenditure.

Determination of an initial regulatory asset value for the assets of an established business is not a straightforward exercise.

Economic principles do not provide unambiguous guidance for the setting of a regulatory value for monopoly network assets at a particular point in time, but rather are typically interpreted as providing a feasible range.

- A binding lower limit for the asset valuation is that which is consistent with generating returns to the owner sufficient for the owner to have the incentive to continue to use the asset for the regulated activity, which implies that the owner must receive a return at least as good as it would if the asset were used in its next best use. The asset value meeting this criterion is commonly referred to as "scrap value". Except for assets like freehold land, the value of network assets in alternative uses is typically very low.
- An upper limit that is typically posed is the value that is consistent with the price that would be charged by a hypothetical (efficient) new entrant. The rationale for this valuation derives from the observation that, in a perfectly contestable market, prices would reflect the cost structure of the efficient new entrant. Thus, it is argued that prices would contain monopoly rents if they were higher than would be earned in a contestable market, and so this should place a cap on the regulatory valuation. A DORC valuation – if implemented correctly (as described in section 2.4 of this report) – provides an estimate of the regulatory value for an existing asset that is consistent with the cost structure and prices of the hypothetical (efficient) new entrant that operates with a new asset.

While economic principles suggest that regulated assets should not be valued at less than scrap value or more than a (correctly-determined) DORC value, the principles do not provide guidance as to whether a regulatory asset value should be set as scrap value or at DORC value, or at any particular value in between. There is no economic efficiency reason for regulated assets to be valued at a level that is commensurate with the cost structure of a hypothetical (efficient) new entrant.[1] Efficiency requires that prices reflect cost – the relevant cost being marginal cost – which is primarily a question of price structure rather than the average level of prices.

[1] This issue was discussed extensively in the report that we wrote on asset revaluation for the ACCC: The Allen Consulting Group 2003, *Methodology for updating the regulatory value of electricity transmission assets*, www.accc.gov.au.

One argument in favour of a valuation based upon the prices that would be set by a hypothetical (efficient) new entrant – a DORC value – is that the outcome of a contestable market should be taken as a definition of monopoly rent and unless prices are above the hypothetical (efficient) new entrant level consistent with the DORC value of assets, there is no rationale for intervention. However, while this argument is often given weight by regulators, the argument does not derive from a well-considered analysis of economic efficiency, and so need not prevail over other possible considerations.

There are many examples of regulatory values being set at values lower than the estimates of DORC to reflect other concerns, the primary concern being a desire for the introduction of regulation to not lead to a rise in prices from those previously prevailing. Thus, the regulatory values for the predominantly-rural Victorian electricity distributors were determined at a discount to DORC to limit the magnitude of potential price increases experienced end users of electricity.[2] A similar approach was adopted for the AlintaGas gas distribution networks in Western Australia,[3] and AGL Gas Networks in New South Wales.[4] These valuation methodologies are generally presented as a version of a deprival value, being an asset value that is implied by existing prices for, and revenues from, the relevant services.

There are also practical considerations in valuation of assets at above scrap value. In particular, a regulated business has minimum requirements for revenue to secure and service debt and, in part, to finance business expansion. These minimum revenue requirements (and associated prices) may imply regulatory asset values in excess of scrap value.

2.4 Asset valuation methodologies

In view of the limited guidance provided by economic theory in determination a regulatory asset value for the existing assets of a business, a range of asset valuation methodologies have commonly been applied or considered in determining values. These include:

- historical cost values;
- replacement cost and optimised replacement cost;
- depreciated optimised replacement cost;
- deprival value and optimised deprival value; and
- a "line in the sand" valuation.

These valuation methodologies are defined and described as follows.

[2] Office of the Regulator General, Victoria, October 1998, *Access Arrangements - Multinet Energy Pty Ltd & Multinet (Assets) Pty Ltd, Westar (Gas) Pty Ltd & Westar (Assets) Pty Ltd, Stratus (Gas) Pty Ltd & Stratus Networks (Assets) Pty Ltd Final Decision*, pp 51 – 70

[3] Independent Gas Pipelines Access Regulator Western Australia, 30 June 2000, *Final Decision: Access Arrangement Mid-West and South-West Gas Distribution Systems*, Part B pp 73 – 84.

[4] Independent Pricing and Regulatory Tribunal of New South Wales, July 2000, *Final Decision Access Arrangement for AGL Gas Networks Limited Natural Gas System in New South Wales*, pp 71 – 88.

Historical Cost

An historical cost value of regulated assets refers generally to a value derived as a sum of the actual cost assets and subtraction of any subsequent return of capital or depreciation of the assets. An historical cost value is often referred to as a "depreciated actual cost" or "DAC".

Different methodological approaches may be taken to determination of DAC value.

"Actual costs" of the assets may be considered as either the actual cost of construction of assets, or the cost of purchase of the assets by the current owner. In determining a DAC value for regulatory purposes, the historical costs of asset construction have generally been considered. The use of historical costs of construction rather than costs of purchase of the assets by a current owner has been held to be the appropriate basis for determination of a DAC value under the National Gas Code by the Western Australian Supreme Court.[5]

Actual costs of construction may also be considered differently in terms of date of valuation, being considered either in historical cost values or escalated to dollar values at a particular time. The appropriate approach in this respect is a matter related to the approach being taken for determination of regulated prices, that is, calculation of regulated prices in nominal or real terms considering nominal or real rates of return.

Approaches to determining accumulated depreciation of assets may also vary. Most commonly, depreciated asset values have been taken to be written down values of assets in statutory accounts. However, depreciation allowances have also been determined by other methods.

- In determination of a DAC value for the Dampier to Bunbury Natural Gas Pipeline under the National Gas Code, the Independent Gas Pipelines Access Regulator in Western Australia determined values of depreciation as values of capital recovery explicitly provided for in historical tariffs for gas transmission determined either under regulation or under contracts.[6]
- In determination of a DAC value for the Goldfields Gas Pipeline, the Economic Regulation Authority in Western Australia (the successor entity to the Independent Gas Pipelines Access Regulator) has determined values of depreciation by a capital recovery calculation consistent with a concept of economic depreciation.[7] Under this calculation, capital recovery was determined in each of the quarterly periods since commencement of construction of the pipeline assets as the value of revenue above costs, where costs include a benchmark return on the residual asset value in the relevant quarterly time period. Where revenue was less than costs in any quarter, the implied "loss" was capitalised into the asset value in the subsequent quarter.

[5] *Re Dr Ken Michael AM; Ex Parte Epic Energy (WA) Nominees Pty Ltd & Anor* (2002) 25 WAR 558.

[6] Independent Gas Pipelines Access Regulator Western Australia, 21 June 2001, *Draft Decision: Proposed Access Arrangement Dampier to Bunbury Natural Gas Pipeline*, Part B p 122.

[7] Economic Regulation Authority, 29 July 2004, *Amended Draft Decision on the Proposed Access Arrangement for the Goldfields Gas Pipeline*, pp 19 – 22.

Replacement cost and optimised replacement cost

A replacement-cost valuation of infrastructure assets is, as the name suggests, the cost of replacing the existing assets on a "new for old" basis. At its simplest, this valuation methodology would involve estimating the cost of constructing the infrastructure assets at the present time. However, a replacement-cost valuation is not usually undertaken in this manner. Instead, a replacement cost valuation is usually undertaken taking into account available modern technologies, and directed at determining the cost that would be incurred in constructing new assets using modern technology and to provide the same "service potential" as the existing assets. A valuation made in this manner is commonly termed an "optimised replacement cost".

The use of an optimised replacement cost as an asset valuation methodology is mandated under the Western Australian rail access regime. Under the *Railways (Access) Code* of Western Australia, a regulatory asset value for a railway system is required to be determined as a "gross-replacement-value" that is calculated as the lowest current cost to replace existing assets that:

- have the capacity to provide the level of service that meets the actual and reasonably projected demand; and
- are, if appropriate, modern equivalent assets.[8]

By virtue of the requirement to consider "modern equivalent assets", the gross replacement value as defined in the *Railways (Access) Code* in Western Australia is closer to the concept of an optimised replacement cost than to a replacement cost. Changes in technology since the assets were constructed and different expectation of use of the assets may cause the "modern equivalent" or "optimised" assets to be different from the existing assets, although the service notionally provided is the same.

Determination of optimised-replacement-cost values for assets may be undertaken under a range of different constraints and assumptions.

- *The level of service potential to be reproduced.* An optimised replacement cost may be determined to reproduce the "service potential" of the existing assets (i.e. the maximum level of service able to be offered) or to achieve a "required level" of service, for example to meet current or forecast level of demand for the service, even though this may be less than the service potential of the assets.
- *Assets included in the valuation.* Certain assets may be explicitly excluded from the valuation. Using again the *Railways (Access) Code* of Western Australia as an example, this code explicitly requires that the value of land on which railway assets are located be excluded from the valuation, although improvements to land (such as railway cuttings and embankments) are to be included.[9]

[8] *Railways (Access) Code 2000* (Western Australia), schedule 4, clause 2.

[9] *Railways (Access) Code 2000* (Western Australia), schedule 4, clause 2.

- *The extent of optimisation.* The extent of optimisation of an asset may vary. At the simplest level, optimisation may involve just removing any surplus assets or excess capacity from the asset or from elements of the asset.[10] At a more complex level, optimisation may involve reconfiguration of the asset[11] or even fundamental change in the nature of the assets used to deliver the service.

- *"Brownfields" or "greenfields" assumption*. The replacement cost of the asset may be determined on the basis that there is no basic infrastructure in place (easements, roads, etc.) – the greenfields assumption – or that the basic infrastructure is in place – the brownfields assumption.[12]

- *One-off or incremental asset development*. The optimised asset may be determined to be an asset configuration that would be constructed if the new asset was constructed in its entirety at a single point in time, or may be determined as an asset configuration reflecting that which would have occurred if the asset was developed in incremental stages over time.[13]

For reason of the different approaches and assumptions that may be made in determining an optimised replacement cost, different parties determining an optimised replacement cost for the same asset may derive substantially different values.

Depreciated optimised replacement cost

A depreciated optimised replacement cost (DORC[14]) is derived by scaling down of an estimated optimised replacement cost of an asset to reflect the lower value of the existing (old) asset relative to a new asset. This can also be described as determining a value of the existing asset to a service provider given the option of constructing a new asset.

A lower value of an existing asset relative to a new asset may result from:

- a difference in the service potential of the existing asset and the new asset, such as resulting from a difference in the quality of service able to be provided by the new asset (e.g. greater reliability) or a longer future service life of the new asset relative to the existing asset; and

- a difference in the future cost of operation of the existing asset and the new asset (e.g. lower costs of maintenance of the new asset).

Determination of the DORC value from the optimised replacement cost to reflect these differences in value would be calculated by the following formula.

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10 This level of optimisation is specified in New Zealand guidance for determination of optimised replacement cost for electricity line businesses: Ministry of Economic Development, October 2000, *Handbook for Optimised Deprival Valuation of System Fixed Assets of Electricity Line Businesses* 4th Edition, p14.

11 For example, in determination of an optimised replacement cost value for the Goldfields Gas Pipeline in Western Australia, the Economic Regulation Authority in that state determined the cost for a pipeline of smaller diameter and higher compression than the existing pipeline (Economic Regulation Authority, 29 July 2004, *Amended Draft Decision on the Proposed Access Arrangement for the Goldfields Gas Pipeline*, para 107).

12 ACCC, 27 May 1999, *Statement of Principles for the Regulation of Transmission Revenues* (draft), pp 43, 44.

13 This aspect of optimisation was recognised by Sinclair Knight Mertz (April 2002, *Optimisation Assessment for the SPI PowerNet Network*, p 12) which recommended that the "incremental development" approach to optimisation be adopted in the circumstance of an electricity network.

14 Also commonly referred to as an "optimised depreciated replacement cost" or ODRC value.

$$DORC_0 = ORC_0 - \sum_{t=1} \frac{Serv_{New,t} - Serv_{Existing,t}}{(1+r)^t} - \sum_{t=1} \frac{Cost_{Existing,t} - Cost_{New,t}}{(1+r)^t}$$

where $DORC_0$ is the DORC value at the current time, ORC_0 is the optimised replacement cost at the current time, $Serv_t$ is the value of the service potential of the relevant asset in time period t, $Cost_t$ is the forward looking cost of operating and maintaining the asset in time period t, and r is the discount rate.[15]

It is evident from this formulation that the derivation of the DORC value from the optimised replacement cost would, if undertaken in a manner consistent with this formulation, require substantial information, including:

- a forecast of the future operating and capital cost associated with providing the service using the new asset in each time period into the indefinite future, with this cost estimate taking account of all of the factors that would affect the efficient cost of providing the service using the optimal system;
- a forecast of the future operating and capital cost associated with providing the service using the existing asset in each time period into the indefinite future; and
- an estimate of the value associated with any differences in the service potential between the existing and optimal asset.

Perhaps because of these information requirements, the above "conceptually correct" derivation of DORC from optimised replacement cost is rarely used in practice. The common method for depreciating the optimised replacement cost to a DORC value has been to use a standard financial accounting approach (generally either straight-line or annuity depreciation). That is, to scale down the cost of the new asset to take account of the expired age of the asset in place. This "conventional" approach is recommended by some government economic and regulatory agencies.[16] The approach of depreciating by an accounting methodology contrasts with the conceptually-correct adjustment, which is to adjust the optimised replacement cost value upwards or downwards to reflect the difference between the forward-looking cost of continuing to operate the old and new asset, and upwards or downwards to reflect the difference between the service potential and operating costs of the old and new assets.

The conventional use of accounting methods of depreciation to derive DORC from optimised replacement cost has also been associated with a consideration that the depreciation of optimised replacement cost to DORC should also be the value of historical recovery of capital by the asset owner.[17] This rationale for depreciation is inconsistent with the concept and intent of a DORC value, and has been determined to be an inappropriate consideration in respect of a DORC value of regulated utility assets in a recent decision of the Australian Competition Tribunal.[18]

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15 This formula is taken from "The Allen Consulting Group, August 2003, *Methodology for Updating the Regulatory Value of Electricity Transmission Assets*, report to the Australian Competition and Consumer Commission. It is assumed for simplicity that all costs and revenues are incurred at the end of each time period.

16 ACCC, 27 May 1999, *Statement of Principles for the Regulation of Transmission Revenues* (draft), p 47; Ministry of Economic Development (New Zealand), October 2000, *Handbook for Optimised Deprival Valuation of System Fixed Assets of Electricity Line Businesses* 4th Edition, p19.

17 Sinclair Knight Merz, June 2001, *Depreciation within ODRC Valuations*, report to the Australian Competition and Consumer Commission, p14.

18 Australian Competition Tribunal, *Application by East Australian Pipeline Limited* [2004] ACompT 8.

Deprival Value

A general definition of deprival value is the value of an asset to the owner considered in terms of the loss that would be incurred by the owner if deprived of the asset. This concept of value derives from considerations of value by Bonbright (1937): “the value of property to its owner is identical in amount with the adverse value of the entire loss, direct and indirect, that the owner might expect to suffer if he were to be deprived of the property”.[19]

Various working definitions of deprival value exist. Baxter (1971) extended Bonbright’s concept of deprival value to a valuation methodology for accounting purposes as the lower of replacement cost or “expected direct benefits”.[20] A similar working definition was adopted by the Australian Commonwealth Government: “in most cases [deprival value] will be measured by the replacement cost of the services or benefits currently embodied in the assets”.[21] These working definitions are consistent with a deprival value of assets being the lesser of the net present value of the income able to be generated by the asset, and the replacement cost of the asset.

Under these definitions, however, it is apparent that if a person deprived of an asset were to be compensated by provision of a new asset, that person would be made better off by the difference in value of the old and new assets. For this reason, working definitions of deprival value have also included deprival value as being the lesser of the net present value of the income able to be generated by the asset, and the *depreciated* replacement cost of the asset, or the DORC value of the asset. A deprival value defined as the lesser of the net present value of the income able to be generated by the asset and the DORC value of the asset, is also referred to as an optimised deprival value (ODV).

The New Zealand Government has produced detailed guidelines for determination of ODV values for electricity network assets, under which ODV values for individual segments of an electricity network are determined as the lesser of:

- the DORC value of the network segment, being the replacement cost of the existing fixed system assets with modern equivalent assets, depreciated by a straight-line depreciation methodology according to the age of the existing asset relative to the expected total life of the existing asset; and
- the net present values of future revenues derived from the transmission or distribution service provided by the network segment.[22]

In these guidelines, the New Zealand Government has indicated that it would expect the economic value of a network segment to be less than its DORC in circumstances where regulated tariffs for the network segment are less than the tariff that would correspond to (or be derived from) the DORC value of the relevant network assets.

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19 Bonbright, J.C., 1937. T*he Valuation of Property*, The Mitchie Company. Cited in Clarke, F.L., 1998, Deprival value and optimised deprival value in Australian public sector accounting: unwarranted drift and contestable serviceability, *Abacus* 34(1) pp 8–17

20 Baxter, M., 1971, *Depreciation*: Sweet & Maxwell, p 36. Cited in Clarke, 1998, op cit.

21 Steering Committee on National Performance Monitoring of Government Trading Enterprises, October 1994, *Guidelines on Accounting Policy for Valuation of Assets of Government Trading Enterprises: Using Current Valuation Methods*. Cited in Clarke, 1998.

22 Ministry of Economic Development (New Zealand), October 2000, Handbook for Optimised Deprival Valuation of System Fixed Assets of Electricity Line Businesses.

The Australian Commonwealth Government issued guidelines for determination of deprival values of assets of government trading enterprises that added an extra element to the determination of deprival values, being the consideration of whether or not the assets would be replaced if they were no longer available:[23]

> 175. Deprival value is to be used as the method of application of current value methodology for assets of GTEs participating in the performance monitoring exercise. Under this approach, assets are valued at an amount that represents the loss that might be expected to be incurred by an entity if that entity were deprived of the service potential or future economic benefits of these assets at the reporting date. Thus the value to the entity in most cases will be measured by the replacement cost of the services or benefits currently embodied in the asset, given that deprival value will normally represent the cost avoided as a result of controlling the asset and that the replacement cost represents the amount of cash necessary to obtain an equivalent or identical asset.
>
> 176. Under this methodology
>
> a. where the service potential or future economic benefits embodied in the asset would be replaced if the GTE was deprived of the asset, the primary bases for valuation of assets are:
>
> (i) current market (buying) price of a similar asset - where a similar asset can be purchased;
>
> (ii) current replacement cost of the same service potential or future economic benefits of the existing asset - where a different asset having a similar purpose can be purchased; or
>
> (iii) current reproduction cost of the same service potential or future economic benefits of the existing asset where the above techniques are not applicable.
>
> b. where the service potential or future economic benefits embodied in the asset would not be replaced if the GTE was deprived of the asset, the basis for valuation of assets is the net present value of the cash flows expected from continued use and subsequent disposal of the asset.
>
> c. surplus assets (that is, assets held for sale without replacement) are to be measured at their current net market selling value.

Under the Commonwealth Government guidelines, where an asset would be replaced the deprival value is taken to be the current replacement cost of the asset or of an alternative asset with the same service potential. Depreciation of a replacement value to reflect the age of the existing asset is not explicitly contemplated, although an accountant may interpret the terms “similar asset” and “the same service potential” as taking into account the age of the existing asset and hence valuation at depreciated replacement cost or DORC.

There are two common problems in determining deprival values for regulated infrastructure assets.

Firstly, for regulated infrastructure assets, the future prices of services provided by these assets will be regulated and determined from the regulatory asset value. There is an obvious circularity in the asset valuation at a deprival value and the dependence of the deprival value on prices that would be determined from that value.

Secondly, it may be difficult to determine an economic value for a set of assets where there is no clearly identifiable revenue stream for those assets, for example where a deprival value is to be determined for network assets within a vertically integrated utility business where revenues relate only to the retail sale of utility services and implicitly include revenues attributable to the wholesale, network and retail business units of the utility business.

[23] Steering Committee on National Performance Monitoring of Government Trading Enterprises, October 1994, *Guidelines on Accounting Policy for Current Valuation of Assets*, pp 44, 45.

A "line in the sand" valuation

Valuations of regulated assets have been determined by methodologies conceptually similar to deprival values for gas distribution networks in Australia while seeking to avoid the circularity problems inherent in the deprival value methodology. For example, the regulatory asset base for the AlintaGas Distribution Networks in Western Australia was determined to be a value of less than DORC through consideration of an economic value. The economic value for the networks was, in effect, determined by assuming values for all cost elements in the retail supply of gas other than the value of the distribution networks, and then solving for the value of the networks that gave a total cost for gas supply that corresponded to the revenue that would be generated by the prevailing retail gas prices.[24] Similar methodologies were applied in valuation of gas distribution assets of AGL Gas Networks in New South Wales and two of the three gas distributors in Victoria.[25] In each case, assets were valued by this methodology at a value less than the estimated DORC value, with the explicit intent of establishing an initial regulatory asset value that would not give rise to increases in retail gas prices for end users of gas.

2.5 Changing a regulatory asset value

In contrast to the setting of an *initial* regulatory asset base, economic principles provide substantial guidance for the approach that should be taken to revaluing assets over time. That guidance being that the method of revaluation, when combined with all other elements of the regulatory framework, must provide investors with expectations of making a reasonable return on new investment and the return of that capital over time. That is, the revaluation method must be consistent with providing incentives for investment. While there are different possible approaches to revaluation – with the different approaches implying a different allocation of the market risk between customers and investors – the principle that investors must expect to make sufficient returns on the value of investment is paramount.

The overriding consideration in determining an appropriate methodology for the re-valuation of assets is consistency of the revaluation methodology with provision of incentives to private investors in the transmission assets for efficient investment, while at the same time providing incentives to minimise costs in service provision. This is considered to be best achieved by a "roll-forward" methodology, whereby the regulatory asset value is updated between periods by adjustment for capital expenditure, depreciation, asset disposals and inflation.

24 Independent Gas Pipelines Access Regulator Western Australia, 30 June 2000, Final Decision: Access Arrangement Mid-West and South-West Gas Distribution Systems, Part B pp 73 – 84.

25 Independent Pricing and Regulatory Tribunal of New South Wales, July 2000, Final Decision Access Arrangement for AGL Gas Networks Limited Natural Gas System in New South Wales, pp 71 – 88. Office of the Regulator General, Victoria, October 1998 Access Arrangements - Multinet Energy Pty Ltd & Multinet (Assets) Pty Ltd, Westar (Gas) Pty Ltd & Westar (Assets) Pty Ltd, Stratus (Gas) Pty Ltd & Stratus Networks (Assets) Pty Ltd Final Decision, pp 51 – 70.

The argument for applying a roll-forward methodology for re-valuation of assets at each regulatory reset is still relevant but perhaps less strong in the circumstances of a water service provider where capital investment would occur in large part to meet community service obligations in service provision rather than responding to commercial incentives. In this context, greater importance may be given to a re-valuation methodology that maintains consistency and transparency in the determination of regulated prices for water services and valuation of the community service obligation. However, even in this context the roll-forward methodology would be preferred over other methodologies of re-valuation (such as DORC or deprival-value methodologies) that do not reflect costs actually incurred. Under the roll forward methodology, the extent of under-recovery of costs (including capital costs) of service provision would be transparent in regulatory accounts.

2.6 Asset valuation for contestable elements of a water business

Regarding the valuation of assets in the potentially contestable parts of the industry, the appropriate methodology is to value the assets in a manner that reflects their likely market value in the contestable market (that is, in the period after contestability has emerged). A value that reflects the price that would be charged by a hypothetical (efficient) new entrant is likely to provide a reasonable estimate of that value, for which the DORC methodology provides an estimate.

2.7 Guidelines and requirements for asset valuation

On 27 February 1998, guidelines for pricing of water services were endorsed by the Agriculture and Resource Management Council of Australia and New Zealand. These guidelines indicate that assets should be valued by the deprival value methodology unless another method is justified in specific circumstances.[26] None of the business-specific legislation for the Water Corporation, Aqwest or Busselton Water provides guidance as to the manner in which prices should be determined or the manner in which assets should be valued if prices are to be determined to reflect costs.

2.8 A pragmatic approach to asset valuation

As indicated above, the only formal guidance provided for the regulatory valuation of assets of water service providers in Western Australia is the requirement of the guidelines for pricing of water services were endorsed by the Agriculture and Resource Management Council of Australia and New Zealand that assets be valued by the deprival valuation methodology unless another method is justified.

[26] National Competition Council, June 1998, *Compendium of National Competition Policy Agreements* Second Edition, p 112.

Despite the standing of this guidance as part of an intergovernmental agreement, deprival value is an accounting concept developed for the purposes of monitoring the performance of government trading enterprises and has no particular standing or merit in regard to determining an initial value of assets for regulatory purposes. Other valuation methodologies, including historical cost and DORC valuations, similarly lack any overriding merit in determining an initial value of assets for regulatory purposes. There is good reason to determine initial regulatory asset values at some point within the range of scrap value and DORC, but economics provides no guidance as to where in this range the value should be set.

The determination of an appropriate initial regulatory asset value for a particular set of assets is therefore by necessity a pragmatic determination, with the most appropriate valuation determined by consideration of the particular circumstances of the regulated business and the outcomes of the valuation. This has been evident in past regulatory valuations of utility assets throughout Australia wherein regulators have given consideration to, *inter alia*, the reasonable expectations and legitimate business interests of the owners of regulated assets prior to determination of regulatory values, and the impacts of regulatory asset values on the users of the assets and the end users of the services provide by use of the assets. Taking these factors into account, regulated assets have been at various times valued at substantially less than, close to, and even in excess of DORC values.

For the Western Australian water-service providers, relevant factors to take into account in a pragmatic determination of the regulatory asset value are considered to be as follows.

Firstly, the asset valuation should recognise the particular context of the water service providers as being, in reality or in effect, government-owned businesses that are required to be self sustaining in terms of generating sufficient revenue to cover costs. The regulatory asset value ascribed to infrastructure assets is a significant parameter in the determination of regulated prices for infrastructure access, and/or regulated prices for infrastructure services to end users. As such, the determination of a regulatory asset value will affect the revenues and values of the infrastructure businesses.

Government ownership of a business has particular implications that do not apply to a privately owned business in respect of revenue generation and the coverage of costs. While bother privately-owned and government-owned businesses may be required to recover costs and make a return on investment, the revenue requirements of a government business may extend beyond this requirement to generating sufficient revenue to cover the costs of new capital investment without raising further equity. The reason for this is that it may be "politically difficult" for a government-owned business to raise funds for new investment through an equity injection from its shareholder (i.e. the government) as a financial injection into the business may be perceived as symptomatic of inadequate performance of the business, despite the fact that capital markets may fully accept, and even welcome, a privately owned business in a similar position seeking to raise an equity injection. For this reason, a practical "floor" to the regulatory asset values for the Western Australian water service providers may be that which is commensurate with prices and revenue sufficient for the businesses to remain commercially viable, stand-alone entities, able to finance ongoing operations and new investment without further injections of funds from the State Government.

Secondly, the valuation of assets at any level above the practical floor for asset valuation will affect the value of the business. Higher asset valuations would correspond to higher "cost-reflective" prices and greater revenues, and hence greater value of the businesses through higher profits (for the notional for-profit business of the Water Corporation) or higher accumulation of cash reserves (for the notional "not-for-profit" businesses of Aqwest and Busselton Water). The level of returns that the Government desires to be made from the businesses (through the combination of taxation receipts, dividends and accumulation of reserves) is therefore a factor of relevance in determining the appropriate regulatory asset value for each business.

Thirdly, the regulatory asset value of a business may affect the future values of payments that the Government makes to the businesses in return for the businesses meeting community service obligations (CSOs) for the provision of services at prices less than prices than would be justified on the basis of the regulatory asset value. A higher regulatory asset value will, all other things being equal, imply a higher notional cost of providing a service. Hence, where the Government seeks (as its does for the Water Corporation) to set service prices for particular classes of customers at a ceiling that is below a notional cost of service provision, higher regulatory asset values will imply greater differences between the prices and notional costs of service provision, and hence a higher value of CSO payments that the Government may make to the businesses for the provisions of these services at prices "below cost". The willingness of Government to make CSO payments is therefore a factor of relevance to determining the appropriate regulatory asset value for each business.

As a related matter, however, for government-owned businesses, the Government has the ability to make trade-offs between, on the one hand, the regulatory asset value of the infrastructure assets and the value of the business, and on the other hand the future value of CSO payments. This may be a future, as well as current, consideration in establishing a regulatory asset value depending upon the Government's policy in respect of future prices for water services and CSO payments.

- If the Government's policy were to be the removal of CSO payments over time and allow prices to be cost reflective, then a mechanism to facilitate this would be to determine a low regulatory asset at the current time that minimises CSO payments, and then allow the regulatory asset value and network and service prices to trend upwards over time as the asset base is increased by the actual cost of new and replacement assets.

- Alternatively, if the Government's policy is for the maintenance of both prices at current levels into the future (at least in real terms), then a choice remains as to how the cost associated with these lower prices should be presented in the State's budget statements. One option would be a valuation at a DORC value (or at least at the value implied by the total revenue currently gained by the electricity business through sales and CSO payments), which would imply that the asset value, regulated prices and value of CSOs would maintain a similar relativity into the future. A second option would be for the lower regulatory asset value referred to in the bullet-point above to be adopted, which would imply a reduction in CSO payments and commensurate reduction in earnings to the utility business. The CSO payments would be expected to increase over time as new capital expenditure is included in the regulatory asset value at full cost – but it may take several decades for the CSO payments to rise to levels consistent with a DORC valuation.

A pragmatic approach to determining regulatory asset values may therefore involve consideration of the Government's intent in respect of both the value of the businesses and the current and future value of CSOs.

Chapter 3

Reviewing the Efficiency of Cost Forecasts

3.1 Introduction

The section of the methodology paper discusses the general issues associated with capital and operating cost forecasts, the accuracy of forecasts and the manner in which assessments of efficiency can be made.

The efficiency of forecast operating and proposed capital expenditure has been assessed using this general methodology for the Water Corporation's metropolitan operations and Aqwest's and Busselton Water's operations. The overriding aim of the review is to ensure the methodology behind future cost forecasts is consistent, transparent and technically sound.

3.2 General approach

Cost forecasting methodologies in the water industry vary both within, and between organisations and are generally dependent on the size of the organisation and available resources. A summary of forecasting techniques employed for both capital and operating expenditure is given below.

Operating costs

Operating costs cover all expenditure related to the overall operation of the business and include water and wastewater treatment plant operation (power, chemicals, labour, materials), plant and equipment, administration, salaries, contracted services, overheads and depreciation.

Methods commonly used to forecast operating costs include:

- extrapolation of historical costs, and adjusting for increases such as inflation and decreases such as expected efficiencies;
- review and updating of historic costs allowing for new levels of service; and
- bottom up predictions based on current activities.

A proportion of operating expenditure and overheads associated with the capital programme are allocated to capital schemes as highlighted in each company's cost allocation models.

Capital costs

Once the need for a capital scheme has been identified there are numerous ways of predicting capital costs, with increasing accuracy during the project's development:

- costs based on similar schemes, taking into account inflation and any physical differences;
- in-house or external cost estimates based on historical data, vendor quotes or costing tools;
- unit cost databases, recording historical costs and attributes for later re-use;

- tender prices, based on a defined scope of work; and
- bills of quantities and firm quotes during the construction phase.

Capital costs are generally broken down into direct and in-direct project costs in the development of overall scheme budgets. Direct costs include construction plant, labour and materials costs whilst indirect costs include items like corporate overheads, internal staff input, external consultants, historical scheme costs, contingencies and any risk allowance.

3.3 Capital cost forecasts

The review of capital cost forecasts needs to focus on the transparency and robustness of the cost forecasting techniques applied in each organisation. Capital cost forecasts are based on capital investment programs which are driven by asset management planning, strategic development plans, corporate directives, external drivers (regulatory, government, environmental, etc) and the supply-demand balance.

In larger organisations where capital programs exceed current budgets or borrowing capability, capital prioritisation is required. Sound capital prioritisation is undertaken using a risk based assessment framework taking into account the financial, operational, environmental, strategic and corporate implications of individual schemes.

Assessment methodology

To assess the efficiency of capital cost forecasting, and more generally the efficiency of capital delivery programs, a significant level of detailed data is required. For the purposes of the current study, an opinion on the efficiency of proposed capital expenditure programmes has been reached by reviewing the processes and methodologies behind capital delivery and capital cost forecasts. This involves undertaking an assessment and developing an informed opinion on the following.

- Capital delivery structure as it relates to the size of the organisation and in comparison with current industry best practice.
- Capital program drivers and how they relate to other organisations current drivers.
- Cost forecasting techniques, and their applicability to the size of the capital program.
- Robustness and level of accuracy of engineering estimates.
- The level of indirect costs applied to capital schemes, such as internal costs, risk and contingencies applied at a project or capital program level.
- Procurement practices in relation to current water industry best practice, both in Australia and overseas.
- The capital prioritisation process and the possible impacts/risks on the operation of the organisation.

This assessment provides an overall opinion on the efficiency of the organisation in relation to capital cost forecasting and capital delivery and should highlight where potential savings may exist.

To undertake the above assessment data related to capital forecasts and the capital delivery structure is required. When available, the following data have been obtained.

- the structure of the organisation as it relates to capital delivery. This includes the roles and responsibilities of departments including planning, asset management, procurement, project and program management, estimating and corporate approval.
- Strategic development plans, as appropriate to understand the background behind and process of determining the 5 year capital investment program.
- Capital program drivers
- Capital cost forecasts over the period, split at the financial year and project/scheme level.
- Forecasting cost databases including the form of the model, sources and age of data and inclusions/exclusions.
- Relevant previous projects and their capital estimating, delivery process and completion cost history.
- Data relating to in-house capital implementation costs including design, management, supervision, field team input and corporate overhead allowances.
- Information relating to capital procurement methods.
- Capital prioritisation process including the scheme approval process and internal reviews.

3.4 Operating cost forecasts

A review of operating cost forecasts assesses the cost components and forecasting methodology behind them. The overall aim of the investigation into operating costs is to ensure a reasonable and transparent approach has been applied to cost forecasting.

Assessment methodology

The review of operating costs is undertaken by examining data provided by the water authorities and further discussions with relevant staff. Data requirements include:

- Summaries of operating cost forecasts per annum, broken into operating functions and resources.
- Historical operating costs as required for various functions.
- Methodology behind future cost forecasts.
- Any constraints in regards to operating expenditure.

- Details on proposed efficiency gains including the allocation of gains to operating areas.

In reviewing the above data the following tasks need to be undertaken.

- Review of corporate structure and functions undertaken, both in-house and outsourced.
- Investigate the appropriateness of the functions undertaken, with reference to the private enterprise water/wastewater businesses.
- Examine predicted efficiency gains over the 2003/04 – 2008/09 period including reviewing the process behind predicting efficiency gains.
- Review operating cost structure for each organisation and business unit and the division between country and urban costs.
- Review of historical urban operating costs and predicted operating costs up to 2008/09.
- Obtain and review any previous investigations undertaken into corporate operations, structure or operational performance/benchmarking.

The investigation aims to provide an opinion on the potential for improvements in operating efficiency and the likely impacts on operating expenditure. An opinion on the efficient level of operating expenditure is be based around an overall assessment of each water provider, a review of the operations undertaken, size and age of the operational asset base and the associated customer base.

This is broadly achieved by reviewing predicted operational expenditure on a per customer basis, taking into account benchmarking issues discussed below. Costs are examined to identify any that appear abnormally high or low when compared to similar service providers.

3.5 Benchmarking

An assessment on efficient levels of capital and operating expenditure requires comparisons between other similar organisations, both public and private. Benchmarking can be undertaken on various aspects of a water utility, but is generally based on:

- financial comparisons of charges and costs on a per customer basis;
- service quality and operation;
- financial performance and returns; and/or
- customer satisfaction.

Comparisons and benchmarking between water and wastewater utility businesses are complicated by numerous regional issues that need to be taken into account. Some of the issues that need consideration are:

- the relative condition of the asset base;
- size, location and density of the service area;
- supply/demand balance and the security of supply provided;

- capacity of existing water/wastewater systems and ability to economically supply predicted growth areas;
- existing infrastructure and proposed technology utilised for water sourcing, treatment and distribution and wastewater treatment, reuse and/or disposal;
- current and future regulatory environment;
- differences in operating environments including supply standards, climate influences, and environmental factors; and
- political and social factors.

The benchmarking process for both capital and operating expenditure depends on the size of the organisation, but may include:

- an assessment of current capital and operating expenditure practices based on experience with private enterprise;
- regional or national reviews of similar water service providers using available information published by water authorities, Water Services Association of Australia and other government bodies;
- comparisons with the United Kingdom water industry which has just entered its fourth term of regulation.

The benchmarking process should be treated with some degree of caution given the number of variables and regional issues between organisations, however educated comparisons are seen to be of benefit.

Chapter 4

Cost Allocation and Price Determination

4.1 Introduction

Cost allocation in an environment of cost-based regulation of prices refers to the determination of a proportion of the total costs of the service provider that are recovered from particular customers or classes of customers, and from particular components of a price (for example, fixed and variable charges) that a customer or class of customers pays for the service. In effect, the cost allocation refers to the setting of prices for particular customers or classes of customers that recover the costs of the service provider.

The allocation of costs and setting of prices may, in a general sense, be accomplished in one of two ways:

- an explicit allocation of costs or shares of costs to customer classes and to particular components of a price structure, with the prices being an outcome of the cost allocation; and
- a determination of prices for customer classes and components of a price structure according to a range of commercial or other considerations and subject to a constraint that the prices set should not recover more than the total cost of the service provider, with the prices implying an allocation of costs.

Both approaches have been accepted under cost-based regulatory regimes in Australia. Examples are as follows.

- For the Dampier to Bunbury Gas Transmission Pipeline the service provider proposed, and the regulator accepted, a cost allocation approach for determination of zonal prices for gas transmission whereby costs were allocated to each of 10 zones and compressor stations of the pipeline, and prices for each zone were determined by (in effect) dividing the costs allocated to each zone and compressor station by the forecast quantity of gas passing through each zone and compressor station.
- For the Victorian electricity distribution systems, the service providers are subject to a "tariff basket" form of price control whereby the distributors have substantial flexibility in the setting of prices subject to maximum changes in prices from year to year, a constraint of a forecast of total revenue that may be recovered and maximum and minimum prices for particular customer classes, as described below.

Whatever approach is taken for the setting of prices, the resulting prices should meet requirements for economic efficiency.

4.2 Efficient Prices

Economic efficiency can be defined as an outcome whereby it is impossible to reallocate resources between uses, or to change production techniques, and/or to trade goods between customers in order to make consumers as a group better off.

Economic theory distinguishes between three components of economic efficiency:

- allocative efficiency – which means that the right mix of goods and services is being produced;
- productive efficiency – which means that the mix of goods and services is being produced at lowest cost; and
- dynamic efficiency – which means that the right mix of goods and services continues to be produced for the lowest cost over time.

In a market economy, producers and consumers respond to prices. Efficient prices are those that encourage efficient outcomes.

In a competitive market, the efficient pricing rule is price = marginal cost. As customers have to pay the cost that it takes society to produce any good, this rule will make them choose the goods and services they value most highly – allocative efficiency. Similarly, the producers who can produce for the lowest cost get to sell their wares – and so productive efficiency results. The role of competition is to force prices down to marginal cost so that when customers choose the lowest priced item, they are also selecting the lowest cost item for society to produce.

In an industry that is characterised with economies of scale and scope (such as gas distribution), setting of prices at marginal cost would leave investors unable to recover their costs (and so fail to attract investment into industry in the future, violating requirements for allocative and dynamic efficiency). The modified efficient pricing rule is that prices should:

- deliver revenue on a per customer basis that is lower than the stand alone cost of providing the service – which is the cost of duplicating the service to that customer, using least cost technology;
- deliver revenue on a per customer basis that is higher than the avoidable cost of providing the service – which is the cost that the service provider could avoid by ceasing to provide service to that customer (note that this is the requirement of section 8.38(a) of the Code);
- minimise the divergence in consumption of the service from efficient levels – the efficient use of the service would occur if all users paid the marginal cost of usage, hence where there are fixed costs to be recovered prices should be determined such that there is minimisation of the difference in consumption from a situation where customers were charged only marginal cost.

The first two criteria are commonly referred to as the upper and lower bounds for efficient prices.

The practical rationale for the upper bound is that if individual customers were charged more than the cost of duplicating their service (using least cost technology), then this might induce them to by pass the system. If this causes costs to be borne that exceed the avoidable cost of serving that customer through the existing system, then this would result in society incurring costs that are unnecessary and wasteful. As customers as a whole generally bear all of the costs incurred in providing their service, this would increase the total costs they would bear (i.e. costs of the incumbent and by passing system) and so increase average prices from what they otherwise would have been.

The practical rationale for the lower bound is that if customers pay less than the avoidable cost of providing their service, then:

- the customer might choose to take the service even thought they place a value upon it that is lower than the cost to society of providing it; and/or
- the customer might choose to take service through the existing network, even though there might be cheaper options available to provide the service potential (for example, if faced with the costs they cause, the customer might be happy with using electricity for all energy needs).

If customers take a service that they value at less than the cost of provision, then consumer benefit can be increased by diverting those resources to other uses, and if customers choose a higher cost means of providing a service (such as energy supply), then the costs incurred in providing that service to customers is higher, and so prices to customers for that service would be higher on average. In addition, if an individual customer causes more (forward looking) costs to be incurred than they pay for through tariffs (and other charges), then they generate more costs than revenue for the service provider – and so cause tariffs for all other customers to be higher as a result.

On the basis of these considerations of efficiency, a price structure should comply with the following broad criteria.

- All customers should pay at least the avoidable cost of the water supply and wastewater disposal service that they receive.
- For the last unit of a water supplied or wastewater disposed of, the marginal charge to the customer should be equal or close to the marginal cost of service provision.

Setting of prices within these bounds involves or implies an allocation of the joint or overhead costs of service provision across customers. As indicated above, principles of efficiency would dictate that the determination of prices within this range should be such as to minimise the effect on the usage of the service from the level of usage would occur if all customers paid the marginal cost of usage. As a general proposition, this efficiency objective would be met if the recovery of joint or overhead costs is preferentially from those customers with more inelastic demand for the services over the relevant price range.

4.3 Equity and social-policy considerations in price determination

There are also equity criteria against which a set of prices and the explicit or implicit cost allocation can be assessed. A price structure allocates costs across customers of a particular service. Generally accepted equity considerations often require that cost recovered from each customer cover at least the avoidable cost of providing the service and that common costs be allocated such that each User bears a share of these costs that meets generally accepted criteria of “fairness”. Such criteria may be highly subjective and implicitly dictated by government social policies, such as through assistance measures for low-income customers and uniform tariff policies for metropolitan and rural customers.

In practice, it is unlikely to be possible to implement prices and cost allocations that would meet all possible efficiency and equity criteria: indeed it is likely that different efficiency and social policy considerations may conflict with each other. As a consequence, a price structure will generally not meet strict criteria of efficiency and the achievement of all social policy objectives.

4.4 Fully-distributed-cost models for cost allocation

A fully-distributed-cost model allocates costs incurred by a multi-product and/or multi-customer business to individual products and to customers (or to components of prices and to customer classes, and hence in effect to particular customers).

Generally, fully-distributed-cost models allocate costs by:

- for those costs directly attributable to production of a particular product or to provision of a product to a particular class of customers, the costs are typically allocated to the relevant product and class of customers; and
- for costs that are of a common or shared nature (often referred to as overhead costs), the costs are typically allocated by cost-allocation "rules". These rules may allocate the common costs (or different components of the costs) according to criteria such as, for example:
  - in proportion to directly attributable costs; or
  - evenly across customers.

Chapter 5

Short-Run and Long-Run Marginal Costs

5.1 Short-run marginal costs

Definition and relevance to pricing of services

The short-run marginal cost is the cost of providing an additional unit of service — the marginal unit — on the assumption that all physical infrastructure is fixed.

A unit price for water at, or in excess of, short run marginal cost would ensure that when an additional unit of water is provided to a customer that the service provider receives additional revenue to equal to or greater than the additional costs incurred in providing the additional unit of water. Estimates of short-run marginal costs can be used to constitute a floor for water rates, that is, volumetric rates should be greater than short-run marginal costs. Such an approach to pricing of water services is recommended by the California Urban Water Conservation Council among others.[27]

Estimating short-run marginal costs

In the context of the current study, the short-run marginal cost for water supply services is considered as the cost of delivering an additional unit of water (in this case one kilolitre) given existing infrastructure constraints. For wastewater services, the short-run marginal cost is considered as the cost of collecting, treating and disposing of an additional kilolitre of wastewater given existing infrastructure constraints.

Estimating short-run marginal costs requires identification of the true variable operating costs that are immediately and directly affected by the quantities of water delivered or wastewater treated. In the case of water delivery, the variable costs of importance are pumping and treatment costs or, more specifically, the electricity and chemical costs incurred in water treatment and transportation of water from its source to its final destination. Both these costs vary directly with the quantity of water delivered. Similarly, the short-run marginal cost of wastewater treatment involves an assessment of pumping and treatment costs and how these costs vary with changes in quantities of wastewater treated and disposed of.[28]

Once the true variable (or avoidable) costs of water production (or wastewater disposal) are isolated, the process of estimating the short-run marginal cost is relatively straightforward and can be done using the following equation:[29]

$$SRMC = \frac{\text{Variable costs}_t}{\text{Quantity of service produced}_t}$$

[27] California Urban Water Conservation Council 1997, *Designing, Evaluating, and Implementing Conservation Rate Structures*, p. C-5.

[28] R. Warner 1996, *Water Pricing and the Marginal Cost of Water*, Occasional Paper No. 1, Urban Water Research Association of Australia, p. 6.

[29] R. Warner 1996, *Water Pricing and the Marginal Cost of Water*, Occasional Paper No. 1, Urban Water Research Association of Australia, p. 18.

5.2 Long-run marginal costs

Definition and relevance to pricing of services

The long-run marginal cost is the cost of providing an additional unit of service over a long-term time horizon where capital or physical infrastructure can be varied to meet changes in the supply and demand balance. A long-term perspective takes into account the cost of long-term investments in assets used to provide water and wastewater services. Customer habits and demand are largely influenced by long-term considerations and investment programs are typically framed with the long term in mind and capital projects frequently involve the construction of long-life infrastructure which requires long lead up times in terms of planning, design and construction.

Long-run marginal cost is considered by many analysts and regulators to embody an efficient price signal, and therefore they argue that, to the extent possible, volumetric rates or tariffs should reflect long-run marginal costs.[30] The arguments as to why volumetric water charges should reflect long-run marginal costs can be broadly summarised as follows.

- When based on long-run marginal costs, prices faced by customers reflect the forward-looking cost of providing the service — including the need to augment supply systems to meet future demand. As such, decisions made by customers on whether to increase or decrease consumption will reflect their willingness to finance the future costs that will be incurred as a result of their consumption behaviour.[31]
- Long-run marginal cost pricing enables water supply companies to recover all costs associated with the delivery of water including costs related to long-term supply issues — if water suppliers do not recover costs through the setting of appropriate tariffs they run the risk of exposing themselves to financial difficulties at some point in the future.[32]
- Setting prices based on long-run marginal costs prevents water service providers from generating monopoly profits. If prices are set equal to long-run marginal costs, it follows that average revenue per unit sold is equated with average efficient costs thus resulting in the utility earning a "normal" profit consistent with the opportunity cost of the investments made in the business.[33]

[30] For example, see Ofwat 2001, *The Role of Long Run Marginal Costs in the Provision and Regulation of Water Services*, Report A or Queensland Competition Authority 2002, *Gladstone Area Water Board: Investigation of Pricing Practices*.

[31] Ofwat 2001, *The Role of Long Run Marginal Costs in the Provision and Regulation of Water Services*, Report A, p. 2.

[32] Ofwat 2001, *The Role of Long Run Marginal Costs in the Provision and Regulation of Water Services*, Report A, p. 2.

[33] R. Warner 1996, *Water Pricing and the Marginal Cost of Water*, Occasional Paper No. 1, Urban Water Research Association of Australia, p. 8.

Of these arguments for setting prices equal to long run marginal costs, it is only these first that has some economic justification. Water consumption patterns of water consumers typically reflect long term decisions such as decisions by households on such matters as use of swimming pools, garden design and plumbing fittings; and decisions by commercial and industrial water users on production processes. The setting of prices equal to long-run marginal costs has the effect of causing the consumer to factor in the long-term costs of water services in these long-term decisions on water use.

The last two of the above arguments for setting prices at long-run marginal cost have limited support from economic principles. The ability of a provider of water services, and the scope for the service provider to earn monopoly profits, depends upon the total of charges paid by customers, which may include a range of fixed and quantitative charges, rather than the price paid by customers for the "last unit" of a service purchased. Indeed, charging for all units of a service at a unit price of long-run marginal cost may result in the service provider earning excessive profits as the prices would be based on costs that may be incurred by the service provider at some future time, rather than costs currently incurred.

Estimating long-run marginal cost

There are two general approaches that can be used to estimate long-run marginal costs:

- *the average incremental cost approach* — based on the incremental cost of a system augmentation; and
- *the Turvey approach*[34] — based on the costs incurred in an acceleration of growth in demand or the costs avoided by a deceleration in demand.

The two approaches have common elements within them, and in a broad sense each approach should yield comparable outcomes. Both approaches are sensitive to cost and quantity estimations and the application of each method requires estimates to be made of:

- future demand;
- future costs (both capital and operating); and
- inflation rates and discount rates.

The average incremental cost approach

The average incremental cost approach considers the level at which future increments of output must be sold to ensure recovery of incremental cost, given forecast changes in demand and hence supply. Specifically, the approach involves:

- consideration of the resource position over a suitably long-term period;
- forecasting demand over the same period;
- optimising various strategies available to generate the least-cost solution to addressing supply/demand imbalances; and

[34] Sometimes referred to as the perturbation approach.

- estimating long-run marginal costs as the present value of the expected extra costs of the optimal strategy divided by the present value of the changes in the supply/demand balance in terms of additional volumes of water supplied through additional supply schemes.

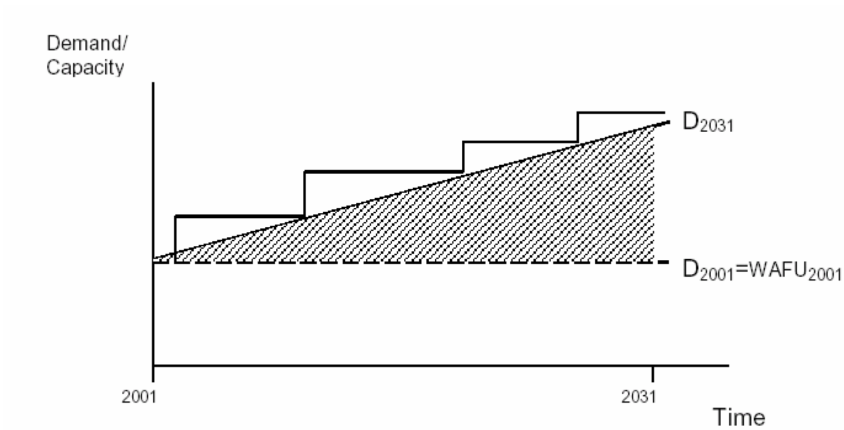
In short, the approach involves estimation of long-run marginal costs by using the following equation:

$$LRMC = \frac{PV \text{ (extra capital and operating costs of optimal strategy)}}{PV \text{ (additional volumes of water supplied)}}$$

A graphical illustration of the average incremental approach is provided in Figure 5.1. The figure illustrates the situation whereby the optimal long term strategy of the water supplier comprises increases in supply capacity such that supply keeps up with forecast demand (forecast for water demand in 2031 is illustrated by D_{2031}). Given existing capacity or water available for use ($WAFU_{2001}$) this implies a future supply deficit, equivalent to the shaded area. The supply/demand balance is maintained through four successive investment projects (depicted by the stepped line representing changes in capacity). Using the average incremental approach, the long-run marginal cost would be estimated as the present value of the costs of the investments required to close the supply deficit divided by the present value of the additional water supplied (depicted by the shaded area).

Figure 5.1

THE AVERAGE INCREMENTAL COST APPROACH



Source: OFWAT 2001, *The Role of Long Run Marginal Costs in the Provision and Regulation of Water Services*, Report C, p. 39.

The incremental cost approach requires an explicit understanding of the relationship between future costs and growth in water supply. In order to generate cost estimates that reflect the influence of changes in the volume of output, it is necessary to distinguish and disregard those costs that are unrelated to supply augmentation.

Similarly, the demand forecast used in the analysis has a significant impact on estimates of long-run marginal costs. As such, when using such an approach, the demand forecast has to accurately reflect expectations about the future path of total demand.

The Turvey approach

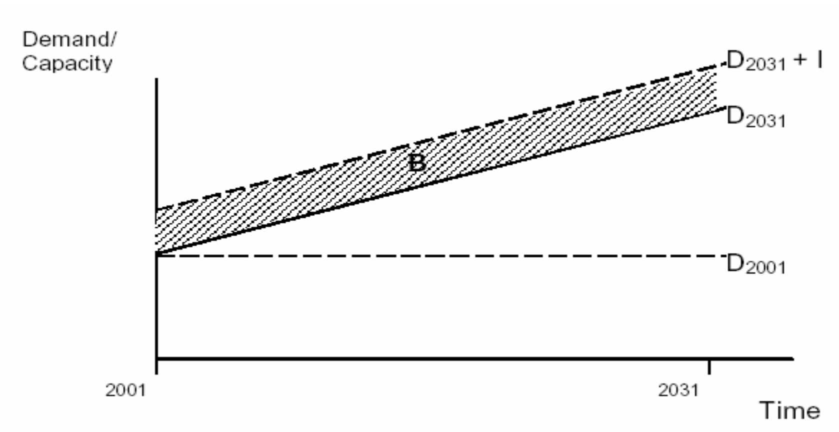
The Turvey approach was initially developed to estimate the savings associated with a slowing of system expansion through reductions in demand for water as a result of the implementation of conservation programs. The approach can also be applied in an opposite manner to address the costs associated with a bringing forward of system expansion to meet increases in demand.

The approach involves:

- consideration of the resource position over a suitably long-term period;
- forecasting demand over the same period;
- optimising the various strategies available to generate the least cost solution to avoid supply/demand imbalances; and
- estimating long-run marginal costs by considering the change in the present value of costs over the planning period resulting from a permanent increment or decrement in forecast demand at a given date and then dividing this by the present value of the increment/decrement.

A graphical illustration of the average incremental approach is provided in Figure 5.2. Suppose D_{2031} represents a company's central demand forecast. The approach considers the impact of a marginal change in demand, represented by alternative forecast (D_{2031} + I). In this case, long-run marginal costs are calculated as the change in the present value of schemes required to maintain the supply/demand balance, divided by the present value of the "marginal change" in expected demand (represented by the shaded area B).

Figure 5.2
THE TURVEY APPROACH



Source: OFWAT 2001, *The Role of Long Run Marginal Costs in the Provision and Regulation of Water Services*, Report C, p. 41.

A simplified example of the process undertaken in estimating long-run marginal costs using the Turvey approach is provided in Box 5.1. In this example, an increase in demand has resulted in a capital expansion program being brought forward by one year; the costs of which divided by the initial augmentation of demand provide a basis for estimating the long-run marginal cost. In a more realistic situation, estimating long-run marginal costs using the Turvey approach would involve an assessment of the costs involved in changing the timing of a number of projects.

Box 5.1

SIMPLIFIED EXAMPLE OF THE TURVEY APPROACH

Given a central demand forecast, a water supplier plans to construct a treatment facility in four years at a cost of $17 million in order to maintain the supply/demand balance. An alternative “unconstrained” forecast of demand of around 1 000 kL per day higher than the central forecast in each year would result in a need to bring forward construction of the treatment facility to year 3 instead of year 4.

Using a discount rate of four per cent, the $17 million spent three years from today has a present value of $15.1 million ($17/(1+0.04)^3$). If the project is instead to be undertaken in year 4, the present value of it would be $14.5 million ($17/(1+0.04)^4$). Under the Turvey approach, the cost numerator is the difference in the present value of capital expenditure brought about from bringing the investment forward; $0.58 million. Dividing the change in cost by the present value of the change in annual demand required to bring the capital project forward (365,000 kL/annum, over a period of, say, 25 years) yields a marginal capital cost estimate of $0.10 per kL. This estimate is then added to a SRMC estimate to yield a LRMC estimate.

Source: Based on the California Urban Water Conservation Council 1997, *Designing, Evaluating, and Implementing Conservation Rate Structures*, p. C-10.

Appendix A

Methods and Assumptions used in Modelling Statutory Accounts

A.1 Statutory Accounts

Analysis undertaken in Chapter 3 of each of the service provider reports involves the modelling of statutory accounts over the forecast period to 2008/09. Specifically, this involves the modelling of both the capital and the profit and loss accounts so as to be able to calculate financial indicators of the service providers that may prevail under different regulatory asset value scenarios. Initial 2003/04 values for figures modelled form the basis of all projections made and are taken from annual reports and other information sources obtained from the three service providers for which this study applies to.

The process of modelling capital accounts involves modelling the components of current and non-current assets and liabilities — from these values forward projections of net assets are made. Variables modelled within the capital accounts are used to calculate financial indicators such as gearing ratios and debt payback periods.

Modelling profit and loss accounts involves modelling both revenues and expenditure upon which forecasts of net profits can be determined. Key assumptions are made when modelling the distribution of net profits. For the Water Corporation, the key assumption made is that the change in cash reserves for each of the forecast years is set equal to zero. In this instance, dividend payments are taken as the balancing item, that is, dividend payments are set such that there is no change to the organisation's cash reserves. Aqwest and Busselton Water do not pay dividends to the Government and therefore the key assumption made for these two service providers is that surplus revenue is treated as a change in each of the organisation's cash reserves.

Other items modelled fall under the title of Borrowing and Investment Activities. These include repayment of borrowings, investment in property, plant and equipment, new borrowings and changes in cash reserves. The modelling of profits and loss accounts and borrowing and investment activities allows for the estimation of financial indicators such as interest cover and the internal financing ratio.

Specific methods and assumptions made in modelling each of the items of the capital and profit and loss accounts are detailed below.

A.2 Capital Account Modelling

Current Assets

- Cash assets are dependent upon the value recorded in previous years plus any change in cash reserves. In the case of the Water Corporation, where changes in cash reserves are assumed to equal zero, cash assets are held constant.

- Receivables are modelled such that the ratio of receivables to total revenue from operations in 2003/04 is kept constant for each of the forecast years.
- Inventories and 'other assets' are assumed to remain constant in real terms throughout the forecast period.

Non-current Assets

- Property, plant and equipment values are rolled forward each year taking into account depreciation, sales and investment.
- Deferred tax assets are kept constant in real terms throughout the forecast period.
- Receivables in the form of pensioner rate deferrals are modelled such the ratio between receivables and total revenue from operating activities in 2003/04 is held constant throughout the forecast period.

Current Liabilities

- Both payables and interest-bearing liabilities are modelled such that the ratio of payables to operating expenditure in 2003/04 is kept constant throughout the forecast period.
- Current tax liabilities are modelled such that the 2003/04 ratio of tax liabilities to tax payments is kept constant throughout the forecast period.
- Provisions and other liabilities are held constant in real terms over the forecast period.

Non-current liabilities

- Interest-bearing liabilities are set equal to the previous year's debt plus new borrowings that are incurred minus repayments of borrowings.
- Deferred tax liabilities are modelled such that the 2003/04 ratio of deferred tax liabilities to total revenue is kept constant over the forecast period.
- Provisions and other liabilities are held constant in real terms over the forecast period.

A.3 Profit and Loss Account Modelling

Revenue from operating activities

- Total revenue from operating activities is set equal to total costs as calculated by the cost of service methodology, reflecting an assumption that regulated prices and CSO payments would be set to recover this revenue.

Other revenue

- Revenue received from the sale of property, plant and equipment is assumed to remain constant in real terms over the forecast period.
- Interest revenue is held constant over the forecast period because cash reserves are held constant.

- Developer contributions are taken as projected by the relevant service provider.

Expenses from Ordinary Activities

- Depreciation figures are taken as projected by the relevant service provider.
- Other expenses are set equal to total operating expenses as projected by the Water Corporation.

Borrowing Costs

- Interest charges payable are modelled such the 2003/04 ratio of interest charges payable to interest bearing liabilities is held constant over the forecast period.
- Amounts capitalised are assumed to equal zero over the forecast period as is the gain on general loan fund repayment and the premium on the repayment of debt.

Net Profit

- Profits are determined based on modelled revenue and expenditure. Income tax is modelled as a constant proportion of profit before tax and net profits are determined by subtracting tax payments from profits.

Borrowing and Investment Activities

- The repayment of borrowings is modelled as being constant in real terms over the forecast period.
- Investment in property, plant and equipment is set equal to total capital expenditure over the forecast period.
- New borrowings are modelled such that the 2003/04 ratio of new borrowings to total capital expenditure is kept constant over the forecast period.[35]

[35] An exception to this rule is made to cater for the Water Corporation's investment into the desalination plant; in 2006/07 an additional $160 million is borrowed.