Allocating capital costs of bulk water supply assets

An Issues Paper prepared for the Queensland Competition Authority by PricewaterhouseCoopers

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PRICEWATERHOUSECOOPERS

Contents

1 Introduction

1.1 Background

The Queensland Competition Authority ("the Authority" or "QCA") is an independent statutory body responsible for assisting with the implementation of competition policy for government owned business entities in Queensland. As specified under the *Queensland Competition Authority Act 1997* (QCA Act), the QCA at the direction of the Premier and Treasurer (the Ministers) may investigate and report on pricing practices of certain business activities of State and local governments.

On 19 March 2010 the Premier and Treasurer, pursuant to Section 23 of the QCA Act directed the Authority to recommend irrigation prices to apply to SunWater water supply schemes (WSSs) from 1 July 2011 through to 30 June 2016. The Authority must provide the draft recommendations by no later than 31 January 2011 and final recommendations by no later than 30 April 2011. SunWater, a Queensland Government-owned Corporation (GOC), owns and operates bulk water supply and distribution infrastructure throughout the state. SunWater supplies about 40 per cent of the water used commercially in Queensland via 27 water supply schemes (WSS). Twenty-six of these schemes provide irrigation water.

The Ministers' Referral Notice requires that bulk water supply and channel prices/tariff structures are set so as to provide a revenue stream that allows SunWater to recover:

- its efficient operational, maintenance and administrative costs;
- its expenditure on renewing and rehabilitating existing assets, whether through a renewals annuity or a regulatory depreciation allowance;
- a rate of return on assets valued at 1 July 2011 (the initial regulated asset base (RAB)); and
- after 1 July 2011, a return of, and on, prudent capital expenditure on existing assets or construct new assets.

1.2 Purpose and approach

In allocating capital costs of bulk water supply assets between high and medium priority water allocations (including between urban, industrial and rural water users), SunWater has proposed to apply an approach based on headworks utilisation factors (HUFs). This approach differs from how costs were allocated across different water entitlement holders in earlier pricing determinations and on this basis the Authority has commissioned this issues paper to consider the rationale for the proposed approach and its appropriateness as a method for allocating capital costs of bulk water supply assets.

In assessing the HUF approach, this issues paper discussed the following matters[1]:

- SunWater's rationale underlying the proposed HUF;
- issues relevant to applying HUF for the purpose of allocating capital costs, including reference to:

[1] Full terms of reference are provided at Appendix A.

  - whether the approach is consistent with generally accepted means of allocating capital costs of bulk water supply assets (including between different classes of entitlement) adopted by regulators;
  - valuation of irrigation supply in the establishment of a regulatory asset base; and
  - the conversion factors used to transform water entitlements into high and medium reliability entitlements.

This report is structured as follows:

- Chapter 2 provides an introduction into the economic principles regarding costs allocation and the regulatory considerations involved in setting charges.
- Chapter 3 provides an overview of SunWater's proposed approach for allocating headworks capital costs between different users.
- Chapter 4 describes some the cost allocation approaches applied for allocating headworks capital costs in other jurisdictions, and also considers how other utilities allocate costs relating to level of service and capacity utilisation.
- Chapter 5 provides an assessment of SunWater's proposed cost allocation approach, looking at both the rationale and methodology for this approach. The implications for capacity to pay are also considered.

2 Regulatory principles for cost allocation

2.1 Why is cost allocation relevant?

Cost allocation is a key issue for regulators. The nature of most regulated utilities means that regulators need to deal with a range of cost allocation issues. This includes the allocation of costs to regulated and unregulated activities, and the allocation of common costs for regulated and unregulated activities between different customers.

Cost allocation is about the way in which costs are attributed to single activities, functions, products or services, and in general, these costs should be allocated on the basis of causality where this is practicable. However, cost allocation issues arise because it is sometimes more efficient to organise operations such that they use some of the same resources to provide services to more than one business activity. Common examples include head office management teams, corporate support services (human resources administration etc), computer networks and support, and common buildings or other shared infrastructure – in this instance a single water infrastructure supply scheme is a common cost for supplying water to both high and medium priority entitlement holders.

Cost allocation is also important insofar as it impacts the regulated prices for each of the different regulated services of a business.

Costs can generally be broken down into three categories:

- direct costs, which are exclusively caused by production of a particular service, and can be specifically attributed to that service;
- indirect costs, which cannot be exclusively attributed to a particular service, but which can be allocated between different services on some objective basis of cost causality; and
- common costs, for which there is no clear objective cost causative basis for allocation across different services. Formally common costs are related to economies of scope. A cost is common if once incurred to produce product A, the cost does not have to be reincurred to produce product B. Some common costs cannot be separated because they must be produced in fixed proportions.[2]

In cost allocation, there are two main steps. First, it is necessary to identify those costs that can be directly or causally attributed to a particular service (e.g. direct and indirect costs), which is typically done via the application of activity based costing systems. Following this step, for most utilities this still leaves a residual of unallocated common costs. Hence, the second step of cost allocation deals with how these residual common costs are to be allocated.

Water infrastructure (e.g. dam storages) shared between water users which have different priority entitlements provides a clear example of a common cost for which it may be difficult to determine an objective cost causative basis for allocating the costs across different services. Given the importance of economic efficiency as a regulatory objective, it is important for cost allocation methodologies to have regard to key aspects of economic efficiency in their design and implementation. Cost causality as a principle is important for helping to achieve allocative efficiency but where it is not feasible other cost allocation approaches may be relevant as explained in this paper.

[2] Costs that must be incurred in fixed proportions are known as joint costs which are a specific form of common costs.

Although providing dam capacity can be considered a common cost, it may still be possible to establish a causal cost relationship where a certain amount of capacity is required to be set aside to meet a specified service level.

2.2 Translating cost allocation approaches to regulated pricing

2.2.1 Marginal cost pricing

Amongst the various objectives pursued by utility regulators, encouraging efficient consumption through appropriately structured pricing is often specified as a priority. On this, the economics literature devotes considerable attention to the principles of marginal cost pricing.

Marginal cost pricing aids efficiency as it presents to users a choice; consume only where the value you derive from each increment in consumption exceeds the marginal cost of providing that service to you.

Practically, there are a range of constraints and limitations to the application of a pure marginal cost pricing regime. These include the information and systems needed to properly calculate and administer a marginal cost pricing approach, and the important matter of dealing with any residual revenue shortfall to the service provider, where marginal cost is below average cost and usage-charges alone do not fully recover the regulated business' costs. On this, the regulator's problem is how to 'allocate' the cost-recovery shortfall amongst different users or services.

A standard approach to the allocation of common costs is based on ensuring 'subsidy free prices'. This approach recognises that the allocation of common costs should fall within the range of 'incremental' and 'stand alone' costs, where:

- incremental cost (IC) measures the additional resource costs of providing an additional unit(s) of output (or incremental activity which may not be an additional unit of output); and
- stand alone cost (SAC) measures the total resource costs of providing the required quantity of output, assuming resources are dedicated exclusively to its production.

Prices that are below incremental cost imply that users of the service are being subsidised, and by their additional consumption are effectively imposing costs either on the firm, or on other users of the service. Conversely, prices in a contestable market could not be sustained above stand alone cost, as new firms would enter the market and draw customers away from the incumbent supplier through the offering of lower prices. Hence prices should be set in a manner that generates more revenue than associated incremental costs but no more revenue than necessary to recover associated stand-alone costs (this is also referred to as a situation where prices are 'subsidy free').

The gap between IC and SAC can potentially be quite large. For example, the additional resource cost of supplying electricity to a new customer where distribution infrastructure is already in place might be comparatively low, while the stand alone cost of supplying only that customer would be significantly greater. Hence how to set prices within that range may require additional consideration.

There also is a need to ensure revenue adequacy for the firm. While pricing shared bulk water infrastructure services at IC will ensure there are no cross-subsidies between users, if there are significant common costs then the water service provider will fail to generate sufficient revenue to cover these. Cost allocation approaches therefore need to ensure that all (efficient) costs are allocated to different services or users.

Revenue adequacy can be most efficiently achieved through mark-ups from IC in inverse proportion to the relative price elasticities of demand for various services – the largest mark-ups being applied where these have the smallest impact on the quantity demanded. In practice, however, the informational requirements for such 'Ramsey' or demand-responsive prices are often prohibitive or the approach is ruled out by community concerns, meaning that alternative cost allocation mechanisms must be found. Inevitably this requires a trade-off between administrative practicability and efficiency in cost attribution.

2.2.2 Peak pricing

A common and related issue in utility regulation is that large fixed costs are incurred as a result of installing capacity to meet peak demand. Peak responsibility pricing means that the users who consume goods or services within periods directly responsible for overall capacity costs should be required to pay for (a higher share of) those costs.

This approach is based on the principle, stated by Kahn that:

> '*if the same type of capacity serves all users, capacity costs as such should be levied only on utilisation at the peak. Every purchase at that time makes its proportionate contribution in the long-run to the incurrence of those capacity costs and should therefore have that responsibility reflected in its price. No part of those costs as such should be levied on off-peak users*'.[3]

If peak capacity costs were instead spread equally over all users this would:

- increase inefficiency – underpricing services in peak times and overpricing services in off-peak times. To the extent off-peak demand has any elasticity, a charge to these users that incorporates any capacity costs will cause them to reduce consumption; and
- decrease equity – off-peak users would pay a share of costs that they are not causally responsible for, implicitly subsidising the consumption of peak users.

This 'peak responsibility' approach is reasonably commonly applied, and examples include:

- telephone companies charging lower rates for night than for daytime long-distance phone calls;
- electricity companies charging lower rates for off-peak hot-water heating;
- electricity and natural gas companies can offer lower charges for of service (agreed by customers) that may be interrupted if limited capacity is being used by other users; and
- railroads charging lower rates for return-hauls of freight, when the greater traffic and cargo flow is in the opposite direction.

The common element to each of these approaches is that costs relating to a common network are allocated to different customer groups differently, depending on the nature of their use of the assets and the service being provided. On the basis that different priority water entitlements holders create different capacity requirements due to the level of reliability (service requirements), the principles of peak responsibility or capacity pricing provide a useful principle in considering how to effectively allocate cost. Such an approach is in effect a cost-causative approach to cost allocation but it could also be reasonably expected that the allocation of costs would reflect differential benefits associated with differential reliability specifications for water allocations.

Economic theory provides useful principles for allocating costs, but these may not always be easy to apply (e.g. due to information limitations), and as such these principles only go some way to determining how costs should be allocated.

This paper will consider the approach proposed by SunWater for allocating headworks storage costs between different users, taking into consideration relevant economic principles, along with appropriateness of their rationale and their practicability.

[3] Kahn, A.E. 1988. *The Economics of Regulation: Principles and Institutions*. The MIT Press. Cambridge.

2.3 Summary

- Cost allocation is a key issue, as it affects how costs are shared between regulated services within a business and therefore impacts on the regulated prices for each of these different services.
- The nature of most regulated utilities means that regulators need to deal with a range of cost allocation issues. This includes the allocation of costs to regulated and unregulated activities, and the allocation of common costs for regulated and unregulated activities between different customers.
- Water infrastructure (e.g. dam storages) shared between water users which have different priority entitlements provides a clear example of a common cost for which there is no clear objective cost causative basis for allocating the costs across different services. Hence, defining how common costs should be apportioned between activities (and customers groups) is very important.
- Economic theory provides some guidance on how costs can be allocated, setting the principle that a subsidy-free allocation of common costs lies within the range of IC and SAC. However, the band between IC and SAC can be significant and other factors such as revenue adequacy may influence how prices are set.
- It may also be the case that where capacity was created to meet the demand requirements of certain users, it may be appropriate to impose a form of peak responsibility pricing to ensure priority requirements were reflected in the allocation of required capacity.
- While economic theory provides useful principles for allocating costs, these may not always be easy to apply (e.g. due to information limitations), and as such these principles only go some way to determining how costs should be allocated.

3 SunWater's approach to allocating capital costs

3.1 Background

Bulk water infrastructure provides benefits to water entitlement holders by storing and making water available for use, subject to the relevant terms and conditions of the water entitlement. Benefits however, are not always shared uniformly among different water entitlement holders, and it may be the case that some entitlement holders derive more benefit from headworks infrastructure than others.

In Queensland, water holders typically belong to a 'priority group' across each scheme.[4] Generally, there are two main priority groups – high priority and medium priority – though the types and numbers of priority groups can differ between schemes. Different water entitlement priority groups enjoy different levels of service from bulk water infrastructure due to resource operation plan (ROP) water sharing and accounting rules (e.g. announced allocation, continuous sharing), critical water supply arrangements[5] and other ROP operational requirements (storage cut-off rules, storage release and/or environmental flow requirements, and inter-storage operational rules).

Based on these arrangements, a high priority water entitlement holder can generally expect to be given preferential or even exclusive access to water stored in a scheme's headworks when available water supplies are low. It is also usually the case that medium priority water entitlements holders can access a share of the stored water supplies only after sufficient water has been set aside to allow high priority water entitlements to be allocated 100 per cent of their entitlement volume.

Hence, it can be argued that high priority water entitlement holders typically enjoy significantly greater benefits and reliability of supply from SunWater's water infrastructure, particularly in years where there are low water volumes and medium priority users are unable to receive all (or any) of their entitlement volume. Even in wetter years, the water sharing arrangements work in such a way that the total storage volume effectively utilised per megalitre of high priority water entitlement is typically greater than that effectively utilised per megalitre of medium priority entitlement holders.

Therefore, analogous to the principles of peak responsibility pricing, as high priority entitlement holders could be classified as those users which contribute more toward the capacity requirements of the water infrastructure, arguably, these high priority water entitlement holders should be required to contribute towards these (capacity related) costs in accordance with share of capacity costs they cause and benefits or level of service they receive. Levying capital costs equally between medium priority and high priority entitlement holders could be deemed as both inequitable and inefficient, on the basis that medium priority water entitlement holders do not contribute to infrastructure capacity requirements to support their water entitlements to the same extent as high priority entitlement holders.

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[4] Under the *Water Act 2000* the term 'priority group' is defined to mean water allocations that have the same water allocation security objective (WASO). A WASO is based on the probability of being able to obtain water in accordance with the nominal volume granted with a water entitlement.

[5] In some schemes critical water sharing rules, or drought management strategies may exist, that if triggered, may 'suspend' normal water sharing arrangements. Under the arrangements, priority will then tend to be given to reserving or allocating water volumes to 'essential' purposes (e.g. domestic use, drinking water supply, power generation). In these circumstances, high priority water entitlements do not necessarily guarantee the holder priority of access which is now determined by the critical water supply sharing rules.

On the basis that most high priority entitlement holders enjoy relatively higher benefits when available water supplies are being shared, SunWater has proposed to apply a method whereby these entitlement holders are apportioned a higher share of capital costs per megalitre of entitlement. This approach could also be rationalised based on recognising that a higher share of capacity (and consequently, capital costs for headworks) has to be committed per megalitre of high priority water entitlement relative to medium priority water entitlement.

3.2 The previous approach

For the 2006/07 to 2010/11 pricing determination, a cost allocation methodology was applied which used 'Water Pricing Conversion Factors'.[6] These factors sought to represent the difference in 'hydrologic value' between water entitlements of differing priority within a scheme on the basis that a unit of high priority water entitlement was conceptually worth more than a unit of medium priority water entitlement in terms of the likelihood of a water user being able to obtain water under the entitlement.[7]

SunWater has advised that the approach adopted for the 2006/07 to 2010/11 pricing determination was a legacy from that adopted by the Water Reform Unit in 2000 when setting the original price paths. Further, this approach was used to allocate both capital (e.g. renewals) and operating costs, which together comprised lower bound costs.

Lower bound costs were allocated by using the water pricing conversion factors to convert all high entitlements within a scheme to a notional volume of medium priority water. The following worked example, drawn from the SunWater's Tier 1 Working Paper No. 18[8], demonstrates how this was done:

- Assume a scheme's total forecast lower bound costs are $1 million, and has 5,000ML of high priority water, 40,000ML of medium priority water and a calculated water pricing conversion factor of 2[9].
- Applying the water pricing conversion factor the 5,000ML of high priority water would equate to 10,000ML of medium priority water.
- Allocating the total forecast lower bounds costs between the water entitlement priority groups would then result in the following:
    - High priority water holders being allocated 10,000 / (10,000 + 40,000) x $1m = $0.2 million of forecast lower bound costs; and

6 These were generally calculated for each Water Supply Scheme using IQQM modelling. They equalled the ratio of the volume of all water entitlements in a scheme notionally converted to entitlements of long-term medium priority reliability, divided by the volume of all water entitlements in the scheme notionally converted to entitlements of long-term high-priority reliability.

7 It is not valid to use the water pricing conversion factors as the basis for actually converting a high priority water entitlement to a medium priority water entitlement because they were based on the ratio of two modelled numbers that did not take any account of the limitations and requirements of Resource Operations Plans relating to medium to high water entitlement conversion (e.g. they assumed an unlimited amount of water could be converted which is not the case). In addition, the factors did not account of the impact of critical water supply arrangements and other operational requirements that may apply.

8 SunWater. 2005. Tier 1 Working Paper No. 18 – Water Entitlement Pricing Conversion Factors. December

9 As an example, if IQQM modelling suggested that the 5000 ML of high priority and 40,000 ML of medium priority within the scheme were notionally equivalent to either a total 56,000 ML of entitlements of long-term medium priority reliability or a total of 28,000 ML of entitlements of long-term high priority reliability then the water pricing conversion factor would be equal to 56,000 / 28,000 or 2.

- Medium priority water holders being allocated 40,000 / (10,000 + 40,000) x $1m = $0.8 million of forecast lower bound costs.

Typically, the pricing conversion factors used were between 1.5 and 2.5, although there were some schemes for which the pricing conversion factor fell outside this range. The outcome of this method was therefore for higher priority water entitlements to generally be allocated a greater proportion of the lower bound costs on a per ML basis than would have been the case had costs simply been allocated in proportion to the nominal volumes of entitlements.[10]

While preserving the underlying principles of allocating costs on the basis of priority groups remains valid, the purpose of water pricing conversion factors was to provide a relatively simple mechanism to allocate all lower bound costs. SunWater believes that the previous approach is no longer appropriate on the basis that it sought to create a simplistic relationship between entitlement groups upon which to apportion total lower bound scheme costs only. The methodology did not adequately account for water sharing arrangements or for critical water supply arrangements that restricted access to bulk water storages by lower priority entitlements.

SunWater therefore does not believe that its appropriate to use the previous water pricing conversion factor approach because it was not designed to specifically allocate capital costs of bulk water supply assets between different water entitlement priority groups.

3.3 Resource Operations Plan conversion factors

Contained within some Resource Operations Plans (ROPs) are 'ROP conversion factors'. These factors are set by DERM and use hydrological assessments to identify the rate at which medium priority water entitlements may be converted to high priority entitlements and vice versa. Where ROPs specify conversion factors, ROPs also place limits on the maximum volumes of each priority group that can exist, which effectively set a ceiling on the conversion of medium priority to high priority entitlements.

For example, looking at the Barron ROP, the following rules are set for changing the priority group of a water entitlement from medium priority to high priority:

> *A change to the priority group of a water allocation (water entitlement) that belongs to a medium priority group to a high priority group is permitted, where:*
>
> - *The nominal value, in ML, is calculated by multiplying the nominal volume of the water allocation that belongs to the medium priority group, by conversion factor of 0.7 and rounding down to the nearest number; and*
> - *The maximum total nominal volume for high priority water supplied under the resource operations license is 33,900ML*
>
> A *change to the priority group water allocation that belongs to a high priority group to a medium priority group is permitted where the nominal volume, in ML, is calculated by dividing the nominal volume of the water allocation that belongs to the high priority group, by the conversion factor of 0.7 and rounding down to the nearest number.*[11]

The above rules set the rate at which medium priority water entitlement can be converted to a high priority entitlement. This conversion factor of 0.7 for the Barron ROP allows for additional losses

10 SunWater. 2006. *SunWater Irrigation Price Review 2005 – 2006: Tier 1 Report,* April 2006

11 Department of Environment and Resource Management, 2005. *Barron: Resource Operations Plan,* June 2005

that must be applied to the delivery of high priority water.[12] Hence, under the Barron ROP, where a medium priority entitlement is equal to 10ML, this would only be equal to a 7ML high priority water entitlement following a conversion.

The above ROP conversion rules also limit the maximum total nominal volume of high priority water which is able to be supplied within this system. This reflects the fact that it is not possible to convert all medium priority entitlements in the scheme to high priority entitlements.[13]

ROP conversion factors are not designed for apportioning bulk water capital costs between different priority groups of water entitlements within a scheme. Instead, for the five SunWater schemes where they are specified, ROP conversion factors and associated limits are designed to maintain the Water Resource Plan basin-wide environmental flow objectives and water allocation security objectives. While ROP conversion factors provide the rate at which one type of entitlement can be converted to another type of entitlement, there are limitations on the number of conversions possible (i.e. it is not possible to convert all medium priority entitlement to high priority entitlements). Further, ROP conversion factors do not take into account a range of factors such as critical water supply arrangements or the likelihood of actually receiving an entitlement.

Therefore a cost allocation methodology based on this approach, while possible in the few schemes where conversion factors have been established, would not be feasible or appropriate.

3.4 The Headworks Utilisation Factor (HUF) Approach

For the 2011/12 to 2015/16 pricing determination, SunWater has proposed applying a different cost allocation approach which seeks to use Headworks Utilisation Factors (HUFs) to apportion the bulk water capital costs in accordance with the benefit or level of service attributable to each water entitlement priority group. HUFs are proposed to be used to allocate bulk water asset capital costs only.[14]

SunWater defines Headworks Utilisation Factors as "*the percentages of a scheme's storage headworks volumetric capacity able to be utilised by each priority group of water entitlements in that scheme, taking into consideration the application of operational requirements, water sharing rules and Critical Water Supply Arrangements associated with the relevant ROP or interim resource operations plan (IROL); and the probability of utilisation of the scheme storages under conditions of relative supply shortage*".

In short, the HUFs seek to specify the share of a scheme's total utilisable[15] bulk water storage capacity dedicated to medium and high priority water entitlement groups, based on conditions of relative supply shortage[16][17]. In doing this, the HUFs take into account that:

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12 Department of Environment and Resource Management. 2005. *Explanatory notes for the Barron Resource Operations Plan 2005*.

13 It is the case that a number of schemes have reached the limit on the conversion (medium priority to high priority) has or nearly been reached. Conversions are only possible in five schemes.

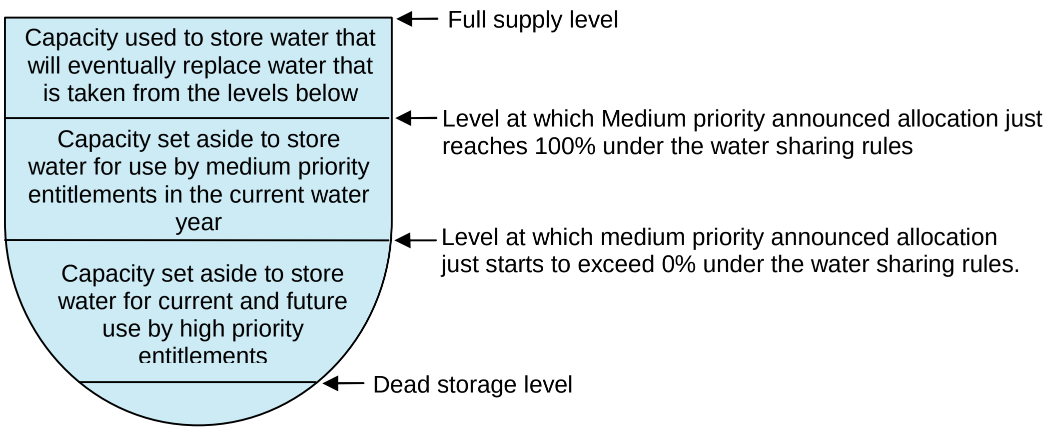
14 SunWater has advised that it does not propose to allocate operating costs according to HUFs, as this related to the share of storage capacity, and consequently asset value. Operating costs are not driven by storage capacity and hence HUFs are not applicable. Cost allocation for bulk water asset operational costs, distribution water asset capital costs and distribution water asset operation costs will be achieved through other means; however these approaches are outside the scope of this report.

15 The term 'utilisable capacity' recognizes that at any time only part of the bulk water storage capacity will typically contain water.

16 Conditions of relative supply shortage are defined as the driest known 15 year period.

- the existing statutory water sharing rules[18] and critical water supply arrangements typically give high priority water entitlements exclusive access to water stored in the lower levels of scheme storage up to the point that medium priority water entitlements just start to get above 0 per cent announced allocation (it should be noted that this point may only occur after the sharing rules have reserved an additional volume of water that is sufficient to supply high priority water entitlements in subsequent water year/s);
- the water sharing rules then give medium priority water entitlements access to water stored in the next levels of scheme storage up to until the point that medium priority water entitlements achieve 100 per cent announced allocation;
- any water stored in the levels of storage above this point (up to the full supply volume) will eventually replace water taken from the lower levels of storage and become accessible by the high and medium priority water entitlements in the future[19]; and
- the proportion of time that water levels within the scheme are likely to be within each of the three ranges mentioned above will vary. More specifically, it is likely that water will be held more often in the lower storage levels than in the upper storage levels.

Figure 3.1 – Diagram illustrating how storage capacity is typically utilised



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17 HUFs exclude water entitlements that derive little or no benefit from a scheme's headworks (e.g. opportunistic water entitlements (water harvesting, credit water)) on the basis that these entitlements do not contribute to bulk headworks capital costs

18 There are two main types of water sharing rules in use within SunWater schemes – for most schemes the announced allocation regime (in which the water sharing rules lead to seasonal "announced allocations"), and in two schemes the continuous sharing regime (in which the water sharing rules explicitly define a total storage capacity share for each water entitlement priority group).

19 Any water stored in the top layer is not allocated by the water sharing rules to either the medium priority water entitlements in the current water year, or to the high priority water entitlements in either the current or future water years. However, water is only stored in the top layer when the bottom two layers are full. This means that as water is taken by either high priority or medium priority water entitlements, then any water stored in the top layer will fill the space made available to the water entitlement priority groups in subsequent applications of the water sharing rules.

3.4.1 Calculating HUFs

A detailed step-by-step technical methodology for deriving HUFs as well as the input data and assumptions that were used in each of SunWater's water supply schemes has been documented by SunWater in a separate Technical Paper, entitled *Headworks Utilisation Factors – Technical Paper* (3 September 2010), and is therefore not duplicated in this report. However, SunWater has summarised the approach as involving the following five main steps[20]:

Step 1: Identify the water entitlement groupings – for each water supply scheme, establish which water entitlement priority groups are to be considered in the 'high priority' versus 'medium priority' groupings for the purposes of the analysis.

In most schemes where there are high and medium water entitlement priority groups this step is straightforward. However, in some schemes there are more than two types of priority groups with a variety of names, some of which may (for the purposes of this analysis) utilise scheme headworks to a similar extent and therefore may be assembled together under either the high or medium priority group.

The conditions attached to some other water entitlement priority groups may be such that they utilise storage headworks to either little or no extent (such as those entitlements with access that is wholly conditional on the existence of run of river flows) and are therefore excluded from the analysis (and assigned a HUF of zero).

Step 2: Determine the volumes of the identified water entitlement groupings – for each water entitlement grouping that has been identified in a water supply scheme, establish the total volume of water entitlements included in each grouping.

For most schemes this step is straightforward with the volume simply being equivalent to the total nominal volume of the relevant water entitlement priority group (or groups where more than one entitlement type has been assembled together under one grouping[21]). In some schemes where there in only one water entitlement priority group, the HUF for that group would be 100 per cent and therefore no analysis would be required.

Nominal volumes are also adjusted for to account for conversions where possible. ROPs provide for the conversion of limited volumes of water entitlements from medium priority to high priority using a conversion factor.[22] Where this is the case, the analysis takes account of this by setting the high priority nominal volume to the maximum allowable under the ROP rules and calculating the reduced medium priority nominal volume by applying the ROP conversion factor.[23]

This step ensures that the headworks utilisation factors take account of the effect of converting medium priority water entitlements to high priority water entitlements.

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[20] For water supply schemes where continuous sharing has been implemented through a ROP (viz. St George and Macintyre Brook Water Supply Schemes), steps 1 through 4 do not apply because the volumes of headworks storage attributable to each water entitlement priority group can be directly inferred from the Continuous Share Volumes stated in the relevant ROP.

[21] Some SunWater schemes have more than one type of high priority or medium priority entitlement type, for the purposes of calculating HUFs, these are grouped together.

[22] Only 5 ROPs provide for conversions within SunWater Schemes. Of these, one scheme has reached its maximum high priority volume limit (Burdekin-Haughton) and four schemes have some limited scope for conversion from medium to high priority entitlements (Boyne-Tarong River, Lower Fitzroy, Nogoa-McKenzie and Mareeba-Dimbulah).

[23] SunWater has found that there has been a trend in favour of the conversion of medium priority water entitlements to high priority water entitlements across its schemes where such conversions are possible.

Step 3: Determine the extent to which water sharing rules, critical water sharing rules and other operational requirements give the different water entitlement priority groups exclusive or shared access to components of storage capacity – the ROP rules and requirements are analysed to establish the (bottom) volume of storage that is effectively reserved for supplying high priority water entitlements, the (next) volume of storage (above that effectively reserved for high priority) that is available for use by medium priority water entitlements, and the (top) volume of storage shared between priority groups.

Examples of rules and requirements that influence these volumes include the water sharing (i.e. announced allocation) rules, split/joint sub-scheme provisions, critical water supply arrangements (including specific storage cut-off levels and trigger rules), and other ROP requirements relating to instream storage infrastructure operations including discharge release rules, low-flow environmental release requirements, hydro release rules (e.g. Mareeba-Dimbulah) as well as inter-storage water level management requirements.

Step 4: Assess the hydrologic performance of each component of headworks storage – outputs from ROP-based hydrologic models (based on DERM's Integrated Quantity Quality Models or IQQM) as well as recent (i.e. 20 to 30 year) recorded daily storage levels are examined and used to assess the proportion of time that each component of headworks storage is accessible to the relevant water entitlement priority group during periods of relative supply shortage. These proportions are then applied to the respective headworks storage component volumes in order to establish an equivalence between utilisable storage volumes at each level of storage prior to calculating the HUF.

This is an important step because the proportion of time that the lower layers of the headworks storage is likely to hold water will be greater than the proportion of time that the upper layers of headworks storage will hold water.

The proportions of time that storages would be likely to be at different levels within each scheme were derived by extracting the daily scheme storage levels for the driest continuous 15 year critical period identifiable from the IQQM model outputs as well as from recent storage level records.[24] In statistical terms this represents the 'expected volume' that is available on average under the conditions of relative supply shortage, defined here to relate to the driest known 15 year period.

Step 5: Determine the Headworks Utilisation Factors – using the parameters established and derived in steps 1 to 4 above, calculate the HUFs for each of the medium and high priority water entitlement groups.[25]

In some instances, water sharing rules are common to two water supply schemes (such as the Lower Fitzroy and Fitzroy Barrage Water Supply Schemes) or to water entitlement priority groups arising from specific headworks infrastructure within a scheme (such as pre-existing and new groups of water entitlements in the Bundaberg Water Supply Scheme). In such cases, HUFs are disaggregated and apportioned to the relevant headworks storage capacity.

In those schemes where different priority groups of water entitlements were (for the purposes of analysis) assembled together under either the 'high' or 'medium' priority group, the HUFs are

[24] Recent observed storage data may be used to calculate HUFs on the basis that the driest 15 years of data may not be captured in the IQQM model data (IQQM model data may only include data up to 1995 in some schemes, and recent drought years may not be captured).

[25] It is not necessary to re-calculate HUFs once set for the 5 year pricing period, on the basis that it assumes all conversions (from medium priority to high priority) have occurred where possible, and dam utilisation storage capacity will not change. However, if water sharing rules or critical water supply arrangements were to vary significantly in the future, SunWater has indicated that HUFs could be reviewed every five years to take account of any substantive change to these rules/arrangements.

disaggregated in proportion to the nominal volumes of the priority groups that were assembled together in step 1.

A sensitivity analysis has been undertaken by SunWater to assess the effect of changing the duration of the 15 year critical period by performing HUF calculations using both ten year and twenty year critical periods. This analysis showed that for the calculations using a ten year critical period, the HUFs in 15 schemes (out of a total 23 schemes) varied by 2 per cent or less from the HUFs calculated using the standard 15 year critical period, 22 schemes varied by less than 10 per cent from the standard period results and only 1 scheme varied by greater than 10 per cent.

For the calculations using a 20 year critical period, the HUFs in 17 schemes varied by 2 per cent or less from the HUFs calculated using the standard 15 year critical period, 22 schemes varied by less than 10 per cent from the standard period results and only 1 scheme varied by greater than 10 per cent.

3.4.2 Applying HUFs to apportion capital costs

Once the HUFs have been established, these are then used to allocate capital costs. The example outline below demonstrates how this would occur:

- Using a simplified building block calculation, assume that the total revenue required to recover capital costs for year 1 is $2.5 million and these costs are shared between different priority groups on the basis of the scheme HUF assigning 70 per cent of the headworks to the medium priority entitlements in the scheme, and 30 per cent to high priority. In year 1 approximately $0.75 million of the capital costs would be apportioned to high priority water entitlements holders, and approximately $1.75 million would be apportioned to medium priority water entitlements.

- Dividing the capital costs for each group by the entitlement volume of each group, would result in a charge for high priority entitlement holders of $150 per ML, while medium priority entitlement holders pay $43.75 per ML.

Table 3.5 – Applying HUFs to apportion bulk capital expenditure – simplified example

Priority Group	High	Medium	Total
HUF	0.30	0. 70	
Regulatory asset value ($)	6.25 million	14.58 million	20.83 million
Return on Asset ($)*	0.62 million	1.46 million	2.08 million
Depreciation ($) (over 50 years)	0.13 million	0.29 million	0.42 million
Capital cost ($)	0.75 million	1.75 million	2.50 million
Entitlement volume (ML)	5,000	40,000	
Entitlement charge per ML ($)	150	43.75	

* Return on assets is determined using a simple weighted average cost of capital of 10 per cent. For brevity, adjustments for asset indexation are ignored.

The defining feature of this approach is that it seeks to allocate the capital costs on the basis of the proportion of utilisable headworks infrastructure available to each water entitlement group rather than according to the volume of water entitlements.

In contrast, note that where the total volume of high priority water entitlements represents 11 per cent of the total volume of water entitlements, allocating capital costs on the basis on entitlement volume alone would result in $0.28 million of bulk water capital costs being allocated to high priority holders and $2.22 million allocated to medium priority water entitlement holders.

3.5 Summary

- Different water entitlement priority groups enjoy different levels of service from bulk water infrastructure reflecting ROP water sharing and accounting rules, critical water supply arrangements and other scheme operational requirements.
- On the basis that some water entitlements enjoy different benefits (defined as levels of service) when available water supplies are being shared, SunWater has proposed to apply a method whereby those entitlement holders receiving higher levels of service are apportioned a higher share of costs.
- SunWater has proposed using HUFs to allocate bulk headworks capital costs. HUFs define the share of a scheme's headworks utilisable storage capacity available to each priority group of water entitlements after taking account of the proportion of time that the storage would reach various levels over the driest known fifteen year period.
- In the last SunWater price determination process, water pricing conversion factors were used to apportion lower bound costs between different customer segments. While the underlying rationale of this approach is broadly consistent with HUFs, SunWater believes the water pricing conversion factor approach has serious shortcomings for allocating costs associated with bulk water assets and has proposed HUFs to allocate capital costs.
- In five schemes, ROP conversion factors and associated limits are specified and designed to maintain the Water Resource Plan basin-wide environmental flow objectives and water allocation security objectives. A cost allocation methodology based on this approach would be neither feasible nor appropriate.

4 Application of cost allocation methodologies in other Australian jurisdictions and utility sectors

4.1 Cost allocation approaches in other jurisdictions

Allocating costs on the basis of different groups of customers is applied elsewhere in the rural water sector, including New South Wales (NSW), Victoria and Western Australia[26].

- In NSW, IPART ruled that high security water licence holders receive a higher level of service compared to general security water licence holders, and therefore a differentiated price, including a high security premium was deemed to be appropriate. This approach is used to allocate both capital (e.g. depreciation/renewals) and operating costs. Their methodology for allocating costs is provided in Box 4.1

- In Victoria, charges for water storages are differentiated between customers on the basis of priority (and sometimes other factors, such as whether an entitlement classified as associated with land, or non-land use). While different charges are levied there is no clearly defined approach for setting these prices from a regulatory perspective, and to date the Essential Services Commission (ESC) has not been directly involved in assessing the mechanisms applied by Goulburn-Murray Water in allocating headwork costs across different water users. According to Goulburn-Murray Water, different costs are calculated on the basis of a hydrological yield relationship, which is used to identify the relative share of storage. However, there was no easily identifiable formula applied.

- Harvey Water, in Western Australia, applies differentiated charges to its two main classifications of customers – industrial customers, which receive a guaranteed level of reliability, and irrigators, which do not have the same reliability guarantee. Irrigators are subject to a fixed charge (comprising a storage component and a dam safety component) which is applied as a charge per ML of entitlement, and a variable (water delivery component). Industrial users however, pay a variable charge (per ML) (with no fixed charge component). This variable charge incorporates capital-related costs, and a premium associated with the level of reliability they receive.

Considering the underlying rationale for these three jurisdictions it is clear that differential charges are commonly applied in other water businesses. This is done through a range of mechanisms, including, in the case of State Water, in NSW, the application of a high security premium to the charges for high security entitlement holders.

[26] Further explanation of the processes applied in NSW, Victoria and Western Australia is provided in Appendix C.

Box 4.1 – State Water – High Security Water Premium

In IPART's 2010 price determination for State Water, it made the decision to:

'*…rebalance high security and general security entitlement charges by incorporating a high security premium into the calculation of high security entitlement charges to better equate the costs and benefits of high and general security entitlement charges*.'

Based on this decision, high security entitlement charges are calculated on the following basis:

> *High security entitlement charge* **=** *the general security entitlement charge* ***x*** *(conversion factor* ***x*** *high security premium)*

Where the:

- conversion factor is the high security premium used in the 2006 IPART price determination defined as the quantity of general security units required to secure one high security unit, and is taken from each valley's water sharing plan; and

- high security premium is equal to the average allocation of water actually received by high security water entitlements over the last 20 years *divided by* the average allocation of water actually received by general security water entitlements over the last 20 years. This is derived from actual allocations from 1989/90 to 2008/09 to calculate the average actual allocation between different users over the last 20 years (as a percentage of the full entitlement).[27]

This approach is used to allocate both capital (e.g. depreciation/renewals) and operating costs. The application of a high security water premium represents a change from how costs were allocated in the 2006 price determination. Further description regarding how costs were allocated for the 2006 pricing determination is discussed in Appendix C.

4.2 Cost allocation approaches in other utility sectors

There are also other instances where differentiated charges are applied to different customers groups. This may be through:

- peak responsibility charges:
  - e.g. urban water fixed charges – meter size is used as a proxy for the customer's ability to draw on the system's available supply capacity at any point in time;
  - e.g. interruptible gas supply arrangements – which involve gas supply arrangements which may be 'interrupted' in times of peak demand. Due to the less reliable nature of the right to gas supply, the user is charged at a different (lesser) rate; or
- location/geographic differentiated pricing:
  - e.g. rural water charges – costs are allocated on the basis of different geographical areas or zones that signify distance from a bulk water take-off point, proximity to a wastewater treatment plans or some other network characteristic impacting on costs (for instance, if certain areas of the distribution network receive demonstrable different

[27] Data on actual allocation to high and general security licence holders is taken from the NSW Office of Water website.

levels of services, or otherwise have higher/lower costs to meet the same level of service).

While there are few directly comparable circumstances where the costs of shared or common infrastructure facilities are directly apportioned between different users of that facility, there are many instances where regulators and utilities have adopted pricing strategies which deliberately and effectively seek to achieve the same outcome; where the revenue share from that customer and therefore the cost 'allocated' to it is not directly related to their volumetric usage proportion.

Indeed virtually any non-linear tariff construct achieves this outcome and in many instances the tariff strategy is especially designed to result in a certain revenue/cost allocation between different customer's types. Frequently this is done with some proxy for that user's share of capacity consumption, either at the time of peak demand or otherwise, which is conceptually similar to SunWater's proposed HUFs.

4.3 Summary

- In general, other than for separate supply systems with isolated costs, there are relatively few examples of direct allocation of common costs to different customers on a shared network. However, there is clear precedent in differential cost recovery through the way that prices are set, which effectively achieves a similar outcome.
- Regulators typically seek some form of costs causality link in the way that costs are recovered through pricing, with concepts such as peak responsibility relevant here.
- State Water's approach for allocating costs is based on the notion that high security licence holders receive a higher level of service compared to general security licence holders, delivered through State Water's assets and activities, and therefore a differentiated price, including a high security premium is appropriate.
- SunWater's proposed HUF concept, in principle, is not dissimilar, as it seeks to allocate capacity costs based on the share of storage costs on the basis of level of service/ benefits accruing to each entitlement priority group.

5 Assessment of HUFs

5.1 Discussion of SunWater's proposed cost allocation rationale

SunWater's proposed HUFs are based on a premise that, where certain water entitlements holders enjoy different benefits (defined as different levels of service) associated with their utilisation of headworks, these entitlement holders should be apportioned a higher share of the headworks capital costs.

Setting charges in a way that allocates costs on the basis of levels of service, or capacity utilisation is analogous with the economic principles of peak or capacity pricing, as those users which contribute more towards the capacity requirements of water infrastructure should be required to contribute towards these (capacity related) costs.

The approach is also supported by economic precedent in other jurisdictions such as NSW, Victoria and Western Australia, which differentiate charges across different customers to reflect different levels of services or benefits. There are also instances in other utilities where differentiated charges are applied to different customers groups on the basis of peak responsibility charges and location/geographic differentiated pricing, which is similar in principle, to the concept of allocating costs differently on the basis of benefits or levels of service.

SunWater has applied differential headworks charges based on priority water entitlements holders since its original 2000 pricing determination process. In the past this was achieved through water pricing conversion factors. Although the business is proposing a new bulk water asset capital costs allocation approach (HUFs) for the 2010/11 determination, the underlying premise that water entitlement priority groups should be differentiated has not changed. The approach adopted was a legacy from that adopted by the Water Reform Unit in 2000 when setting the original price paths.

Indeed, in the case of HUFs, the approach is able to identify the utilisable storage capacity effectively available to each priority entitlement holder, taking into consideration water sharing rules, critical sharing arrangements and the proportion of time of actually achieving various storage levels over a 15 year period.

A cost allocation methodology which seeks to allocate costs on the basis of storage that is required to be utilised, rather than entitlement volume, better reflects the contribution of entitlements holders to the costs of the dam storages and the level of services (or benefits) received.

5.2 Discussion of SunWater's proposed cost allocation approach

In general there are a number of desirable characteristics for cost allocation approaches. These include:

- internal consistency – that the approach does not include arbitrary rulings or changes to the methodology;
- replication and transparency – that an external party/auditor is able to use the inputs and derive the same output and understand the methodology; and
- reasonableness – that the allocation of costs is linked with an acceptable underlying rationale (i.e. the allocation of costs on the basis of capacity utilisation/benefits received).

The proposed HUFs follow a detailed methodology which does not involve arbitrary rulings or changes in approach. It is also flexible and able to adapt to specific scheme characteristics – that is, where there are more than two priority groups of water entitlement holders, where water sharing rules or critical water supply arrangements differ and where water availability may have been scarce (which is captured in the assessment of the proportion of time that the storage would be at various levels).

It is also possible for a third-party to replicate the HUF calculation, using the detailed step-by-step technical calculation methodologies outlined by SunWater and the relevant inputs for a scheme. These inputs include data such as the total water entitlement volumes in each priority group, the details of the prevailing water sharing rules/critical water supply arrangements and other rules prescribed by the relevant scheme's ROPs, as well as headworks water storage level probabilities that can be derived from recent records and/or the outputs from IQQM model simulations.

Although the methodology may be replicated, it is technically complex and may be difficult for some water users to understand and apply the different steps.

The approach also relies on expert analysis of the data. The reference to IQQM outputs places an emphasis on detailed and expert review by an independent regulator or auditor to ensure that correct inputs and modelling cases are used and that the calculation methodology is correctly applied. However, unlike the previous pricing round in which SunWater generated a series of customised IQQM model runs for each scheme to calculate water pricing conversion factors, the HUF methodology simply utilises the outputs of standard ROP-case runs for each scheme that have been developed by DERM as part of its statutory water planning process.

It is noted that the HUF inputs, assumptions and calculations performed by SunWater have been reviewed and audited by an independent and professionally qualified third party.

The proposed HUFs methodology appears to meet its objective in terms of reasonableness in allocating costs on the basis of capacity utilisation or benefit of the user. It is recognised that to achieve the higher reliabilities associated with high priority water entitlements, a higher proportion of storage capacity relative to the actual volume of entitlements needs to be set aside. Hence, this approach provides a reasonable approach for determining how that proportion can be identified.

This approach also goes further than the water pricing conversion factors previously used by SunWater, by taking into consideration water sharing and critical water supply arrangements which are used to accurately identify how the storage volume is shared across different users. Further, by then assessing the proportions of time that each component of storage would be likely to hold water, it takes into consideration the likelihood of water being available to in each component of the headworks.

The most significant shortcoming of the proposed HUF approach is that it is very complicated and may not be easily understood by water customers. Other approaches which also seek to allocate cost on the basis of capacity utilisation or benefit, such as State Water's approach may provide a simpler methodology. However, the proposed HUF methodology captures a number of additional variables which impact on the utilisation of bulk water storage headworks and which arguably provides a more accurate representation of headworks utilisation by different priority water entitlement holders.

Another potential shortcoming of the HUF approach is that the relationship between the cost allocation process and the actual costs of constructing and maintaining dam infrastructure are not clear. For example, depending on the location of a dam and surrounding topography, a dam may have a different cost profiles at different levels of storage (i.e. the bottom portion of the dam may cost more to construct, compared to higher portions). In contrast the HUF methodology assumes that the magnitude of costs remains homogenous at different storage levels. However, it is clear that it would be challenging to incorporate these cost variations into the HUF (or another) methodology as it would be necessary to undertake technical engineering assessments to capture these differences in costs at different storage levels. Even if this information could be captured it could be necessary to consider the benefits of such an approach, and whether it makes a significant variation in how costs are allocated.

5.2.1 Comparison to the State Water approach

In considering the appropriateness of the proposed HUF cost allocation methodology, it may also be useful to compare it against State Water's approach, in NSW, which sets charges for high priority users on the following basis:

> *High security entitlement charge* **=** *the general security entitlement charge* ***x*** *(conversion factor* ***x*** *high security premium)*

Similar to the SunWater approach, State Water's method seeks to identify the proportional benefit accruing to high security water entitlements over general security water entitlement holders. State Water's method for capturing this proportional benefit is through a 'high security premium' which is defined as the average allocation to high security over the last 20 years *divided by* the average allocation to general security over the last 20 years.[28]

By comparison, SunWater's approach focuses on determining the proportional benefit in terms of the percentage of a scheme's storage headworks utilisable volumetric capacity that is available to each priority group of water entitlements taking into account:

- the scheme's water sharing rules, critical water supply arrangements and other operational rules; and
- the proportions of time that the scheme's utilisable storage is available over the driest known fifteen year period for the scheme.

While the two businesses approach this objective differently, it could be argued that SunWater's HUF methodology incorporates some additional considerations, such as the effect of the water sharing rules and critical water supply arrangements, which to date have not been explicitly incorporated in State Water's approach. Furthermore, SunWater's approach focuses on the sharing of storage or headworks infrastructure in order to assign capital costs, and hence discerns between capital and operating costs.

Finally, SunWater's approach also enables charges to be differentiated between users on the basis of 'capacity to pay', in that the charges applying to different users are not correlated. This is discussed further in the following section.

5.3 Implications for asset valuation and 'capacity to pay'

The QCA has indicated the valuation methodology for SunWater's WSSs is yet to be determined, but that it could include the deprival value.[29] The definition of capacity to pay and the approaches applied in calculating this approach are the subject of another QCA Issues paper, however, the concept requires some consideration in the context of methods for allocating capital costs.

Prior to considering capacity to pay, it is first necessary to set asset values, taking into consideration all relevant (efficient) costs. Once the asset value have been determined, it is then necessary to apportion costs between users in line with the relevant cost allocation methodology; which in this case is the HUFs.

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[28] This is derived from actual allocations from 1989/90 to 2008/09 to calculate the average actual allocation between different users over the last 20 years (as a percentage of the full entitlement).

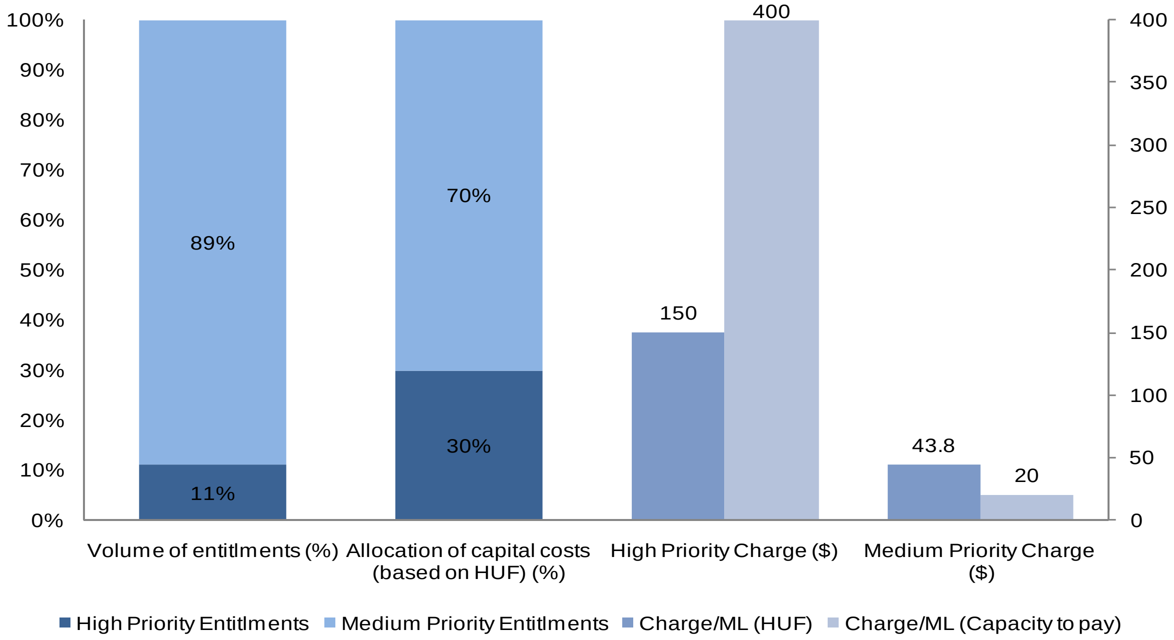
[29] The Optimised deprival value is the lesser of the Depreciated Optimised Replacement Costs (DORC) and the economic value of the asset. This is calculated using the following formula - Optimised Deprival Value = min(DORC, EV), where DORC is the depreciated optimised replacement costs and EV is the maximum realisable value. The deprival value could reflect a value other than DORC if an assessment of the capacity to pay suggests this is appropriate.

Referring back to the simplified example used in Chapter 3, the MAR in Year 1 was $2.5 million, and based on the HUFs, 30 per cent of bulk water asset capital costs ($0.75 million) were allocated to high priority water entitlement holders, while the remaining 70 per cent of costs were allocated to medium priority users ($1.75 million). This equated to an entitlement charge of:

- $150/ML for high priority entitlement holders; and
- $43.75/ML for medium priority entitlement holders.

Once charges are set, it may be necessary to consider capacity to pay as there may be scenarios, where a capacity to pay constraint exists for one (or both) groupings of users and these charges cannot be afforded. For example, it may be the case that medium priority entitlement holders do not have the capacity to pay $43.75/ML, and can only afford $20/ML (see Figure 4.1), and there is no capacity to pay constraint for high priority entitlement holders.[30]

Figure 4.1 – Differences between supply charges and 'capacity to pay'



What this illustration seeks to show is that capacity to pay constraints may affect some user groups differently than others, and to reconcile a user's capacity to pay with its 'unconstrained' supply charge requires first to understand how that charge would be impacted by the proposed HUF approach to capacity cost allocation. In the example above, even though the supply charge for medium-priority entitlements is less than 1/3 of that for high priority users, on account of the HUF allocation approach, this may still be above what the regulator assesses a medium-priority user(s) capacity to pay to be.

In some other jurisdictions, regulators and governments have addressed capacity to pay issues by writing down the value of assets held by rural water services providers. For example, IPART has applied a 'line in the sand' approach in setting State Water's regulatory charges.

Adjustments to asset values are, however, a very blunt means of addressing capacity to pay concerns – as such adjustments do not generally differentiate between the specific affordability characteristics of different users, amongst other things – and are complicated further by the application of SunWater's proposed HUF approach, which differentially allocates capital costs to

[30] It is noted, however, that different customers groups may hold different entitlements types. For example irrigators can hold high priority entitlements, while urban/industrial customers may hold medium priority entitlements. For simplicity, this illustration assumes it is feasible to assess capacity to pay for all users holding a particular entitlement type.

different entitlement types. Further, even where capacity to pay constraints may exist, different customer groups (irrigators, urban, industrial etc) may hold portfolios of different entitlement types, so assessments need to go beyond considerations of 'average' affordability for each entitlement category.

Ultimately, how capacity to pay issues should be addressed is beyond the scope of this report. The discussion above identifies only some HUF-related issues which will need to be considered by the QCA in its wider consideration of capacity to pay matters.

The allocation of capital costs of bulk water supply assets between high and medium priority water based on SunWater's HUFs can be adjusted based on capacity to pay considerations, without impacting on the quantum of costs to be recovered from users who have the capacity to pay, as there is no correlation between the calculation of medium and high priority charges. By comparison, State Water's methodology sets high priority charges by escalating the general security charge (where the escalation factor is the product of the conversion factor and high security premium). In theory, any decrease in the general security charge would result in the high security charge decreasing. This would need to be addressed by maintaining the general security charge at original levels (prior to adjustments for capacity to pay) for the purpose of calculating the high security charge. SunWater's approach may be easier to administer where capacity to pay constraints exist for some priority entitlement holders and not others.

5.4 Summary

- SunWater's proposed HUFs are based on a premise that, where certain water entitlements holders enjoy different benefits (levels of service) associated with their utilisation of headworks, these entitlement holders should be apportioned a higher share of the headworks capital costs.

- Setting charges in a way that allocates costs on the basis of levels of service, or capacity utilisation is consistent with economic principles and charging approaches used in other jurisdictions and other utilities.

- The HUFs methodology largely meets the characteristics of internal consistency, replication and transparency and reasonableness. However, the approach does use IQQM modelling outputs which is not easily replicable, and which places a considerably higher emphasis on detailed and expert review by an independent regulator or auditor to ensure that correct inputs are used and the calculation methodology is correct.

- The most significant shortcoming of the proposed HUF methodology is that it is very complicated and may not be easily understood by customers. While similar methodologies in other jurisdictions, such as NSW may provide a simpler approach, the proposed HUF methodology captures a number of additional variables which impact on the utilisation of dam headworks, such as water sharing and critical water supply arrangements, and which arguably provide a more accurate representation of headworks utilisation by different priority water entitlement holders.

- The QCA has indicated the valuation methodology for SunWater's WSSs is yet to be determined, but that it could include the deprival value. The definition of capacity to pay and the approaches applied in calculating this approach are the subject of another QCA Issues paper, however, the concept requires some consideration in the context of methods for allocating capital costs.

- In some jurisdictions, regulators and governments have addressed capacity to pay issues by writing down the value of assets held by rural water services providers.

- While adjustments to asset values may address capacity to pay concerns, this approach does not generally differentiate between the specific affordability characteristics of different users, and is complicated further by the application of SunWater's proposed HUF approach, which differentially allocates capital costs to different entitlement types. Even where capacity to pay constraints may exist, different customer groups (irrigators, urban, industrial etc) may hold portfolios of different entitlement types, so assessments need to go beyond considerations of 'average' affordability for each entitlement category.

- The allocation of capital costs of bulk water supply assets between high and medium priority water implied by SunWater's HUFs can be adjusted based on capacity to pay considerations without affecting the quantum of costs to be recovered from users who have the capacity to pay, as there is no correlation between the calculation of medium and high priority charges. The HUFs may therefore be easier to administer, then the arrangements that apply for State Water in NSW.

Appendices

Appendix A Terms of Reference

Proposed Scope of Issues Paper

Capital Cost Allocation

Background

The Ministers' Referral Notice requires that bulk water supply and channel prices/tariff structures are set so as to provide a revenue stream that allows SunWater to recover:

- its efficient operational, maintenance and administrative costs;
- its expenditure on renewing and rehabilitating existing assets, whether through a renewals annuity or a regulatory depreciation allowance;
- a rate of return on assets valued at 1 July 2011 (the initial regulated asset base (RAB)); and
- after 1 July 2011, a return of, and on, prudent capital expenditure on existing assets or construct new assets.

SunWater is intending to propose headworks utilisation factors for allocating the capital costs of bulk water supply assets between high and medium priority water allocations (including between urban, industrial and rural users).

Purpose of Issues Paper

The purpose of the issues paper is to:

(a) review SunWater's rationale underlying the proposed headworks utilisation factors;

(b) identify any issues relevant to applying the headworks utilisation factors for the purpose of allocating capital costs, including by reference to:

   (i) whether the approach is consistent with generally accepted means of allocating capital costs of bulk water supply assets (including between different classes of entitlement) adopted by regulators in Australia;

   (ii) valuation of irrigation supply assets as specified in sec. 1.4 of the Ministers' Referral and, in particular, the establishment of a regulatory asset base. It should be noted that the asset base could reflect deprival value and that deprival value could reflect a value other than DORC if an assessment of capacity to pay suggests this is appropriate;

   (iii) the conversion factors used to transform water entitlements into high and medium reliability entitlements.

Appendix B Approaches to allocating capital costs

Cost allocation approaches in other jurisdictions

New South Wales

In NSW the Independent Pricing and Regulatory Tribunal (IPART) determines the maximum price that State Water and the Water Administration Ministerial Corporation (administered by the NSW Office of Water) may levy for services related to bulk water services including water resource management. These services are provided to farmers, irrigators, industrial users and town water suppliers, Sydney Catchment Authority and Hunter Water. Maximum prices for these services were set in 2006 and are current to 30 June 2010. IPART finalised the 2010 price determination for the period from 1 July 2010 to 30 June 2014 on 18 June 2010.

As part of its 1996 determination, the Tribunal established a set of principles for setting bulk water prices to balance competing claims within the community. These principles have guided the Tribunal's subsequent determinations, including the 2006 and 2010 determination. They take into account the Tribunal's obligations under the *Independent Pricing and Regulatory Tribunal Act 1992* and the Government's policies and commitments as part of COAG.

These principles are that:

- water charges should be based on the efficient economic costs of providing water services;
- the administrator of water resources should receive sufficient funds to achieve financial stability and deliver an appropriate level of water services;
- pricing policy should encourage the best overall outcome for the community from the use of water and the other resources used to store, manage and deliver that water;
- the cost of water services should be paid by those who use the services. Those who cause more services to be required should pay more; and
- pricing policy should promote ecologically sustainable use of water and of the resources used to store, manage and deliver that water.

State Water's bulk water charges are broadly based on three types of licences for charging purposes. These are high security, general security and supplementary licences. Both high and general security licences comprise a fixed entitlement charge and all three types incorporate a usage based (variable charge). In NSW high security licences (entitlements) normally receive 100 per cent of their entitlement in all but the severest droughts, while general security licences are only able to extract some of the proportion of their entitlement volume each year, subject to the amount of water available after high security entitlements have been allocated. Hence the actual entitlement volume received by general security licences can vary.[31]

While there are differences in outcomes for some valleys, overall the IPART 2006 determination concluded that high security licence holders receive a higher level of service compared to general security licence holders, delivered through State Water's assets and activities, and therefore a differentiated price, including a high security premium is appropriate.[32] This premium is referred to as a conversion factor and represents the quantity of general security units required to secure one high security unit.

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[31] There may also be variation between valleys, reflect hydrological differences between catchments, the volume of entitlements originally allocate and the capacity of storages in each valley

[32] State Water's high security premium is based on a security of supply-based approach. The security of supply approach uses information on licence volumes and the overall catchment plan limits set out in the water sharing plans to calculate the relative security

In preparing the current 2010 price determination for SunWater, IPART believed that an inequity had arisen between high and general security entitlement charges under the approach used for the 2006 determination.[33] Hence, for the current 2010 determination, IPART made the following decision to:

> *"…rebalance high security and general security entitlement charges by incorporating a high security premium into the calculation of high security entitlement charges to better equate the costs and benefits of high and general security entitlement charges"[34].*

Based on this, high security entitlement charges will be calculated on the following basis:

> *High security entitlement charge* **=** *the general security entitlement charge* ***x*** *(conversion factor* ***x*** *high security premium)*

Where the:

- conversion factor is the value specified as the high security premium in the 2006 price determination (the quantity of general security units required to secure one high security unit, and is taken from each valley's water sharing plan);
- high security premium is equal to the average actual allocation to high security over the last 20 years *divided by* the average actual allocation to general security over the last 20 years (each defined as a percentage of the full entitlement); and
- escalation factor is the product of the conversion factor and the high security premium.

The new approach for setting charges was driven by the fact that State Water believed that conversion factors no longer accurately reflected the costs and benefits of general and high security entitlements. State Water argued there was a need to increase high security charges to correct this, as a number of general security licences holders tried to convert their entitlements to high security (albeit an embargo on conversion prevented the majority of these applications). Hence, this new high security premium aims to better reflect the benefits that high security customers enjoy from a secure water supply under varying degrees of water availability.

Mechanism for calculating the high security premium

The approach for calculating the high security premium changed between IPART's draft and final determination. In the draft determination the high security premium was equal to the inverse of the average allocation to general security licence holders over the last 20 years. However, this approach assumed that high security entitlement holders receive 100 per cent of their allocation in each year, and this is not always the case. On this basis, IPART decided that the high security premium is equal to the average allocation to high security over the last 20 years *divided by* the average allocation to general security over the last 20 years.

The calculation of the high security premium uses 20 years of historical data and divides the actual average allocation to high security licence holders by the actual average allocation to general security licence holders. To do this IPART has used actual allocations from 1989/90 to 2008/09 to calculate the average of actual allocation between different users over the last 20 years (as a percentage of their full entitlement). This data

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of general security entitlements and high security entitlements. Where water sharing plans are not in place, approaches for calculating the ratios needs to be considered on a valley basis. In addition, it was considered that a minimum ratio of 1.25 should be applied across the different schemes.

[33] State Water believes that the current conversion factors result in a strong preference for general security licence holders to convert to high security licences. High security entitlement holders gain in dry times from the high security of their water supply (with close to full allocations on average). Their loss in wet times arises from the increased premium they pay. However, State Water claim that since the spot price for water is significantly higher in times of scarcity, the gain to high security holders far exceeds the value of the loss during wet years.

[34] IPART. 2010. *Review of bulk water charges for State Water Corporation: From 1 July 2010 to 30 June 2014 – Final Report*. 1June 2010.

was obtained from NSW Office of Water website. Data on actual allocations to high and general security licence holders is required because the water sharing plans for each valley have different rules about how high and general security water allocations are made.[35]

The decision to change the approach for calculating charges has resulted in changes to both high security and medium security entitlements charges, however these changes are revenue neutral for State Water overall.

Victoria

In Victoria the Essential Services Commission (ESC) regulates pricing within the bulk and urban water sector. It is responsible for:

- approving all of the prices which a regulated entity may charge for prescribed services, or the manner in which such prices are to be calculated or otherwise determined, as set out in the regulated entity's Water Plan, until the commencement of the next regulatory period; or
- specifying the prices which a regulated entity may charge for prescribed services, or the manner in which such prices are to be calculated or otherwise determined, until the commencement of the next regulatory period.

Prices set by the Victorian rural water services providers are required to be consistent with Water Industry Regulatory Order (WIRO) (Clause 14(1)) which includes principles relating directly to the structure of tariffs levied and how costs are allocated across customers. Clause 14(1) of the WIRO requires the ESC to be satisfied that prices are set so as to:

(i) provide for a sustainable revenue stream to the regulated entity that nonetheless does not reflect monopoly rents and or inefficient expenditure by the authority;

(ii) allow the regulated entity to recover its operational, maintenance and administrative costs;

(iii) allow the regulated entity to recover its expenditure on renewing and rehabilitating existing assets, either by classifying the expenditure as maintenance, recovering a renewals annuity, or borrowing and recovering the cost over time;

(iv) allow the regulated entity to recover:

  a. a rate of return on assets as at 1 July 2004 that are valued in a manner determined by, or at an amount otherwise specified by the Minister at any time before 1 July 2004; or

  b. all costs associated with existing debt incurred to finance recent expenditure prior to 1 July 2006, in a manner determined by the Minister at any time before 1 July 2006;

(v) allow the regulated entity to recover a rate of return on investments made after 1 July 2004 to augment existing assets or construct new assets;

(vi) provide incentives for the sustainable use of Victoria's water resources by providing appropriate signals to urban water users about:

  a. the costs of providing services, including costs associated with future supplies and periods of peak demands and or restricted supply; and

  b. choices regarding alternative supplies for different purposes;

(vii) take into account the interests of customers of the regulated entity, including low income and vulnerable urban water users;

[35] For example, in some valleys general security allocations occur before high security licence holders receive their full allocation, while in other valleys general security water is only allocated once high security licence holders have received their full entitlement. The use of carryover can also complicate this approach.

(viii) provide the regulated entity with incentives to pursue efficiency improvements; and enable customers or potential customers of the regulated entity to readily understand the prices charged by the regulated entity for prescribed services, or the manner in which such prices are to be calculated or otherwise determined.

In Victoria, water entitlement are categorised as high reliability water shares or low reliability water shares. Entitlements can also be categorised on the basis that they are 'associated with land' or 'non-water user'. Different charges exist for each of these types of entitlements (i.e. high reliability water shares associated land, high reliability water share, non-water user etc). Prices can also be differentiated on the basis of customer type (for example urban high reliability entitlement charges are greater than irrigation high reliability entitlements).

While different prices are levied, there is no clearly defined approach for setting these prices from a regulatory perspective, and to date the ESC has not been directly involved in assessing the mechanisms applied by Goulburn-Murray Water in allocating headwork costs across different water user. According to Goulburn-Murray Water, different costs are calculated on the basis of a hydrological yield relationship, which is used to identify the relative share of storage. However, there was no easily identifiable formula applied.

Western Australia

The Economic Regulation Authority (ERA) is the independent regulator in Western Australia and can, at the request of the State Government of Western Australia, conduct inquiries on water charges. The Authority's inquiry role is provided for in the *Economic Regulation Authority Act 2003*. The ERA also grants operating licences to rural water service providers under the *Water Services Licensing Act 1995*. Operating licence specify a range of standards for the water supply service provider, including pricing requirements.

In Western Australia, bulk water for users in the South West, is provided under a framework, whereby Harvey Water, a private irrigators' cooperative, is responsible for the water within storages (under the *Rights in Water and Irrigation Act 1914*) and the delivery of this water through Harvey Water's distribution networks, while the Water Corporation owns the water storages (this applies to eight dams in the South West). Under this arrangement Harvey Water pays to the Water Corporation the cost of water storages, and passes this cost through to its customers.

Harvey Water's storage charges are shared between two main classifications of customers – industrial customers, which receive a guaranteed level of reliability, and irrigators, which do not have the same reliability guarantee. Irrigators are subject to a fixed charge (comprising a storage component and a dam safety component) which is applied as a charge per ML of entitlement, and a variable (water delivery component). Industrial users however, pay a variable charge (per ML) (with no fixed charge component). This variable charge incorporates capital-related costs, and the premium associated with the level of reliability they receive.

Other sectors

In considering methods for apportioning costs across different users on the basis of priority usage or peak responsibility, it is useful to consider how other sectors approach the issue of cost apportionment. This section looks at some examples of how costs have been treated in the water, rail and energy sectors.

Urban Water – connection charges

Within the Australian urban water sector the predominant charging approach is to use a two-part tariff, comprising a fixed and volumetric charge. The volumetric charge is set to cover some measure of (usually long-run) marginal cost, which may be common or differentiated by supply areas.

For the fixed component of a two-part tariff various charge methodologies are used. In some cases water businesses apply a uniform fixed charge for all customers, while other businesses base their fixed costs on meter size or some other identifiable customer characteristic. Meter size is a proxy for a customer's ability to draw on the system's available supply capacity at any point in time, and therefore a fixed charge determined by meter size represents a type of peak-usage responsibility charge.

Geographic differential pricing

Some water businesses use location-based pricing to allocate capital costs between different customers. This approach involves allocating costs on the basis of different geographical areas or zones that signify distance from a bulk water take-off point, proximity to a wastewater treatment plant, or some other network characteristic impacting on costs (for instance, if certain areas of the distribution network receive demonstrable different levels of service, or otherwise have higher/lower costs to meet the same level of service).

Location-based pricing is generally premised on the grounds of economic efficiency and user pays. There are two parts to this concept: firstly the customer only pays for the level of service they use; secondly it provides a price signal that may encourage consumers to alter their behaviour, thereby impacting future costs.

In the Gladstone Area Water Board (GAWB) draft report on pricing practices[36] a geographically differentiated price for all customers was retained by the QCA on the basis on their utilisation of specific components of the infrastructure network.

Gas – Interruptible supply arrangements

Capacity pricing is commonly applied in the gas sector, where the network capacity is constructed to meet peak demand requirements. In general there are two main charging approaches applied in the gas sector.

The first approach is based on a fixed charge (connection charge) and a variable charge (based on gas throughput volume) model, which is typically applied for smaller users such as households and small businesses.

The other method applies primarily to significant gas consumers (such as industrial users), and this charge is based on a capacity charge. The capacity charge is determined on the basis of a contract demand volume which is calculated as the number of units of volume consumed on the highest consumption day (for gas distribution). This capacity service charge is applied in the form of a fixed charge, without any variable component, and it seeks to recover the capital costs associated with the capacity requirements placed on the system by a user. This charge purchases for the customer a firm service right to capacity, with some guarantee for delivery, even in peak times. Failure of a pipeline company to provide service at the level of the contract demand specified can result in a liability for the pipeline company.

It is also possible to purchase an interruptible service right to gas, which is where a pipeline capacity (or right to capacity) is made available to a customer without a guarantee for delivery. Under this arrangement, in times of peak demand, this supply may be 'interrupted'. Due to the less reliable nature of this right, the user is be charged at a different (lesser) rate to a firm service right, reflecting the fact it is not contributing to 'peak' capacity requirements. Further, there may be instances where charges for interruptible service rights might vary – for example they may be charged less in the instance that their supply may be interrupted, or they may be required to pay more (penalty rights) when then consume over a certain volume during peak events.

ActewAGL, which operates the largest natural gas distribution network in the Australian Capital Territory (ACT), uses a capacity based pricing structure for its largest customers consistent with the method described above. As part of its access arrangements[37] it provides a 'managed capacity service' and a 'capacity reservation service'. Under the managed capacity method the transportation service has its charge determined on the basis of capacity. Capacity is measured as a customer's maximum daily quantity (MDQ)

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[36] Queensland Competition Authority, 2010. *Gladstone Area Water Board: Investigation of Pricing Practice,* March 2010

[37] ActewAGL Distribution, 2004. *Access Arrangement for ActewAGL Gas Distribution System in ACT and Greater Queanbeyan*, November 2004

which reflects the maximum daily requirement (based on prior consumption where possible). The MDQ is multiplied by the network unit charge to determine the customer's total charge. Under this method there is no penalty for overruns (going over MDQ) but this will cause the MDQ to be reset in the following year. A capacity reservation service is very similar in nature except that ActewAGL is only obligated to deliver gas to the level which meets MDQ and delivery above this level will result in customers being subject to penalties. These penalties are calculated using a multi-level tariff which relates to the quantity consumed above the MDQ.

Electricity – capacity pricing

The National Electricity Market (NEM) is a wholesale exchange for electricity for those States and Territories that are electrically connected (i.e. Queensland, NSW, ACT, Victoria, South Australia and Tasmania). The National Electricity Rules (NER) which governs the NEM is set by the Australian Energy Markets Commission in accordance with the National Electricity Law (NEL). The Australian Energy Regulator (AER) is responsible for regulating the revenues of distribution network service providers (DNSPs), including Energex and Ergon Energy.

In 2008 the AER released its final decision paper on cost allocation guidelines for DNSPs[38]. The nature of the AER's regulatory role in relation to cost allocation is to ensure that DNSPs fully distribute their shared costs, including capacity costs, and to ensure there is no cross-subsidisation between distribution services and other categories of distribution services.

In accordance with the NEL and the AER's decision paper Energex released its cost allocation method as part of its pricing proposal for the period 1 July 2010 to 30 June 2011. Within this proposal Energex details its method for allocating costs. Energex recognises connection capacity and network demand as two of the primary cost drivers for its network. The method adopted to apportion 'shared system costs', which include capacity costs or the cost associated with meeting peak demand, uses anytime maximum demand (ATMD) to allocate these costs. Energex states that whilst the ideal cost allocation mechanism would be based on a real-time model which replicates network location-specific demands, such an approach is not achievable at present. The ATMD provides a simple and reasonable basis for apportioning costs given the present availability of data. It reflects the fact that demand is the primary driver of shared network costs.

Rail

Rail infrastructure by its nature has natural capacity constraints which limit its use. A key consideration in determining appropriate price structures and methods of cost allocation is how to allocate this limited capacity to users who value it most. One way this can be achieved is through the use of a multi-part tariff which is commonly applied in the regulated below rail industry. This approach involves setting access charges that are made up of fixed and variable charge components, based on variables such as train length or a combination of load weight and kilometres travelled.

The use of two-part tariffs, while prevalent, varies widely across the industry especially in the method used for setting the access charge or fixed charge component. For example, the pricing structure used by the Australian Rail Track Corporation (ARTC) and Queensland Rail's (QR) for the Brisbane – NSW line, determines the access charge using two different methods. The first is on a fixed dollar rate per train which varies by section of track and type of train. The second method is a simple flat monthly fee. QR intrastate (non-coal) lines structure their fixed charge as an up-front charge and a regular periodic charge. ARTC generally calculates its fixed charge amount per 'train kilometre' (the distance travelled by each train). This approach is also used by WestNet Rail.

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[38] Australian Energy Regulator, 2008. *Final Decision: Electricity Distribution Network Service Providers – Cost Allocation Guidelines,* June 2008