



Australian Government
National Water Commission

General Manager
Water Markets and Efficiency Group

Ms Wendy Craik
Commissioner
Productivity Commission
Level 2, 15 Moore Street
Canberra City ACT 2600

Dear Ms Wendy Craik

In June 2010 the National Water Commission (NWC) commenced the *Developing future directions for the urban water sector* project. The purpose of the project is to identify the scope for further reforms to help the water sector perform and better manage future risks and challenges. As part of the project the NWC has had recognised experts in the water sector prepare assessment reports. The Productivity Commission has expressed an interest in receiving the assessment reports for consideration in the Productivity Commission's public inquiry into Australia's urban water sector.

Dr Kerry Schott, Managing Director of Sydney Water Corporation prepared the attached paper as an assessment report on the topic area 'challenges facing urban water supply and demand'. Dr Schott has given her permission for the NWC to forward this paper to the Productivity Commission for inclusion in the public inquiry.

Yours sincerely

Will Fargher

General Manager
Water Markets and Efficiency Group

10 December 2010

Challenges facing urban water supply and demand

Kerry Schott

Thank you for the opportunity to participate in the National Water Commission's urban water project. In 2008 three of us from Sydney Water published an article, *Urban Water Reform: An Industry Perspective* in the *Australian Economic Review*. It set out where the industry had come from and some of the issues for the future. Much of that paper is relevant to the topic areas for the Urban Water assessment reports. A copy of our article is enclosed.

In terms of the challenges you have asked me to address, I have changed the sub topics – but nevertheless hope that the views below cover what you were seeking.

1. Appropriate regulation

The major investments in augmenting the water supply over the last few years clearly demonstrate the need for economic regulators that are independent of government and political processes. Increased investment (whether driven by water security requirements or any other pertinent factor) requires prices to rise, and political interference has constrained this process. Prices must be set independently of the political process. Independent economic regulation is critical to ensure that the 1994 COAG endorsed principle of full cost recovery is maintained, and to assure the community that it is receiving value for money.

The NSW Independent Pricing and Regulatory Tribunal (IPART) have determined Sydney Water's prices since 2000. Other jurisdictions such as South Australia and Western Australia have recently also moved to more independent regulation. However, as we noted in 2008, full cost recovery was a challenge in some jurisdictions and this remains the case. Irrespective of the structure of prices, recovery of the full costs of infrastructure from the community benefiting from that infrastructure is a threshold test for the efficiency of major investments.

Beyond economic regulation, the water industry is also regulated to ensure appropriate health and environmental outcomes for the community. Particularly at a time when utility bills are increasing significantly it is important to ensure that the regulatory effort is co-ordinated. In particular, there needs to be an economic assessment of environmental standards to ensure the community receives value for money and understands any cost/environmental trade-off. I believe frameworks for this are still developing in most jurisdictions, and it is an area where the National Water Commission could make a contribution.

2. Planning

The regimes for planning augmentation to the water supply are evolving in response to the emergence of non-rainfall dependent water supplies. Previously, dams needed to be built many years in advance of need. In contrast, desalination plants, water efficiency measures, and recycling schemes, can be developed more quickly. This provides more scope to optimise investments, but also greater complexity.

Water planning should, in our view, move into the realm of portfolio choice theory. Each new source of water and each new conservation measure, has different characteristics in terms of volume, price and reliability. The challenge is to develop the least-cost portfolio to equate demand and supply, at an acceptable degree of water security. New institutions may be necessary to perform this more complex

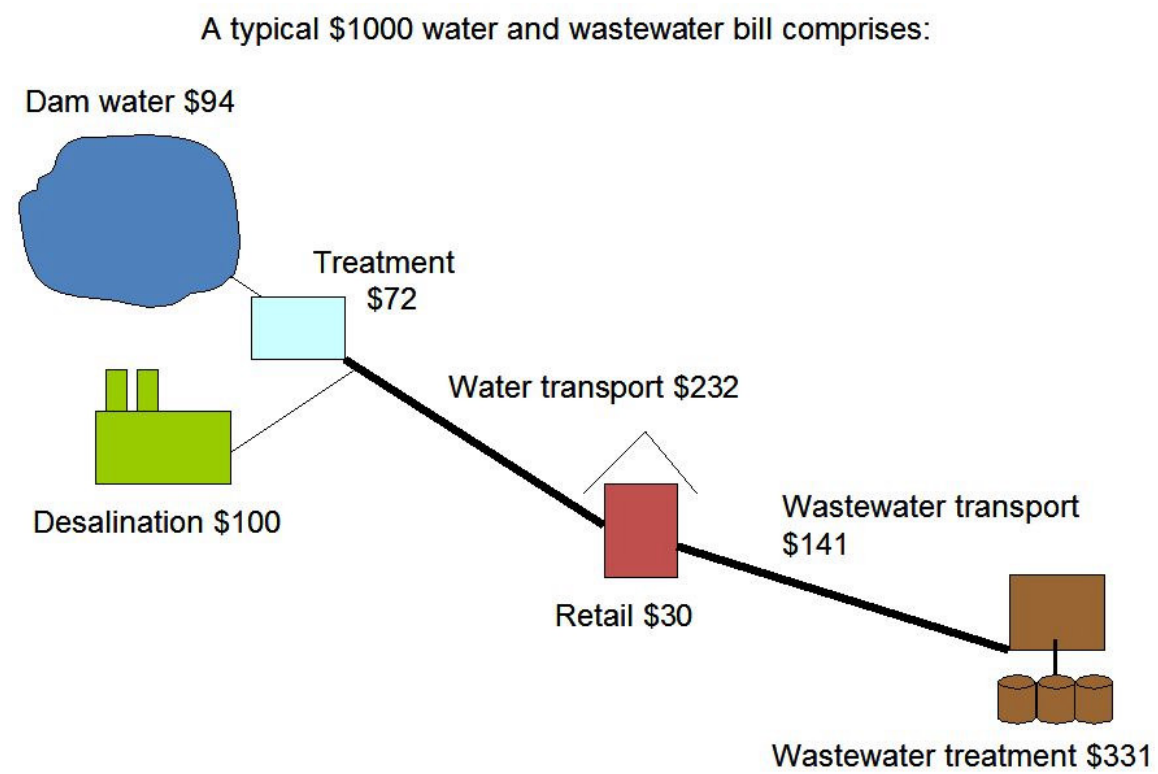
planning function. The National Water Commission could consider what structures are appropriate.

For example, the NSW Government's Metropolitan Water Plan for Sydney is updated regularly, incorporates community input and is reviewed by an Independent Expert Panel. While water utilities have input into the plan, it is developed under a whole of government approach. The adaptive management approach in the Metropolitan Water Plan is practical, but more consideration of the theoretical basis behind a portfolio approach may provide more definition.

3. Underlying economics of urban water

Nearly all the interest of policy makers outside the urban water industry is associated with bulk water supply, and in particular scarcity pricing. While this is understandable, given that the major investments over the last decade have been aimed at securing the water supply, it is important to understand that bulk water remains a relatively modest component of costs within the urban water industry. Figure 1 sets out the supply chain for water and wastewater. It splits up the costs of the industry by individual component, using the typical bill as a convenient metric.

Figure 1 The supply chain cost for urban water - Sydney



In Sydney the bulk water component of the supply chain, including the full costs of the desalination plant and water treatment (which are privately owned and operated facilities) constitutes under one third of costs. Key features of the supply chain costs that are not generally appreciated outside the industry are that:

- wastewater costs are half the costs of the industry;
- the transport component of the water and wastewater industry is just over a third of total costs;

- the largest single cost component — in Sydney larger than bulk water supply and treatment — is wastewater treatment; and
- the retail component of the industry is very small.

In future, the drivers of increasing costs in the water and wastewater industry lie as much downstream of bulk water supply as in the bulk water component.

Four issues that are currently top of mind in Sydney Water are: catering for population growth; energy issues; wastewater treatment plant issues, and intergenerational impacts on prices.

3.1 Population

Sydney Water invests over \$300 million a year or 40% of its capital program on providing services for a growing population. Development is proceeding in Sydney's North West and South West growth centres, and in West Dapto. Ultimately the North West and South West growth centres will each have a population the size of Canberra. Economically efficient provision of water and wastewater services is critical.

Given that expenditure for growth is such an important component of most urban utilities' capital expenditure, the National Water Commission may like to examine the most appropriate arrangements for servicing growth. The centrepiece of Sydney Water's planning for growth is its Growth Servicing Plan. This annual plan provides a clear timetable for government and the development industry on where and when Sydney Water plans to provide urban growth services.

The key principle is timely delivery; a capital expenditure program that meets the needs of the industry, and is economically efficient. Hold points are thus built in after planning and environmental approvals, whereby Sydney Water will only proceed to delivery where there is proven market demand.

The certainty provided by the plan enables developers to make informed decisions about their own projects and investments. This leads to efficient implementation and reduced delays. The Department of Planning and the Urban Development Institute of Australia (UDIA) nominated it as a best practice example of agency planning and servicing. Also, the development community has commented that the plan is a strong model, and sought government support for introducing a similar approach for other infrastructure services.

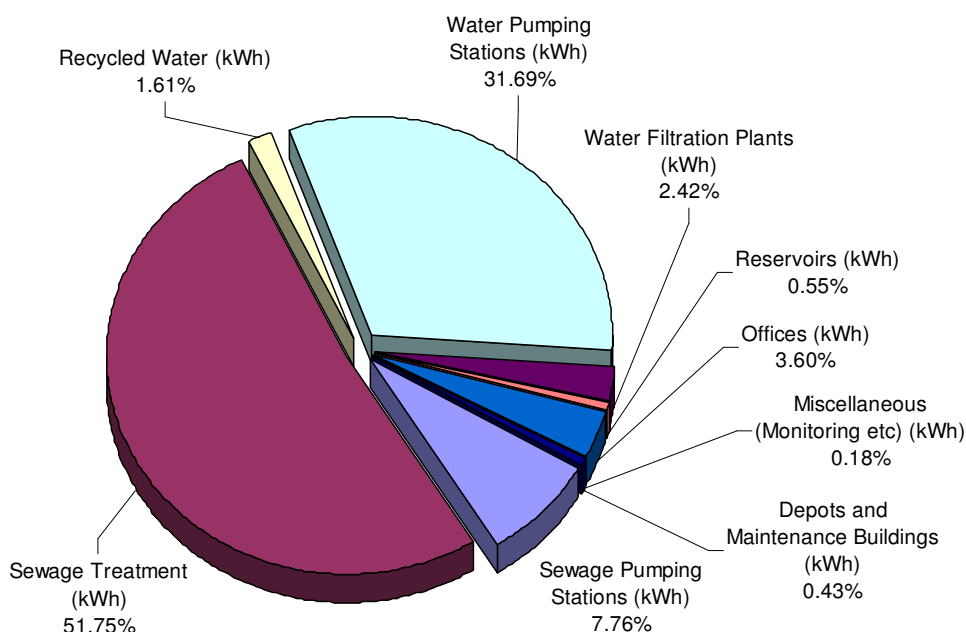
It should be noted access to water does not pose a constraint on population growth in Sydney. There is further scope to increase desalination and recycling to serve growth in coastal areas. As these are areas of high population density, providing them with desalinated or recycled water, reduces the call on dam water, effectively removing any constraint on supply of bulk water to inland areas.

3.2 Energy

Increasing energy costs are a key issue for the urban water sector. Desalination aside, wastewater treatment accounts for just over 50 per cent of the energy used by Sydney Water. Water pumping accounts for another 30 per cent.

However, what makes the urban water industry unique is that energy represents both a challenge and an opportunity. It is a challenge because of the future scope for price rises. However, it is also an opportunity because there is significant energy embodied in wastewater, and this can be used (and is being used) to generate power.

**Figure 2 Energy use within Sydney Water
(excluding desalination)**



3.3 Wastewater issues - bio-refinery and odour control

Bio-refinery is emerging as a key sustainable source of energy. Sydney Water has been quick to adopt this tool to harness energy from within its processes and reduce reliance on fossil fuels. It now has eight cogeneration plants which use biogas (a waste product of the wastewater treatment process) at our sewage treatment plants. The cogeneration plants capture methane gas during the sludge digestion process, compress it and use combustion technology to generate electricity. This offsets electricity used to pump wastewater and operate mechanical equipment.

Sydney Water will also have three hydro-electric plants coming online soon. These plants generate renewable energy from water passing through pipes. Together, the plants generate around 20% of Sydney Water's energy. The hydro-electric generator at North Head Sewage Treatment Plant creates power from treated wastewater falling to an outfall – the first hydroelectric generator in the world to operate on treated effluent.

As energy prices rise the opportunities for further energy recovery are likely to increase. Technological change is also adding to these opportunities.

Traditionally odour from wastewater treatment plants is controlled by providing buffer zones around plants, say to a radius of 400 metres. But with the increasing density of development in cities, and with increases in capital city land values, there is pressure to allow development within odour buffer zones.

For this to occur, further investment in odour control on site is often necessary at existing plants. Odour control works generally involve covering parts of the plant where particular processes are carried out. It often involves extracting the air and treating it to remove odorous components, for example using 'odour scrubbing' or biological processes.

Sydney Water has identified a number of plants with a high risk of odour impacts on surrounding developments, including Warriewood, Cronulla, North Head and Wollongong. Odour works were carried out at Warriewood at a cost of \$14 million,

prompted by significant pressure to develop land within the buffer area. Large expenditure will occur at Cronulla over the next two years for the same reason.

On a community wide basis, investment in odour control is often appropriate as it allows valuable land to be brought into production or improves the amenity of the surrounding community. However, the immediate effect is increasing costs of odour control for water utilities. Sydney Water has 29 wastewater treatment plants, many of them in built up areas.

3.4 Intergenerational impacts

I would also like to draw attention to underlying intergenerational issues, which are a feature of the water industry exerting pressure on prices. The water industry is characterised by being both capital intensive and owning very long-lived assets. Assets constructed up to 100 years ago are still being used today. Warragamba Dam — which provides the majority of Sydney's water supply — is nearly 50 years old.

But funding arrangements in the past were different. Until the 1980s assets were funded from a combination of capital works budgets, Commonwealth grants or through rates from property taxes. In many cities in Australia this has led to a situation where previous generations paid for many of the assets the current generation uses. The flipside is that the current generation has not been paying a full price for the assets it uses. Regulators set prices based on an asset base that is a small proportion of the replacement cost of the total assets water utilities manage.

This phenomenon finds expression in the regulatory system in regulators drawing 'a line in the sand'. This is the practice of creating an asset base for the water industry not based on the optimised replacement value of assets under management, but on the value that prices can sustain. In Sydney Water's case the line in the sand occurred in 2000. The value of assets for regulatory purposes (around \$13 billion) is well under half the depreciated replacement cost of the assets (over \$30 billion).

There is a sound basis for the line in the sand. From a utility perspective it would not be appropriate to charge for assets that have already been paid for. However, it raises a number of interesting economic issues.

First, prices must rise over time as the current generation relies less on the efforts of the contributions of past generations. The mechanism for this in the regulatory system is that capital expenditure to renew and replace existing assets is much greater than the level of deemed regulatory depreciation. Over time the asset base on which prices are set will grow. This pressure for price increases will be present no matter what the future structure of the water industry, and reflects the importance of intergenerational effects. Policy makers must understand these effects when reviewing the performance of the industry.

Second, what does the line in the sand imply for allocative efficiency? If prices are less than half that implied by the optimised replacement value of assets, what incentives for investment does this create? The line in the sand may constitute a barrier to entry in the urban water industry that will need to be addressed if water or wastewater markets are to develop.

4. Competition

Many policy makers have called for increased competition in the water industry. The scope for, and approach to implementing, competition will be major subjects in the National Water Commission's review and the Productivity Commission's inquiry. In the *Australian Economic Review* article we drew attention to features of the water market that made competition more difficult to implement than in industries such as electricity.

In the United Kingdom, steps are being taken to introduce retail competition. While retail is a contestable part of the supply chain, it is also the smallest. Competition in bulk water is likely to be the focus of analysis in the current inquiries, and in particular what institutional change would be necessary to support competition.

Legislative barriers to competition have been removed across Sydney, the Illawarra, and the Hunter region with the introduction of the *Water Industry Competition Act 2006*. The act provides an access regime for water and wastewater and a licensing regime for water, wastewater and recycled water. To date no applicants have sought to use the access to provide competitive services.

This is not to say that new players are not entering the market. The majority of licences granted so far have been for small decentralised schemes, servicing a single building or development. For example, the high-rise development at 1 Bligh St Sydney will take wastewater from Sydney Water's transport network under a sewer mining agreement, then recycle it for use in toilet flushing and cooling towers within the building. Nearby at Darling Walk, a similar development will also use recycled water for garden irrigation.

This trend towards decentralised servicing solutions is likely to continue, with various licence applications currently being assessed to provide water services in developments on the urban fringes. New BASIX requirements to significantly reduce potable water use in new dwellings are driving an increase in recycled water provision.

The new competition framework has also seen the emergence of an industrial recycling scheme in Sydney's west. The Camellia-Rosehill scheme will provide recycled water to six industrial customers, in competition with Sydney Water's potable water service. The recycled water will be used for industrial processes, wash-down, fire fighting and washing machines as well as cooling towers, toilet flushing and irrigation.

5. Pricing and consumer views

The *Australian Economic Review* article discussed the growing debate about scarcity pricing — linking prices to dam storages to balance supply and demand. In summary we argued that:

- the scarcity pricing debate was essentially a debate about whether prices should be set according to Short run marginal cost or Long Run marginal cost.
- that the demand for water was very inelastic and the price rises necessary to equate supply and demand could be very large
- more research, particularly on the elasticity of demand for water was necessary before a credible proposal could be put to policy makers.

Since then there have been further calls for the introduction of scarcity pricing, including further work by the Productivity Commission and a paper from Infrastructure Australia. However, the debate has not been significantly advanced. There is still an absence of detailed design work to demonstrate how scarcity pricing would work in practice. For example, would all households be given an allocation of water for essential purposes? If so, how much? And what would such a mechanism do to the scarcity price for the remaining volume?

Another area that requires close examination is the suggested link between scarcity pricing and efficient investment, particularly by the private sector. The suggestion that temporarily higher prices (of an unknown duration) will create an incentive for entry to the bulk water market needs to be thoroughly tested. While private sector

involvement is extensive in the water industry, the private sector has not to date shown an appetite to accept significant demand risk.

Water utilities should not be seen as vested interests in this debate. Scarcity pricing is fully consistent with full cost recovery. Indeed linking prices inversely with storage levels could increase revenue stability for water businesses during drought. Rather, water utilities' reticence about scarcity pricing is that it has been put forward with little understanding of its impact on prices or on the community.

For its part, Sydney Water is working on better understanding the elasticity of demand for water, and hopes to be able to release further work in the next few months.

Another dimension to consider is postage stamp pricing, or uniform pricing. This is the structure whereby customers pay the same price for the same type of service, regardless of location or cost. For example, all Sydney Water's residential customers with a standard meter pay the same wastewater service charge.

However, it costs Sydney Water more to transport and treat the wastewater for customers in a range of locations, particularly inland areas that discharge to rivers. This is because the distances to the sewage treatment plant can be greater, and the wastewater must be treated further under the licences granted by the Department of Energy, Climate Change and Water.

Sydney Water conducts regular consumer research about attitudes to water. Historically, the cost of water has not been a major concern for most customers. This is changing with recent increases in water and energy prices. The number of Sydney Water customers seeking financial assistance has grown by more than 20% in the past two years. There is now increasing interest amongst consumers in alternative pricing options that would allow them to better manage the cost of water by choosing how and when it is used.

Despite this interest in individual choice, one of the strongest results from the consumer research is the support for uniform based pricing. Consumers expressed the view that water is a basic social right and strongly support postage stamp pricing even in those areas where prices would decrease under area based pricing.

6. Skills and workforce strategy

Workforce issues are a particular focus for the water industry at the moment. The water industry in Australia currently employs over 80,000 people, but with expansion of the industry and an ageing workforce there will be demand for a further 40,000 new water workers by 2018.

The water industry is facing a skills shortage and Sydney Water is working with the Australian Water Association (AWA), the National Water Commission and other water organisations on the 'H₂Oz Careers In Water' campaign.

The aim of the campaign is to generate awareness of the employment opportunities in the water industry and the many different fields of work involved in the industry. Sustainability features strongly in the campaign to provide a compelling argument for environmentally conscious people to join the sector.

Through the H₂Oz website, potential employees can register for tailored job alerts and industry news, search for current job vacancies or submit a general application and be headhunted, learn about the Australian water industry and the job categories, qualifications and resources required.

Water is also an area being targeted by Government Skills Australia. An online directory of careers in the water industry has been developed in collaboration with the water industry.

Sydney Water has about 3,000 employees. 1% of staff are eligible for retirement now. This will grow to about 4% a year over the next five years, increasing risks around critical knowledge retention. The retirement risk is greater with senior managers and technical specialists. Retirement is being delayed for now and turnover remains at a very low average level of 3%. Over one in four current staff have joined Sydney Water in the last 5 years.

To manage these issues, Sydney Water has identified 162 opportunities for knowledge capture and is working to capture this knowledge in systems or to transfer it to other staff. Nine 'corporate critical' positions have been identified and risk management plans are being implemented to ensure business continuity.

Sydney Water is also building better career paths so staff can gain new skills and move up and across the organisation. About 9% of staff have been identified as potential talent who may be able to step up into a more complex job. Nine interlinked competency programs will cover most staff.

Five year strategic workforce plans have been developed for the different divisions of Sydney Water. These plans are produced by forecasting future trends in recruitment, turnover and retirement, identifying the issues, trends and risks affecting the business and then setting out how to respond to these risks. The plans are reviewed annually and tracked quarterly to ensure they are on track to produce the outcomes we need.

To recruit and retain talented staff at all ages and levels, a tailored program is in place. There is an annual internal talent review as part of the strategic workforce plan previously discussed. Talent is defined as staff having the ability, aspiration and engagement to succeed in a more senior role. Candidates are assessed and their retention risks identified and mitigated.

A particular focus is given to employer branding and innovative methods are used to capture the attention of potential external candidates and to retain internal high-performing staff. The branding slogan 'Make a splash', uses a matrix created from the drivers of attraction and retention identified by the Corporate Leadership Council. This brand does appear to inspire people.

On the positive side, the number of women working in the water industry has doubled over the past 20 years.

7. Conclusion

In essence, I consider the three main challenges to be:

- appropriate regulation;
- ensuring that the economics of urban water is well understood; and
- the importance of both increasing energy costs and the opportunities to generate energy and high value chemical products at wastewater treatment plants.

8 October 2010

Policy Forum: Urban Water Pricing and Supply

Urban Water Reform: An Industry Perspective

Kerry Schott, Stuart Wilson and Sally Walkom

Sydney Water Corporation

1. Introduction

Significant reforms have occurred in the urban water industry since the early 1980s. Structural and operational reforms have improved the efficiency of urban water utilities. Pricing reforms, such as the introduction of usage based pricing and moves towards full-cost recovery, have been made to improve the efficiency of water use and to encourage timely and cost-effective investment in water infrastructure. Operational reforms in asset management and procurement, including contracting out, have led to significant cost reductions and better risk management.

Renewed interest in reform is both a result of the evolution of past reforms and a specific response to recent water shortages in most Australian cities. Two particular reform proposals are the introduction of scarcity pricing and an expansion of competition in the urban water industry. This paper discusses scarcity pricing and competition in the context of past reforms in the urban water industry and more recent responses to climate change and drought.

2. Reforms to Date

Publicly owned urban water utilities were part of the commercialisation and corporatisation reforms of the 1980s. Further impetus for change occurred following the Council of Australian Governments' 1994 Communiqué on water reform. Pricing and institutional reforms were key components of that reform (Council of Australian Governments 1994).

2.1 Institutional Reforms

The institutional reform commitments in the 1994 Council of Australian Governments

Communiqué sought the introduction of a more commercial focus for major metropolitan utilities, whether through contracting out, corporatisation or privatisation (Council of Australian Governments 1994). In implementing these reforms, different states and cities adopted different structural models. In Western Australia and South Australia, Water Corporation and SA Water, respectively, provide vertically integrated, state wide water and wastewater services. In Melbourne, bulk water provision is separate from water distribution, and three separate utilities operating in different areas are each responsible for water distribution and wastewater treatment. In Sydney and the Illawarra, bulk water is separated from water and wastewater treatment and distribution. In the Hunter Region, water and wastewater services are fully integrated. In Tasmania, three water authorities provide bulk water to councils, which provide water distribution and wastewater treatment. In the ACT, a public–private joint venture, ActewAGL, provides water, wastewater and energy services to capture economies of scale in a relatively small city. In South East Queensland, the industry is currently being separated vertically and a water grid manager created.

There are varying levels of private involvement in each structure. There is significant private involvement in the activities of Sydney Water. Sydney's major water treatment plants are privately owned and operated and one of Sydney's sewage treatment plants is privately operated. All capital projects are contracted out. A significant amount of maintenance is contracted out, as are most service functions such as meter reading and building management. These changes have led to a reduction in staff numbers at Sydney Water from around 19 000 in 1981 to fewer than 3000

today.¹ At the same time, Sydney Water has increased its efficiency.

Regardless of the industry structure, as the Council of Australian Governments recognised, an independent regulator, separate from day to day political processes, is an essential ingredient for good outcomes. The importance of strong, independent regulatory oversight increases as the industry moves to new sources of supply and potentially greater levels of competition. This is still an area for improvement in some jurisdictions. The Independent Pricing and Regulatory Tribunal, which is the regulator of Sydney Water, Hunter Water and the Sydney Catchment Authority, is a good working model of an independent regulator.

The recent drought and an awareness of increased climate variability have renewed interest in the structure of the urban water industry. The vertical separation of the South East Queensland water industry ultimately may permit competition in both retail services and bulk water supply. This form of competition could also be possible in NSW, under the *Water Industry Competition Act 2006* (NSW). This legislation enables private sector companies to be licensed to provide water and wastewater services and to access the services provided by monopoly water and wastewater infrastructure, particularly the pipe networks.

The prospect of private involvement in the supply of bulk water is relatively new. In the 1990s there would have been a general consensus that all but the retail function of water and wastewater supply were a natural monopoly. Now, the ability to manufacture water through desalination or the treatment and recycling of effluent raises the issue of whether or not the bulk water supply, as well as retail services, can be subject to competition.

2.2 Pricing Reforms

The pricing reform commitments made by the Council of Australian Governments included the implementation of consumption based pricing, full-cost recovery and the removal of inefficient cross-subsidies (Council of Australian Governments 1994). A key change was the introduction of consumption based pricing to re-

place property based charges. The significance of this should not be underestimated. Consumption charging relies on the installation of water meters—crucial to ensuring that water users receive a signal about the value of water resources. Meters are also an essential tool in controlling leakage and managing the distribution network efficiently. In contrast to the urban water industry in Australia, in the privatised UK water industry today, more than 70 per cent of residential households do not have water meters.

The principle of full-cost recovery is also significant. Full cost recovery is, of course, a prerequisite for both increased private sector involvement in the industry and the development of water markets. That said, full cost recovery in the urban water industry remains a challenge in some jurisdictions. For ongoing development of the industry, it is important that prices are sufficient to fund the significant investments required in new water sources, including recycled and desalinated water.

The NSW Independent Pricing and Regulatory Tribunal (IPART) recently set prices for Sydney Water that approach a commercial level of cost recovery. The water price in Sydney will rise by almost 50 per cent in real terms (2008–09 prices) from \$1.34 per kilolitre in 2007–08 to around \$1.93 in 2011–12 (IPART 2008). IPART has estimated that Sydney Water's potable water usage charge in 2011–12 (\$1.93 per kilolitre in 2008–09 prices) will equal the long-run marginal cost of augmenting the water supply. IPART argues that prices set at the long-run marginal cost send the right signal to consumers about the value of water and the right signal to potential suppliers considering whether or not to enter the market (IPART 2008).

3. New Reform Proposals

Drought and climate change have prompted a call for renewed efforts on urban water reform. New institutional and pricing reforms have been proposed, both as an evolution of past reform efforts and as a specific response to the recent water supply constraints experienced in most Australian cities. In particular, the

Productivity Commission and the National Water Commission have proposed two changes. First, consideration of water pricing that reflects the scarcity value of water; and second, competition in the supply of bulk water (Productivity Commission 2008; Frontier Economics 2008).

3.1 Scarcity Pricing

In its simplest form, scarcity pricing involves using prices to reduce demand for water in times of scarcity. At present, water scarcity is managed in the short term by water restrictions. With scarcity pricing, prices would increase as dam levels fall. Prices would decrease after rainfall or as other water sources replenish dams. Most discussions about scarcity pricing recognise that efficiently designed urban water systems require water restrictions some of the time. Sydney's water supply system was designed so that restrictions would be required for three out of every 100 years. By using restrictions to manage consumption during drought there are large savings in capital expenditure on additional water supply infrastructure. Scarcity pricing is an alternative to longer periods of restrictions that potentially enables consumers to adjust their water use according to the extent to which they value water. Scarcity pricing is also intended to improve signals about when to invest in new water sources.

Proposals to introduce scarcity pricing form part of a wider debate about the best way to price water. The introduction of consumption based charging was the first step. In this aspect, Australia is 20 years ahead of the United Kingdom and many other countries. Many Australian cities also extended consumption charging to inclining block tariffs where consumers pay higher water prices the more they consume. Some jurisdictions have had up to five tiers of prices based on the volume of water used.

Recently the rationale for inclining block tariffs has been questioned. If water has a uniform marginal cost of production, why should prices depart from this cost? This concept underpins IPART's view that all water should be priced at the long-run marginal cost.

In essence, debate about scarcity pricing is a debate about whether or not water should be priced at the short-run marginal cost of water. The short-run marginal cost is the cost of supplying an incremental unit of water in the short term, when capital is fixed. During drought, the short-run marginal cost exceeds the long-run marginal cost because the marginal cost includes the opportunity value of water use for other uses, including environmental flows. Traditionally, short-run marginal cost pricing has been rejected by water pricing commentators for several reasons. These reasons include that it would create volatility in prices and that it would not send appropriate long-term signals to encourage efficient consumption and investment.²

The main gap in the scarcity pricing debate is the absence of solid data on the price elasticity of demand for water. This means that it is quite unclear how high prices need to rise in order to reduce water use. Demand for water is inelastic. That is, price increases will lead to a less than proportional decrease in demand. Most water consumption by households is for essential, indoor purposes (Table 1). Customers have limited ability to curtail their use of water for essential purposes, even if prices rise. Also, both households and businesses have already made significant permanent water savings in response to the recent drought. They have done this by installing water efficient appliances, including low-flow showerheads, aerated taps, dual flush toilets, water efficient washing machines, rainwater tanks, by fixing leaks, and through the use of recycled water in some areas. This means that demand in aggregate is less likely to respond to price because there are few easy gains to be made. Even discretionary uses of water, such as garden watering, may not be very price sensitive. Water is a small component of the monetary and time cost of maintaining a garden. It is also only a small proportion of total household and business budgets. In Sydney, the usage component of the water bill is around 0.5 per cent of gross household expenditure. Most customers are likely to absorb significant price increases before significantly changing their behaviour.

**Table 1 Uses of Water in Sydney
Residential Properties**

<i>Type of water use</i>	<i>Proportion of water use (%)</i>
Shower	24.1
Lawn and garden watering	23.6
Washing machine	17.8
Kitchen, laundry, bathroom taps, leaks	15.8
Toilet	13.7
Pools, car washing, hose down	4.4
Dishwasher	0.6

Source: Sydney Water.

The impact of scarcity pricing will vary dramatically depending on the price elasticity of demand for water. Published estimates of elasticity vary significantly. A report prepared for Sydney Water estimated that the price elasticity of demand for urban water was -0.07 . The IPART Secretariat (O'Dea and Cooper 2008) cited estimates of between -0.3 and -0.13 . At these levels, the Secretariat estimated that prices would need to rise by between 62 and 143 per cent to replicate the reduction in demand from Sydney's level three water restrictions. These level three water restrictions have reduced consumption by about 15 per cent. The increase required if non-discretionary water uses were exempted from the scarcity price was estimated to be up to 1000 per cent. Although other studies have estimated elasticity to be closer to -0.45 to -1.0 (for example, see Hughes et al. 2008) they lack credibility. If these estimates were correct, Sydney Water's 50 per cent price increase over the next four years would at least match the reduction in water use achieved through level three restrictions. In other words, Sydney Water's recent price increases would already amount to scarcity pricing.

If very large increases in price were necessary to reduce the demand for water to the same extent as water restrictions, there would be a very large financial transfer from consumers to the water utility or government. Transfers do not have a place in traditional welfare economics, but when transfers are large they are important to policy-makers. While water makes up only a small part of household income, low-

income households and large families need to be considered from an equity perspective. One way of doing this is to exempt a prescribed volume, representing non-discretionary consumption, from the scarcity price. However, this would shift the burden of reducing consumption to the remaining volume of water. Prices would need to rise even higher to have any impact on demand (IPART 2008). Another approach is to provide compensation (for example, as a means tested or per capita payment) to those most affected by price increases. If compensation too closely mirrors the impact of higher prices, the objective of scarcity pricing could be defeated—people would pay a higher water bill in the knowledge that they will get the increase back. In contrast, if payments do not broadly match the impact, some parts of the community would experience a windfall gain, while others would suffer windfall losses. The efficiency losses inherent in any compensation scheme need to be considered when comparing the costs of scarcity pricing with water restrictions.

None of this is to suggest that scarcity pricing should be ruled out, though Sydney Water is sceptical as to its efficacy. To better evaluate the effectiveness of scarcity pricing, further research is needed on the demand curve for water and the elasticity of demand at different prices, including at higher prices than we have so far seen in Australia. A live pilot study in a large but contained urban area would also be appropriate before any general implementation of scarcity pricing occurs. Debate on scarcity pricing may also be informed by the results of Sydney Water's trial of 'smart meters', which allow real time information on water consumption. The Productivity Commission (2008) and the National Water Commission (Frontier Economics 2008) have called for the installation of smart meters and more regular billing to improve price signals.

3.2 Increased Competition

The Productivity Commission (2008) and the National Water Commission (Frontier Economics 2008) have cited a need for increased competition in the urban water industry.

Competition in both retail services and in the provision of bulk water is seen as the next step in institutional reform of the urban water sector. The National Water Commission has commented that 'institutional reform in the water sector has not kept pace with other sectors such as telecommunications, electricity, gas and ports' (Frontier Economics 2008, p. v). In addition, competition in bulk water supply has been made a realistic option since the late 1990s through the diffusion of efficient and cost-effective technology for desalination and water recycling.

Sydney Water welcomes competition and supports the NSW Government's Water Industry Competition Act. Sydney Water also has significant experience with national third party access under Part IIIA of the *Trade Practices Act 1974* (Cwlth), having had the first arbitration on access to infrastructure services in the urban water sector. It is important, however, to note that competition and markets for bulk water have not evolved anywhere in the world. The gas and electricity industries do not necessarily provide a relevant template for the reform of urban water. The characteristics of the urban water industry may have limited the extent of structural change to date.

This is not to say that competition in the water industry cannot occur. Rather, a lot more work needs to be done before there is a clear pathway. The key issue relates to where the line is between the contestable and non-contestable elements of the urban water industry. There is a clear understanding of this line in the gas and electricity industries and, therefore, there is an unassailable logic to the introduction of competition to the contestable areas—principally generation and retail. In the urban water sector, the retail function is certainly contestable. Whether or not the supply of bulk water is contestable depends on some key characteristics of this sector.

Alternative sources of bulk water (like desalination and recycling) tend to be more expensive than water from dams. This is because treatment is more complex (for example, for desalinated and recycled water) and/or because the water has to be transported long distances. Transport costs, in particular, limit the devel-

opment of a national market for urban water. Transport costs are a high proportion of total water or wastewater costs because of the energy costs for pumping and the significant infrastructure involved. At Sydney Water the cost of energy—largely used to transport water and sewage—is 30 per cent of total operating costs. This figure includes energy savings from numerous renewable energy generation schemes within Sydney Water and optimised and efficient network management schemes.

The cost of transporting electricity is comparatively low. This makes it worthwhile to transport electricity over long distances, which enables the electricity generation market to accommodate many players. Gas is also transported long distances, for example, more than 1000 kilometres from Moomba in South Australia to Sydney. As shown in Table 2, the impact on transport costs, over long distances, is minor. The cost of transporting gas for 1000 kilometres accounts for around \$0.80 (or 5 per cent) of the \$16 per gigajoule retail price (in NSW). As a result, sources of natural gas that are a long distance from customers can compete with local sources of gas. In comparison, the cost of transporting bulk water over the same distance would be in the order of \$8.00 per kilolitre. In 2007–08, the average price per kilolitre for potable water in Sydney was \$1.54 per kilolitre. The retail price for potable water would need to be significantly higher for distant water sources to be competitive with local sources.

Another characteristic that would affect the development of an urban bulk water market is that large volumes of water can be stored in dams. Alternative sources of water will not necessarily be required all the time. Volatility in supply and demand occurs over the course of years, rather than hours as in the electricity sector. Short-term supply constraints in the electricity industry arise because electricity cannot be stored in the same way as water (hydroelectric generation aside). This characteristic of the electricity sector creates opportunities for alternative sources of supply even though different types of generation have different costs.

These characteristics mean that, in Sydney at least, dams may have significant natural

Table 2 Indicative Costs of Supplying Gas and Treated Water (2007–08)

	Gas (\$/GJ)	Treated water (\$/kL)	
		Local source	Distant source
Wholesale cost	4.00	0.55	0.55
Transport cost (per 1000 km)	0.80 ^a	na	8.00 ^b
Distribution and retail costs and margin	11.30	0.99	0.99
Retail price	16.00	1.54 ^c	9.54 ^c
Increase in retail price caused by transport (%)	5	na	519

Notes: (a) \$0.80/GJ is the approximate cost of transporting gas for more than 1000 km in the Moomba to Sydney pipeline.

(b) The cost of pipes and pumps to transport a bulk volume of water (say around 500 ML/day) 1000 km would be in the order of \$6.00/kL–\$10.00/kL.

(c) The retail price for water includes a usage charge and a service charge (averaged per kilolitre).

Source: Based on information from Sydney Water, IPART and the APA Group <<http://www.pipelinetrust.com.au>>.

monopoly characteristics most of the time. While they have water in them they can supply the market at lower cost than other sources of supply. New dams are generally not an option because of geographical issues, as well as environmental and transport costs. This means that Sydney's desalination plant is critical to the security of the water supply. However, because of the dams, the contract for the plant allows it to be switched off for considerable periods if it is not required. In this situation (with postage stamp pricing) all water users pay for the security provided by the plant. For a bulk water market to work, there would need to be a market for 'security', independent of the supply of water, to provide an incentive to develop infrastructure.

The security provided by alternative sources of bulk water is a type of insurance. Like an insurance policy, the value of the security provided by alternative bulk water sources is related to both the cost of an adverse event and the probability of such an event occurring. The cost of running low on water is high in both social and economic terms. In Sydney, the probability

of water scarcity is also very high, relative to other cities, given the high variability in rainfall in Sydney's catchments. Therefore, the security value provided through a diverse range of water supply sources is high.

4. Conclusion

The urban water industry in Australia has changed substantially since the 1970s and 1980s. Institutional and pricing reforms have increased the efficiency of water use, investment in water infrastructure and water utilities themselves. This reform effort continues as institutions adapt to managing new sources of water made necessary by changing rainfall patterns. Further debate and empirical work is required to identify the feasibility of further pricing reforms, such as the introduction of scarcity pricing. Work is also required to identify mechanisms for creating markets for bulk water supply, including markets that specifically recognise the insurance value created by diversity in bulk water sources. There is a role for national involvement in the reform effort. But there is also a role for the continuing diversity of policy approaches that has underpinned improvement in the water industry to date.

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Endnotes

1. In 1999, the Sydney Catchment Authority (SCA) was created as a separate agency. This contributed to the reduction in Sydney Water's staff because the SCA's functions were previously carried out within Sydney Water. Around 200 staff were transferred from Sydney Water to the SCA.
2. The former Industry Commission (1992, pp. 64–5), now the Productivity Commission, outlined a number of issues with setting water prices at the short-run marginal cost of water. These include that: 'marginal cost pricing would involve significant price fluctuations. This is because systems are generally expanded through the addition of large blocks of capacity—for example the construction of a new dam—while demand grows more evenly over time. This means that after each new augmentation there is surplus capacity and hence under marginal cost pricing, prices would fall sharply. Thus consumers who did not accurately foresee future price increase, would be encouraged by low prices to develop and maintain gardens, only to have water rationed through price increases when the next capacity constraint

was approached. Following new investment in capacity, water would again return to a low price.'

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