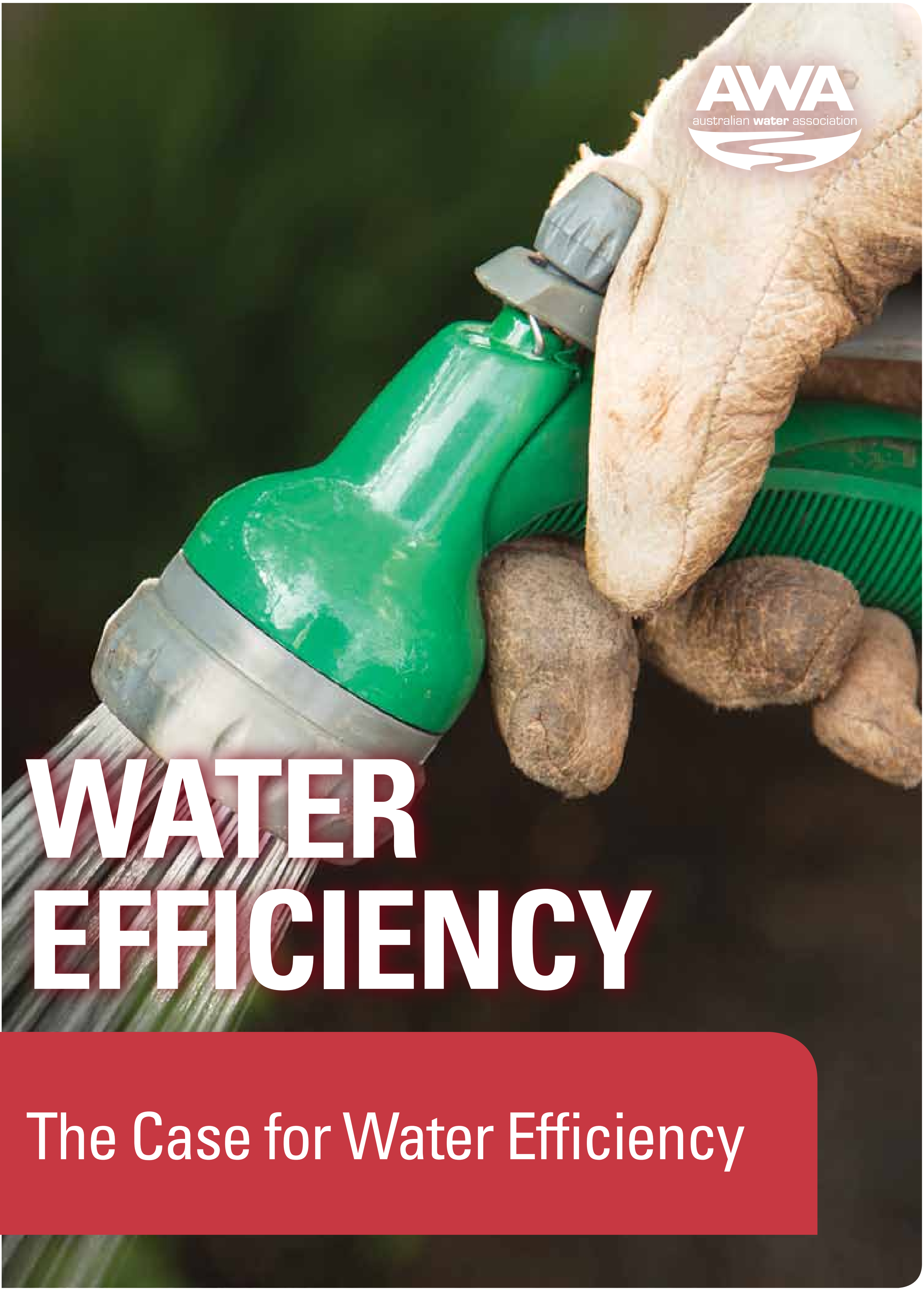

WATER EFFICIENCY

The Case for Water Efficiency

AWA Position Paper – OCTOBER 2012

Contents

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1. Scope

This position paper describes the role of water efficiency in urban water use in Australia and identifies emerging issues. It is written for those with responsibility for developing policy and making decisions on how water is delivered, used and managed and for those with an interest in such matters.

Water services in the 21st century will differ in fundamental ways from the systems that preceded them, and which were directed almost exclusively at protecting community health. In this century, water supply provision will not just provide healthful water and treatment of wastewater. It will: be better integrated with other urban services; deliver better asset maintenance strategies; include alternative supply options; explicitly consider the environmental, energy and other costs associated with water supply and wastewater management; and focus on provision of an integrated service offering to customers. Advanced water efficiency will be an integral component of such an offering.

It is within this context that this paper presents the case for consideration of water efficient policies and practices. Whilst reference is made to operational efficiency – including leakage control and water management policies and practices that lead to better integration of water supplies within the urban environment – it is directed primarily at water efficiency at the point of use.[1]

1. For an overview of the context of water efficiency, see White, S. (2010). "Securing water supplies through sustainable water management." LGSA Water Management Conference. Orange, LGSA.

2. Synopsis

- Water efficiency is an economically viable way to enhance water security in many circumstances. Water efficiency also makes sense in its own right and is worthwhile even when water security is not a goal; water efficiency can increase the availability of water for environmental, economic, cultural, spiritual and aesthetic purposes.
- Australia's climate is highly variable and emerging pressures such as population growth will affect the security of water supplies in ways that are difficult to predict. A changing climate will exacerbate these pressures. Flexibility is required to deliver effective solutions, and opportunities to achieve greater water efficiency must always be part of these solutions.
- Water efficiency must be considered equally with supply-side options in the development of any strategy to improve long term water supply security.
- In line with the 1994 *COAG Water Reform Framework* and the *National Water Initiative*, **all** costs associated with water supply should be internalised. This would facilitate comparison of demand and supply-side water security options.
- Calculation of the benefits of water efficiency and of options to improve supply should not just include those items that are easily monetarised. The community holds strong views about other values that can be realised through water efficiency. Such values must always be taken into account in any comparison of alternatives.
- Greater consistency in approaches taken to water efficiency across the country would facilitate the sharing of experiences and would minimise the risk of research being duplicated.
- Skills, knowledge and practices in delivering water efficiency need to be maintained during times of plentiful rainfall.

3. Definitions

'Water efficiency' refers to the suite of practices and policies that maximises the benefit gained from every unit of water used.

'Water conservation' refers to approaches that prevent the wasteful and excessive use of water resources. It is the view of AWA that water efficiency and water conservation are synonyms, as wasteful practices produce no benefit.

'Water restrictions' refer to those voluntary or mandated limits on the volumes of water that can be used, the time of use or the purposes to which water can be put that may be applied from time to time in response to supply insecurities. Water restrictions introduced in Australia differ from region to region and may be tightened or relaxed in line with relative availability of water.

'Demand management' refers to "*any regulatory, policy, technical, service or commercial interaction with customers or consumers that enables volumes to be managed to minimise economic costs and environmental impacts to society*" (Cooperative Research Centre for Water Quality and Treatment 2006). In other words, demand management initiatives may include water efficiency but might also include regulations, changes to price and infrastructure improvements intended to reduce demand on potable water supplies.

'Water Security' refers to the extent to which consumers can rely on there being a consistently available, high quality water supply that meets their demands.

'Supply-side' options refer to those approaches that secure greater volumes of water through the accessing of new supply sources.

'Demand-side' options refer to those approaches that increase water security by reducing consumers' water needs (see also 'Demand Management', above). Supply-side options are at the opposite end of demand-side options in an integrated water security strategy.

4. AWA's Position

General

1. Water efficiency offers significant potential to enhance water security. Water efficiency measures should be considered alongside all other options for improving water security.
2. The breaking of drought over much of Australia does not reduce the importance of water efficiency. Climate change and population growth will mean that in future more will need to be done with less. Skills, knowledge and practices in delivering water efficiency should be maintained.
3. Water efficiency can also make economic sense in its own right and could be employed even when water security is not a goal (e.g. to reduce treatment operational costs).
4. Water efficiency is not a goal unto itself. Where the costs of its implementation are greater than the benefits gained, or where it does not compare favourably on a triple bottom line basis with supply-side options, it should not be pursued.
5. In making comparisons between demand and supply-side options, the full costs and benefits of options available should be considered, including non-monetary values, external costs and benefits.
6. In line with the 1994 *COAG Water Reform Framework* and the *National Water Initiative*, externalities associated with water supply should be internalised. This would facilitate comparison of demand and supply-side water security options.

Water Prices

7. Price is an important mechanism for stimulating water efficiency. AWA strongly supports full-cost recovery pricing, and research into the value or otherwise of scarcity pricing.
8. Prices should be reviewed to ensure they are structured in a way that best rationalises water consumption and, with respect to developer charges, enables developers to capture the benefits of innovations in water efficiency incorporated in their developments.

Information, Research and Technology

9. Information on the benefits or otherwise of water efficiency measures should be shared freely among all jurisdictions to minimise the risk of research efforts being duplicated and mistakes being repeated.
10. Water monitoring data should be used thoughtfully to identify and research the successes and failures in water efficiency to date and to provide guidance for future actions and programs.
11. Effort should be directed to ensuring that water efficiency measures are considered as an alternative to system expansion. Such 'mainstreaming' will help to ensure that the best option from the suite of options available is always chosen.
12. AWA encourages research and development of technological advances to achieve water efficiency.
13. AWA supports the widespread adoption of schemes such as WELS and Smart Approved WaterMark.

Accreditation and Training

14. AWA strongly encourages the development of training courses and guidelines that are consistent nationally. Courses should be generic enough to be used internationally and flexible enough to be updated to respond to new ideas and technologies.

5. Why is Water Efficiency an Important Issue?

Over the past decade there has been significant investment in water conservation and efficiency measures (including water restrictions) as part of crisis management during drought. Recent rainfall across many of Australia's cities has, however, led to the lifting of water restrictions in many areas and reduced the emphasis governments and some utilities place on water efficiency measures. Nevertheless, there are still some areas in Australia that have not returned to historical average rainfall patterns, notably much of Western Australia and South Australia.

The statement that Australia is the driest inhabited continent on the planet, while true, masks regional variations. It is these variations that affect the need for and viability of water efficiency measures, not average precipitation and evaporation across the continent. The availability of water for urban purposes depends on a wide range of factors, including:

- Variability of rainfall across years
- Evapotranspiration (the amount of water vapour returned to the atmosphere through the transpiration of vegetation or evaporation from water bodies or runoff) (Chiew, Wang et al. 2002)
- The volume of water that percolates to groundwater tables, the accessibility of those groundwater tables and the rate at which they recharge over time
- The volume of storage available (which includes dams, reservoirs and managed aquifer injection and recovery)
- Availability of surface water flows (rivers, creeks and streams) and limitations (caps) that may be imposed on that resource
- The extent of loss from distribution systems
- The availability of recycled water and/or desalinated water
- Population and the rate of water consumption per head of population
- The intensity of water use by industry and commercial establishments and competition for available resources from other industries such as agriculture, forestry and energy generation
- Other factors such as accessibility and cost, among others[2]

Each of these factors varies from area to area. Relative security of water depends upon the interaction of these factors and will vary over time. It may be difficult to predict the relative security of water supply in a particular area in future due to uncertainty related to population and demographic change, changes in industrial water consumption and climate change.

Rainfall across many areas of Australia (but certainly not all) has returned to historical averages at periods over the past two years. This has led to an increase in stored water levels in Sydney, Melbourne and Brisbane and other centres, mainly on the east coast and has contributed to the lifting of "Exceptional Circumstances" declarations in all areas.[3]

The water industry has recently expressed its strong support for continued conservation and efficiency measures. The *AWA/Deloitte State of the Water Sector Survey 2012* included the question "Drought conditions have eased across much of Australia over the past 18 months. To what extent should water conservation and efficiency programs be curtailed during wetter periods?" and 67% of respondents answered "Not at all" or "Marginally" (AWA/Deloitte 2012).

A continued focus on water efficiency remains important because:

- Water still remains the Australian public's number one environmental issue (Mobium Group 2011). There is an expectation that the water industry, working with the community, will be an effective steward of the resource.
- When assessing different measures on a triple bottom line basis (Figure 1), water efficiency has the potential to save energy and money and delay the construction of major water supply and treatment infrastructure in the future (Nelson, South East Water et al. 2010).

Figure 1 Comparison of management options using a Triple Bottom Line assessment. (Nelson, South East Water et al. 2010)

2. The National Water Commission's website (www.nwc.gov.au) contains information on factors affecting urban water availability and projects related to quantification of Australia's water resources among a wide range of other matters. Information on water accounting is available at http://www.nwc.gov.au/rnws/accounting

3. See www.daff.gov.au/agriculture-food/drought/ec

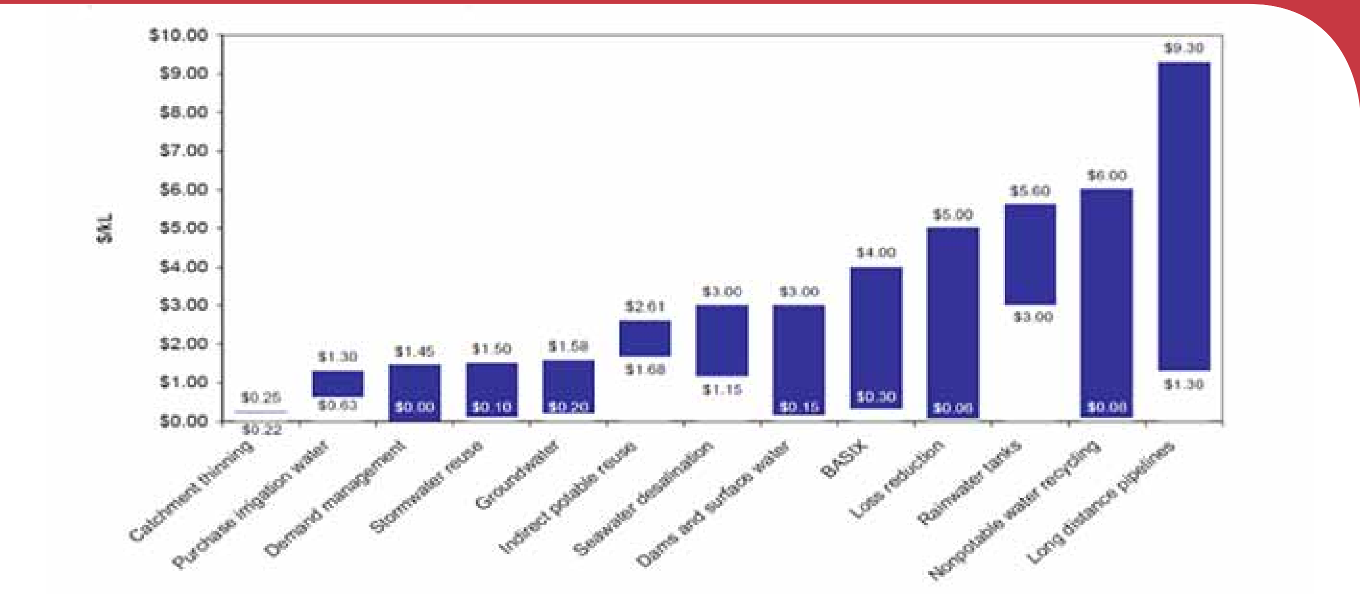


Figure 2: Direct Costs of water supply/demand options (Marsden Jacob Associates 2006)

- Water efficiency can be cost-effective, whether water is plentiful or in short supply. *The Melbourne Joint Water Efficiency Plan* (Nelson, South East Water et al. 2010) revealed, for example, that 'Demand Management' is among the cheapest of options for enhancing water security (see Figure 2).
- Water efficiency remains an important element of water supply security strategies in many urban areas.[4] Figure 3 shows the contribution that might be made to future water supply security for Sydney by water efficiency measures.
- Retention of knowledge and skills to operationalise these and other water supply strategies will be critical to the success of these strategies.
- Water efficiency measures are enduring; producing benefit for many years after the initial investment is committed. Experience in Brisbane, Melbourne and Sydney shows that even when broad water efficiency programs are curtailed (such as the Target 140 and 155 programs) water consumption does not return to pre-program levels. The continuing water savings are a combination of water efficient technologies being hardwired into infrastructure (e.g. dual flush toilets) and changes in consumer behaviour.
- Water efficiency may produce benefits other than the conservation of supplies such as increased availability of water for environmental, cultural, spiritual and aesthetic purposes, reduction in energy use and related carbon emissions.
- Householders and businesses may reduce their costs if they continue to be water efficient. In this respect, provision of information by utilities about ways in which customers can be 'water smart' is justified, as is investment in programs to promote water efficiency in the non-residential sector. Many investigations into high water-use businesses have shown that significant water savings are available if the right support and incentives are provided in partnership with business customers (*Victoria's WaterMAP*[5] approach may provide a good model). Investment to reduce water consumption by businesses often has a short pay-back period.
- By engaging and supporting householders and businesses to make water efficient choices that suit their circumstances and personal preferences, utilities and other water service providers develop closer, more collaborative relationships with customers. This is good business practice.
- Australia's skills and experience in water efficiency can be exported for the economic benefit of the nation.
- Efficient water use can be vital in times of emergency. During recent floods in Brisbane, water contamination required the implementation of water efficiency practices to allow for 'breathing space' while critical water supply and treatment infrastructure was brought back online (Hanna and Waters 2011).

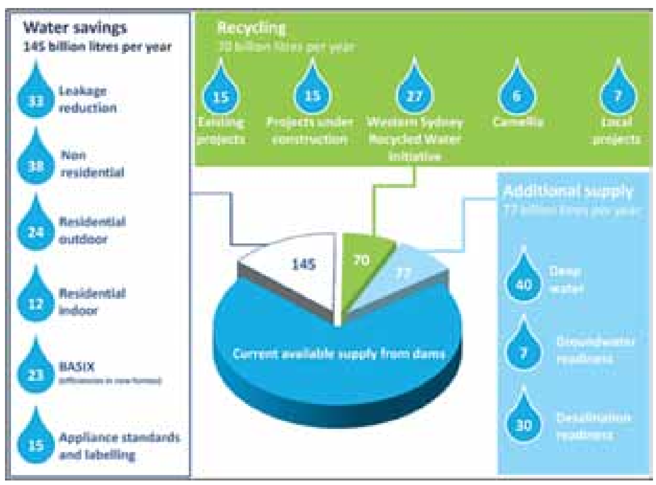


Figure 3 – Relative Contribution to Supply and Demand: Sydney (White 2010)

4. See, for example Water Corporation (2011). Water Forever Whatever the Weather: Drought-proofing Perth; NSW Office of Water (2010). 2010 Metropolitan Water Plan; and http://www.citywestwater.com.au/residents/saving_water.aspx.

5. See www.water.vic.gov.au/saving/industry/watermap

The breaking of drought in many areas has reduced the immediate need for significant investment to be made in water efficiency measures (at least in terms of there being a particular imperative to conserve water). This provides breathing space for some governments and parts of the water industry to review the impact of efficiency measures. This is an ideal opportunity to take a careful strategic review of the approaches taken to water efficiency to determine which approaches are the most effective. The gathering of this information will also facilitate sharing of data between jurisdictions and will provide opportunities to 'mainstream' water efficiency so that it becomes a standard way of doing business.

Avoiding the need to augment water supplies or reducing users' water bills are not the only reasons water efficiency might be pursued, nor is demand management at the point of use the sole focus of efficiency policy. According to the Australian Bureau of Statistics, 7% of water supplied in Australia was 'consumed' by the water industry in 2000-2001 (ABS 2004). In 2004-2005, this was 11%, when the total national consumption was lower (ABS 2006). In 2011 CSIRO reported that this consumption is "mainly the losses of water that occur in supplying water and providing sewerage services" which may include wastewater generated as a result of water treatment process, water used to wash down facilities, water consumed in mains flushing (cleaning) and water loss through cracked and broken pipes, unmetered water and water theft (CSIRO 2011). While the performance of Australian systems is at least consistent with other developed nations if not notably better, new technologies and practices are emerging that may lead to further reductions in loss at a reasonable cost.[6]

It should also be noted that a continuing focus on water efficiency will be justified because of several significant challenges facing the nation. Foremost are population growth/demographic change and the rapid urbanisation of the city centres. These pressures will be exacerbated by climate change, even if only the most conservative estimates of the impact of climate change on the reliability of rainfall come to pass. Thus, Australia is almost certainly facing circumstances in which it will be required to provide water for a larger population (and, potentially, higher water use industries) and to do so in drier conditions.

Regional variations in population growth and rainfall in future may mean that areas now considered water secure will be tested and others will face significant investment to maintain water security levels. A further challenge is that of the rising cost of energy and the connection between energy generation, the production of greenhouse gases and water supply. In short, there are strong links between water use and energy demand and between energy generation and water demand.

Each of these challenges is discussed further below.

A word of caution…

Promotion of water efficiency measures, changes to water prices to stimulate conservation, restriction and other measures directed to reducing water demand (each discussed in this paper) may have the effect of stimulating a shift to alternative sources of supply. This may be appropriate and beneficial, but should be assessed on a case-by-case basis as there can be undesirable impacts. For example, a shift to local groundwater supplies may deplete aquifers or lead to saline intrusion, and more widespread use of rainwater tanks may lead to a significant increase in energy usage. It is important, therefore, that water efficiency is considered in context and the outcomes of change be considered alongside the benefits derived from reduced water consumption.

5.1. Climate Impacts

While a trend towards a warmer and drier future has been identified, the extent of the change and the timeframe of this change are less well known. There is significant variation between best and worst case scenarios projected by both CSIRO and the United Nations Intergovernmental Panel on Climate Change (IPCC). Nevertheless, the Prime Minister's Science, Engineering and Innovation Council (PMSEIC) indicated that global temperature increase would lead to a dramatic drop in the likelihood of rainfall over the main urban population centres of Australia (PMSEIC 2010). Figure 4 shows the predicted changes in temperature over the continent for scenarios of global temperature increases of 2 deg and 4 deg, respectively. For each prediction, a corresponding expected change in precipitation over the continent is shown for both the summer and winter months. It is observed that in both scenarios of temperature rise there is an uneven precipitation response across the continent which is more pronounced during the winter months.

While there is considerable uncertainty about the impacts of climate change, there is a strong likelihood that many of Australia's cities will be affected negatively in future and that supply planning should include water efficiency measures. A multi-faceted water supply and demand strategy is needed to produce a robust, resilient and integrated approach to water management in the face of climate change.

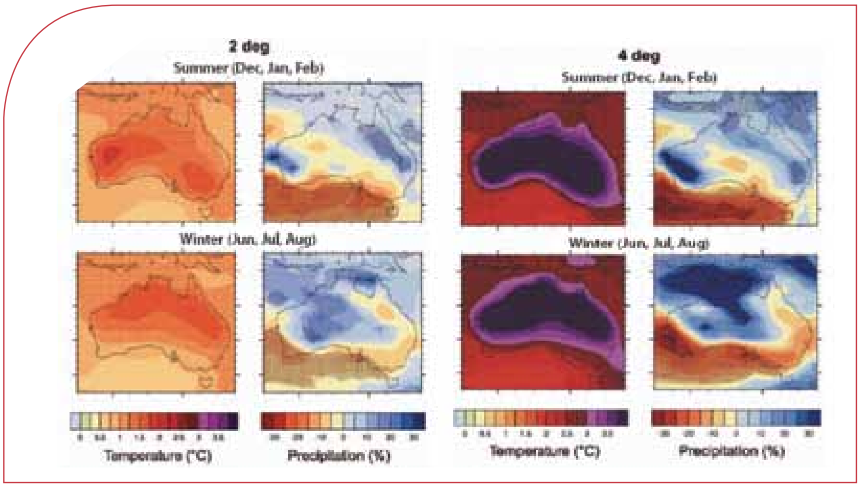


Figure 4. Variability in Temperature and Impacts for Precipitation and Temperature. (PMSEIC 2010)

6. There are a number of measures for 'non-revenue water' also known as 'unaccounted for water'. One is kilolitres lost per kilometre of water main. Australia's rate against this indicator is 4.4Kl/Km which compares favourably with England and Wales at 10/Kl/Km but less well against the Netherlands at 1.5Kl/Km (see Danish Water and Wastewater Association (2010), which includes data from DANVA using its own data and data from OFWAT, the UK water industry regulator).

5.2. Population and Demographic Impacts

Population growth is also a major driver of urban water demand. The Australian Bureau of Statistics population projections suggest that between 32.9 and 42.5 million people will be living in Australia by 2056, one-and-a-half to two times more than our current population (Australian Bureau of Statistics 2008).

The Water Services Association of Australia (WSAA) estimates that for a variety of reasons (including the introduction of more water efficient practices) per-capita water use will drop by around 9% by 2056 on 2009 levels (Water Services Association of Australia 2010).

Nevertheless, under the influence of population growth, WSAA also estimates that water demand across Australia's major capital cities could rise between 961GL to 1612GL by 2056, the higher estimate representing more than a doubling on 2008/9 consumption levels.

In addition to population growth, the demographic structure of Australia's cities is changing. This too has implications for future water demand, although there is significant uncertainty about how demographic change will affect water demand.

The two main features of demographic change are an ageing population and the growth in single-person living. A significant proportion of new housing development occurs in existing areas, largely through the construction of units.

This can impose new pressures on existing supply systems. While there may be a reduction in outdoor space requiring irrigation, the timing of water demand may change affecting the way in which infrastructure is renewed, maintained and designed.

While the more widespread introduction of water efficient technologies, increases in the price of water (which are expected to stimulate a reduction in demand) and more widespread use of water-sensitive urban design practices might curb total water demand, uncertainty about the effects of a combination of population growth and demographic change require a continued focus on water efficiency.

> "THERE IS ALSO A STRONG LINK BETWEEN ENERGY GENERATION AND WATER CONSUMPTION, AS SIGNIFICANT VOLUMES OF WATER ARE NEEDED TO PRODUCE POWER."

5.3. Water/Energy Nexus and the Price on Carbon

A significant amount of energy is consumed in the capture, treatment and delivery of potable water throughout urbanised areas in Australia; there is a direct link between water consumption and energy consumption. Energy consumption will likely rise as the population increases and as water sources that are more energy intensive are utilised (e.g. water sourced from remote locations requiring pumping and the use of lower quality water that requires energy intensive treatment including wastewater, stormwater and ocean water).

There are various ways in which energy is conserved when reducing water use. On a site basis, less energy is required to heat water. On a network distribution scale, less energy is required to treat and pump water from the supply dam, groundwater source or recycling facility and on-site. Water distribution pump sizes can also be optimised to match demand levels better.

Research by CSIRO has suggested that total utility energy use in 2007 was equal to only 15% of the total energy used Australia-wide in domestic hot water heating (Kenway, Lant et al. 2009). In other words, it takes only a relatively small decrease in hot water usage in households to offset all of the energy used in conveying treated water to households in the first place. This is a strong argument for water efficiency.

If, as suggested in some future projections, Australia's population increases by 25% by 2030 the additional energy required to supply water at a consumption rate of 300 litres/per person/per day (l/pp/pd) is 26-36 petajoules, whereas the increase of the same population consuming 150 l/pp/pd would effectively be zero. See Table 1 below:

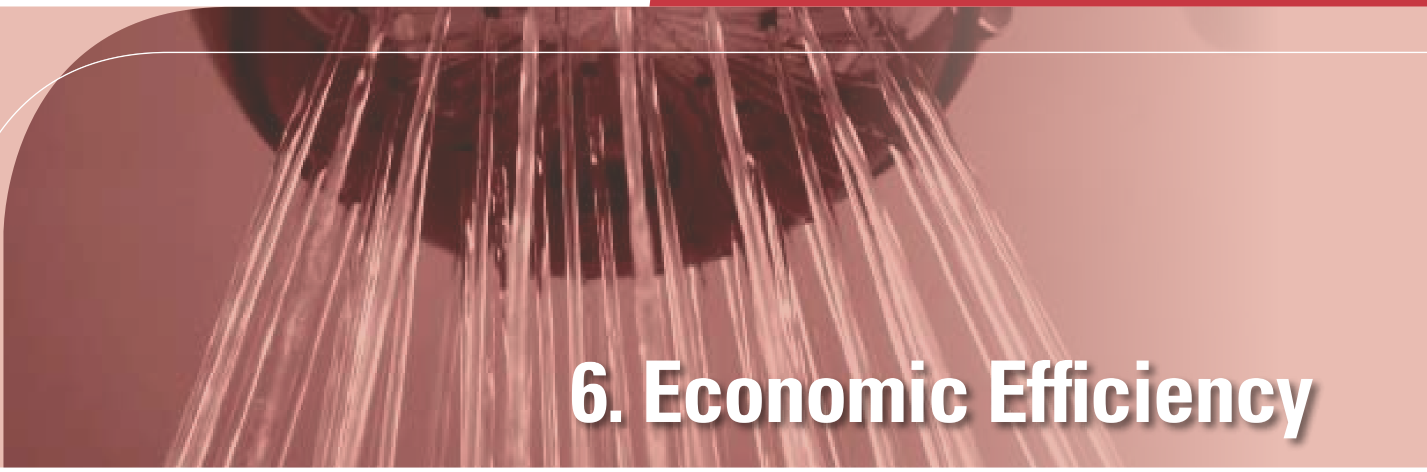
Table 1 Implications for future energy use of water conservation
(Kenway, Priestley et al. 2008)

Consumption per capita in 2030[7]	Anticipated increase in energy (Petajoules)	Anticipated % increase in energy use
300 L/cap/d	26-36PJ	260-400% increase
225 L/cap/d	16-41PJ	130-200% increase
150 L/cap/d	7PJ	0% increase

There is also a strong link between energy generation and water consumption, as significant volumes of water are needed to produce power. With a tax now imposed on carbon and subsequent rises in the carbon price from $23/tonne to $25.40/tonne over the next three years (Commonwealth of Australia 2011), water-related energy savings will become more attractive financially in the future.

Finally, reduction in materials use can arise from water efficiency measures. These might include a reduction in pipe diameters, reduction in wear and tear on pipes and pumps and the like. Such material use reduction can reduce energy and water use and may produce fewer greenhouse gas emissions.

7. Based on a population increase over 2007 levels of 25% and existing water supplies used.



6. Economic Efficiency

Whilst this paper sets out the case for a continued focus on water efficiency, it is not AWA's contention that water efficiency is the answer to every water security challenge. Those with responsibility for augmentation of water supplies have a diversity of options available to them. The cost of accessing these alternatives depends on local circumstances. Factors such as geography, population, accessibility, quality and others all affect the cost that would be incurred in utilising the resource and, by extension, the price paid by consumers.

The notion that water efficiency should always be the option preferred by policy makers because it represents a reduction in use of the resource is not one that AWA shares. Rather, it is the position of the Association that investments in water security must be directed to the most economically efficient water source. Generally speaking, this might be defined as the resource that meets requirements at the lowest overall cost. There is no justification for always seeking to conserve a resource, as the cost of such conservation might outweigh the social benefit. For example, if funds are committed to efficiency, and the costs of that commitment are greater than accessing a new water source, the community's funds are being misallocated. To make such investments is to say to the community that there is greater benefit in water conservation than, for example, education or health, because over-investment in water efficiency may mean fewer dollars are available for those services. It should not be up to water managers to determine how the community's funds are spent.

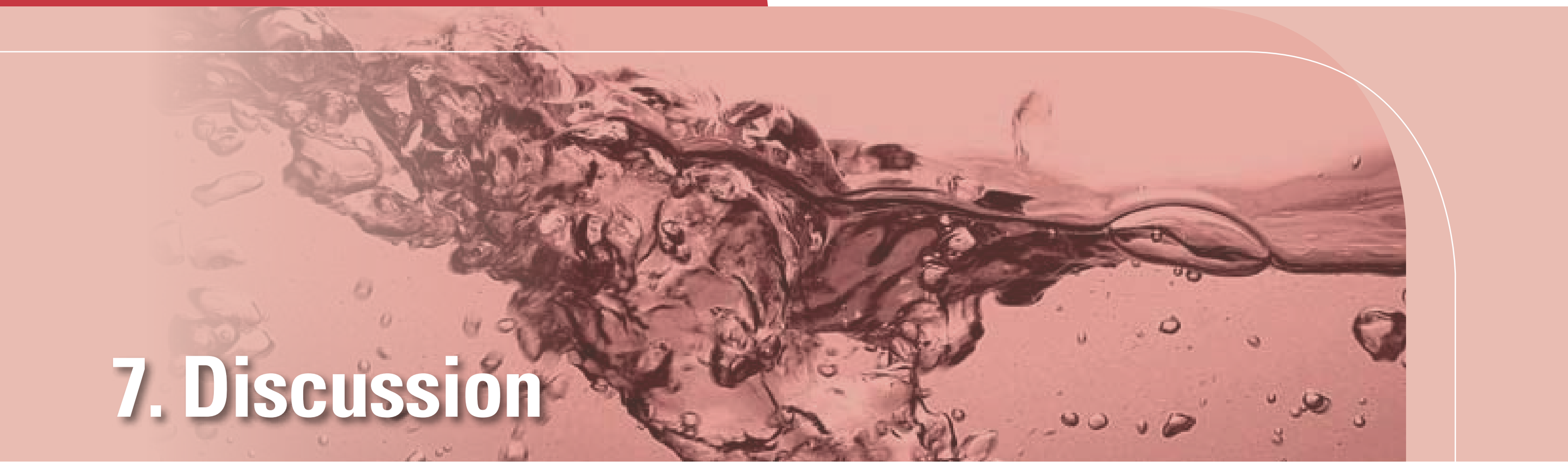
To provide a more concrete example, the Productivity Commission in its report on urban water (2011) noted that some water efficiency programs provided a subsidy for the purchase of water efficient appliances, but that the effective cost of water conserved as a result of these subsidies ranged to $33,395 a megalitre (in the case of subsidies paid in Melbourne on AAA-rated dishwashers for householders) (Productivity Commission 2011). This is taxation revenue or money raised from water rates that could have been used for a more socially beneficial purpose or to reduce water charges overall.

This said, water efficiency measures are frequently the most cost-effective options for promoting water security. It should be self-evident that a resource that is not used will often be cheaper than one that is, if for no other reason than storage, transport, energy, materials and other costs are avoided from the outset. Some of the data in *Figure 2* shows this to be the case.

Improved maintenance and management techniques may reduce wastage and loss cost-effectively. AWA does not argue for over-investment in system maintenance any more than it argues for over-investment in demand management or other efficiency measures. However, where there is a positive cost-benefit arising from a particular efficiency measure, it should be pursued.

Clearly, this means that water managers have to pay particular attention to quantification of the costs of avoided water use. Whereas the costs of actual water consumption are generally transparent (as the cost of transport, energy, materials and other inputs need to be met) the costs avoided by reduced water consumption are not always clear (as in the case of avoided energy). Such avoided costs need to be identified and quantified or the potential will exist for poor decisions to be made about the relative costs of water supply options. It is certainly the case that a decision to, say, construct a new dam will be sub-optimal if the full costs and benefits of all available options are not considered (see also Section 7.3 on *Pricing*, and Section 5 *Why is Water Efficiency an Important Issue*).

> "IT IS THE POSITION OF THE ASSOCIATION THAT INVESTMENTS IN WATER SECURITY MUST BE DIRECTED TO THE MOST ECONOMICALLY EFFICIENT WATER SOURCE."



7. Discussion

The remainder of this paper deals with the current state of urban water efficiency, which can be discussed by breaking it into key elements, each of which has its own specific issues. Broadly these are:

1. **Water Restrictions and Mandated Efficiency Standards**
2. **Externalities and Comparison of non-Monetary Costs and Benefits**
3. **Pricing**
4. **Education and Community Awareness**
5. **Water Auditing and Meter Monitoring (Smart Meters)**
6. **Technology**
7. **Consistency of Approaches to Water Efficiency**
8. **Emerging Issues**

7.1. Water Restrictions and Mandated Efficiency Standards

Throughout Australia's European history water restrictions have been used during times of water shortage to extend supplies. Limits have been placed on total volume of water that may be used, the time of day it may be used, or the days of the week. Some practices, such as hosing down of hard surfaces or car washing have, at times, been banned completely and, in some cases, permanently. Restrictions have been enforced with varying degrees of rigour; frequently it is community (peer) pressure that stimulates compliant behaviour by householders, businesses and local governments.

While restrictions should always remain an option available to policy-makers in emergency situations, they can be a blunt instrument that may not produce the greatest social good. For example, restrictions on irrigation of a playing field potentially prevent use of that facility, with all the concomitant impacts this may produce (loss of recreational opportunities, diminution of community health). Similarly, industries subject to water restrictions may lose sales or productive capacity, the value of which may be significantly greater than the value of water saved. AWA believes that restrictions should, therefore, be used only in the case of emergency.

The exceptions to this rule are those options that improve water efficiency at little or no cost, such as bans on the unnecessary hosing down of hard surfaces, or the introduction of watering regimes in commercial establishments. The effectiveness of such permanent water efficiency regimes have been well researched in a number of jurisdictions, are targeted and justified on a range of criteria including cost-benefit. The horticultural industry in Perth has, for example, collaborated with the Water Corporation in responding to proposals to limit the days on which watering can occur. The industry now saves water, and saves money. The type of efficiency regime may vary from area to area according to local circumstances, but should be considered as a component of any comprehensive water management and security strategy.

It is also possible to provide incentives to stimulate the uptake of water efficient practices. These may take the form of subsidies, or requirements that appliances or processes achieve a minimum level of efficiency. Recently, the Productivity Commission suggested that the role of governments should be restricted to the provision of information about the relative water efficiency of various practices and appliances, rather than the mandating of water efficiency options by states, water utilities and other authorities, as the monetary costs of each unit of water saved through the mandating of water efficiency are sometimes greater than the current price charged for that unit of water (Productivity Commission 2011).

AWA recognises that the monetary value of the water saved through some water efficiency activities can be less than the money invested in implementing the change. However, rather than restricting governments' role to that of information provider, governments and utilities should continue to support options where the benefits gained outweigh the costs. These would include 'no regrets' options, where the cost of water efficiency appliances (e.g. dual-flush toilets) is now no greater than their alternative and other programs developed in collaboration with affected customers.

7.2. Externalities and Comparison of Non-Monetary Costs and Benefits

While AWA does not support restrictions or mandates that cost more than the benefits they produce, it is concerned that the cost-benefit analyses used often do not include all costs and benefits, consequently under- or overstating the case for the introduction of water efficiency measures, or distorting any comparisons that might be made with the costs and benefits of supply-side options. As early as 1994, the Council of Australian Governments (COAG) urged that externalities associated with water services be internalised (COAG, 1994). Externalities are those costs and benefits incurred by third parties as a result of an activity carried out by others for which they are not compensated or do not pay. For example, an angler whose catch is reduced as a result of pollution from a sewage treatment plant incurs a loss for which those using the plant are not providing compensation. As long as such costs are not 'internalised' the price of the service will be lower than it should be, leading to over-consumption. AWA believes that more effort should be directed to dealing with such externalities.

Furthermore, there is difficulty in monetarising some benefits and costs arising from water efficiency. It is difficult, for example, to place a value on the loss of recreational opportunities arising from the flooding of a valley for water supply. This does not, however, provide an excuse for not dealing with such issues, and there is a range of methodologies available for comparing non-monetary costs and benefits.[8]

8. It is acknowledged that internalisation of externalities is not a simple matter. Nevertheless valuable work has been done across a number of years. Interested readers might review Bowers, J. and M. Young (2000). "Valuing externalities: A method for urban water use." CSIRO Urban Water Program. Adelaide, CSIRO and/or Frontier Economics (2011) Externality Pricing in the Australian water sector. Waterlines Report, National Water Commission, Canberra

"...THE PRICE PAID BY CONSUMERS ACCURATELY REFLECTS THE LONG-TERM COSTS OF SUPPLY AND IS ECONOMICALLY EFFICIENT"

7.3. Pricing

In 1994 COAG agreed to a package of water reforms directed to increasing efficiency and ensuring that water utilities were sustainable. Among the measures adopted was a move to full-cost recovery pricing and the removal of cross-subsidies between user groups (e.g. the commercial and residential sectors). These reforms have meant that consumers generally pay on average the full cost of water services. The reforms have introduced a financial discipline that is vital and have ensured that funds are available for operation and maintenance of the system into the future. Charging an accurate price for water also means that consumers have rationalised water use.

As discussed above, water restrictions and water efficiency standards are important tools available to policy makers to require or encourage water efficiency. Price is clearly another tool but, to date, the price charged has not been linked to availability of the resource (as it is to other commodities such as petrol), only to the long-run marginal costs of providing water services.

The Productivity Commission, among others groups, has argued for research into the efficacy of more innovative approaches to water pricing. Among these would be included:

- Scarcity pricing of water, which would see water prices rise in times of water shortage, in much the same way as other commodities. The Productivity Commission argues that this would be an economically efficient means of allocating water as the price paid would more accurately reflect availability and the value derived by consumers from the water purchased.
- Allowing urban consumers a choice in water service offerings. For example, paying a higher price for water that would never (or very rarely) be restricted or paying less for a service that would be subject to restrictions more frequently

AWA believes strongly in ensuring that the price paid by consumers accurately reflects the long-term costs of supply and is economically efficient, and supports investigations into alternative approaches or refining of options that might better achieve these ends. The Association believes, however, that such investigations should closely consider equity and community support for new or refined pricing regimes.

There is also a case for research to be carried out into the optimal mix between access charges (fixed charges) and usage charges. In Australia, each household and business pays a fixed price for access to the water supply system and then incurs a cost for each unit of water consumed. It is argued that because the cost of water supply infrastructure is so high and lumpy, the fixed charge is necessary to ensure sufficient funds are available to invest in future water supplies. However, the greater the fixed component of water prices, the less incentive there is for consumers to conserve water because they cannot avoid the fixed charge. In the interests of water efficiency, AWA believes a review of water charges is warranted.

A further aspect of pricing is related to developer charges – those prices charged to developers for the additional demand placed on infrastructure as a result of their developments. In some jurisdictions, developer charges are no longer imposed, but where they are there is commonly no difference in the price charged to a developer of a water efficient sub-division and one whose development is not so innovative. Where more water efficient developments attract access charges that are as great as those paid by traditional developments there is no incentive for improved performance (aside from the premium that might be charged to purchasers). AWA believes that where upstream water supply savings are generated, there is justification for savings to be passed downstream to developers, as well as consumers.

Pricing is a vital part of the water efficiency mix. If water is underpriced it will be over-consumed. In this regard, AWA strongly supports full cost-reflective pricing and also supports research into the benefits that might be gained through regular and thorough reviews of water pricing regimes. AWA also supports policy analysis directed to eliminating cross-subsidies between users, including analysis of the impact of developer charges and the structure of water charges overall to ensure that the right incentives are provided to consumers to use water efficiently. AWA believes that the impact of not carrying out such analysis would be to allow a situation to emerge (or persist) in which selection of one water source over another, more sustainable source, is made simply because the full costs of harnessing the former are not fully accounted for.

7.4. Education and Community Awareness

The effectiveness and rate of uptake of water efficiency measures requires consumers – residential, industrial and commercial – to be aware of the options available, how they should be used or incorporated into existing systems and their performance specifications. Significant efficiency gains can be made if consumers are merely made aware of how much water they use for particular activities and how this water use might be curbed through changes in practice. Education and community awareness are essential elements of water efficiency campaigns in time of scarcity, but even when water supplies are secure it would seem incumbent on utilities to provide advice on water efficiency so that consumers can make informed choices about the water they use.

As a result of the education and awareness-raising measures employed to curb demand in areas in which water has been and may continue to be water short, Australians are among the most water-aware of the world's citizens. This water-awareness has served the country well, and will continue to do so if reinforced. Delivery of cost-effective water services will be achieved more readily if the community is provided with information sufficient to ensure it does not lose its water-literacy over time.

"AUSTRALIANS ARE AMONG THE MOST WATER-AWARE OF THE WORLD'S CITIZENS. THIS WATER-AWARENESS HAS SERVED THE COUNTRY WELL, AND WILL CONTINUE TO DO SO IF REINFORCED."

Education does not end at the point at which consumers are informed of the options available. Often householders and the managers of commercial premises are unaware of the impacts of their approaches to water management, or how systems or water efficient appliances should be operated to produce maximum benefit. For example, customers may use potable water instead of recycled for outdoor water use in areas with dual reticulation systems. Such behaviour can increase system costs as peak demand is transferred from the recycled system to the potable system, unnecessarily requiring more water to be supplied through the potable system, affecting pumping, storage and transport costs.

AWA strongly urges that comprehensive information be provided to consumers to enable them to make effective choices and to use systems appropriately.

There is a strong argument for more consistent messages to be delivered by utilities operating in different jurisdictions and for exchange of information between utilities about the campaigns and collateral that have been most effective. AWA applauds efforts by its sister organisation, the Water Services Association of Australia (WSAA) which represents the major water utilities, to facilitate exchange of information and promote consistency in messages to the community.

7.5. Water Auditing and Meter Monitoring (Smart Meters)

Monitoring of water flow through meters (such as those installed on utility water mains) is required to get a true picture of the operation of the utility distribution system as well as a specific site's actual water consumption. Increasingly, 'smart meters' are being used to improve information about water consumption patterns of end-users.

These devices have a 'real time' monitoring device incorporated in their design, which provides data that can be used by utilities to provide a more accurate picture of site water usage and by the managers of water supply systems for identifying supply problems. A number of utilities have embarked on programmes to install 'data loggers' at commercial premises to provide a finer, more immediate, analysis of water use.

The information obtained provides input to 'Water auditing' programs carried out at these premises to improve their water use and management practices. This information is a fundamental pre-cursor to the design of good water efficiency programs.

The National Business Water Efficiency Benchmark Project (Mulley, Nelson et al. 2012) is an initiative managed by several water utilities in various states that uses consumption data derived from audits and from 'de-identified customer data' and compares this across a group of similar industries to understand water use characteristics and identify efficiencies. The project aims to identify best practice usage levels across a range of industrial and commercial users and should be promoted to participating utilities and their business customers when completed. Various other research projects based on smart meter data are being undertaken by universities, utilities and CSIRO to optimise system operations and determine the savings in potable water that may be available.

The savings achieved through implementing water efficiency programs are quantifiable through monitoring. Similarly, utility distribution system managers need to regularly monitor and report on their effective delivery of water across the network. However, leaks and inefficient practices cannot be completely removed because they arise over time through wear and tear and poor management. To maintain savings continual vigilance is needed through monitoring, training, regular maintenance and investment in new maintenance and management techniques.

The improvements in water meter accuracy and the delivery of monitored data to easy-to-read interfaces such as phone apps and web portals in homes and workplaces should strengthen the awareness of water efficiency and the ability to identify and act upon issues.

AWA strongly supports the improved monitoring of water consumption patterns and research based on the information obtained. The factsheet '*What are Smart Meters?*' (Australian Water Association 2012) details the current and possible future technology and applications.

7.6. Technology

Technology has had an important role to play in water efficiency. As previously mentioned, water efficient versions of many appliances and fixtures are now readily available and information on their performance is provided through the Water Efficiency Labelling and Standards (WELS) and Smart Approved WaterMark schemes. In NSW, the BASIX scheme mandates the use of a minimum WELS rating for fixtures and appliances in all new buildings. Similarly, in Western Australia the Building Code mandates the use of Smart WaterMark approved pool covers for new pools and spas. Retailers are required to show the WELS rating on appliances and tap-ware. The technology behind these fittings has advanced to the extent that they provide a consumer experience similar to that of older fittings. As a result, the early consumer resistance to low flow fixtures has largely abated.

Notwithstanding the success of the WELS approach there may be grounds for improving the rigour of the scheme by demanding the adoption of minimum efficiency standards for WELS rated products and, potentially, integrating WELS rates with the Equipment Energy Efficiency (E3) rating so that consumers better understand the running costs of appliances. It should be noted that all Melbourne water utilities undertake Residential Appliance Stock Surveys that involve understanding the appliances and fittings in people's homes and how they are used.

AWA supports the widespread adoption of schemes such as WELS and Smart Approved WaterMark. With the withdrawal of some rebates for water efficient appliances, there has been a tendency for commitment to the WELS rating scheme to fall away, leading to the reintroduction to the market of appliances that are not water efficient and on which no data are available to enable consumers to make an informed choice.

> "THERE HAS BEEN A TENDENCY RECENTLY FOR APPLIANCES THAT ARE NOT WATER EFFICIENT AND ABOUT WHICH THERE IS LITTLE CONSUMER INFORMATION TO BE REINTRODUCED TO THE MARKET."

Advances in residential water efficiency technology have occurred in irrigation, domestic appliances, greywater reuse, high-pressure cleaning and pool system water reuse, among others. While there is good information on the water efficiency of many of these technologies, knowledge gaps exist both in the impact of people's behaviour on their effectiveness, and in the efficacy of certain garden products such as mulch, wetting agents and soil ameliorants. Further research is needed to address these gaps.

In the non-residential sector there have been significant improvements in water efficiency across a range of technologies from cooling towers and commercial cleaning equipment through to laundry and restaurant appliances. Hybrid cooling towers, for example, use much less water than a conventional water-cooled system, although there is often an increase in energy consumption which needs to be balanced with the value of water saved and any reduction in capital cost. Other improvements are very cost effective as they are simple to implement. Merely providing a broom rather than washing down hard surfaces can save a significant volume of water over a period. Process reformulation – such as adjusting spray nozzles on production lines to accurately hit their targets or installing automatic shut off devices that activate once a cycle is finished – can similarly be simple, cheap and effective. On-site recycling systems are being implemented on sites that enable the wastewater stream from one process to be the feedwater for another.

Notwithstanding the comments above, further research could usefully be conducted into the availability and efficacy of water efficient technologies for use in outdoor areas and in commercial processes at smaller scales than those encountered by large area water managers, or heavy industrial processes.

Each of the developments described above represents a rapidly developing field. AWA strongly supports objective analysis and research into the cost and benefits of the following:

7.6.1. Recycling and Decentralised Systems

Traditionally, water has been distributed from centralised systems, the source water typically being a dam, groundwater or a river. Advances in technology have made small scale water recycling facilities cost-effective in some situations enabling wastewater to be reused for a variety of purposes.

Decentralised approaches can address water security issues and may produce efficiencies, including a reduction in materials and energy use and a reduction in dependence on centralised supplies which may be cost effective. However, the cumulative energy demand of smaller systems is often higher in many situations, and other issues such as disposal of by-products (wastewater, brine, biosolids and residuals) may be problematic.

There may also be implications for system integrity and cost if existing urban areas are excised from the centralised system. Further research into these issues is needed to quantify their impact. It should also be noted that recycling, as with desalination, is not an efficiency measure in itself – although it may produce efficiencies – as the water that is produced may still be used wastefully.

7.6.2. Distribution System Maintenance

Network performance is also an area in which technological improvement can lead to a reduction in the volume of water drawn down from established water sources. Substantial water savings can be achieved if investment is made in reducing leakage and deterioration of the network. AWA applauds the Australian water industry's significant achievement in leakage control and supports continued developments in this important area.

To this must be added improved management of water pressures, use of new materials, improved metering of network flows and techniques to rehabilitate pipelines in situ. These techniques improve the overall efficiency of the distribution network, but have no or little impact on the consumption of water at the end of the pipe.

Note should also be made of technologies that may reduce total water demand, but which are directed to improving system performance or reconfiguring systems using smaller scale and new technologies, or by better integrating water systems into the design of cities. These are not demand management initiatives, but they may improve the efficiency of system operations. Of particular note are strategies that build efficiency into systems as they are expanded to new growth areas.

The Water Corporation has, for example, adopted approaches that enable pressure to be managed more effectively in new development areas. The result is less water loss and fewer pipeline failures, without any diminution in service quality at the customers' tap.

7.6.3. Water Sensitive Urban Design

Significant improvements can be made in the design of urban areas in order to better integrate urban services, including water, and maximise their value. The federal government with local, state, national and private research partners has recently funded a Cooperative Research Centre for Water Sensitive Cities to "deliver the socio-technical urban water management solutions, education and training programs, and industry engagement required to make Australian towns and cities water-sensitive". Research investment is directed to enabling urban areas to "use efficiently the diversity of water resources available within towns and cities; enhance and protect the health of urban waterways and wetlands; …mitigate…flood risk and damage…and create public spaces that harvest, clean and recycle water, increase biodiversity and reduce urban heat island effects" (CRC for Water Sensitive Cities 2012).

Similarly, the Institute for Sustainable Futures, at the University of Technology, Sydney has been engaged in a significant program of research over many years into the development of more sustainable water systems and has recently referred to society's progression to a fourth generation of urban water service provision. This is characterised by an integrated service offering that is focussed on "planned and managed distributed wastewater treatment and reuse, advanced water efficiency, [and] distributed stormwater capture and management integrated into water supply" that could be delivered at "medium financial cost" to households and which would take account of the environmental and social costs and benefits of urban water service provision (White 2010).

> SUBSTANTIAL WATER SAVINGS CAN BE ACHIEVED IF INVESTMENT IS MADE IN REDUCING LEAKAGE AND DETERIORATION OF THE NETWORK.

7.7. Consistency of Approach to Water Efficiency

Stimulated by drought conditions and backed with evidence of their effectiveness, many federal and state programs were set up to promote water efficiency. Among these were:

- **Victoria - Water Management Action Plans (waterMAPs)**
- **Queensland - Water Efficiency Management Plans (WEMPs)**
- **New South Wales - Water Saver Action Plans (WSAPs)**
- **Western Australia - Waterwise program**
- **South Australia - H2OME and Water for Good**
- **Brisbane - Target 140 program**
- **Melbourne - Target 155 program.**

Many of these were developed without the lessons of existing and predecessor programs being taken into account. The learnings of a program in one state should be noted by other states and the impacts of programs run at an earlier time should be recorded and improved upon in subsequent programs. Lessons can also be drawn from programs and research undertaken overseas. Failure to address this often leads to duplication and waste. The Australian water industry needs to have a coordinated approach to efficiency to maximise its ability to reach the community and industry with the water efficiency message.

As a corollary of this, AWA strongly supports the development of training courses and guidelines that are more consistent nationally. Courses should be generic enough to be used nationally and flexible enough to be updated to respond to new ideas and technologies.

> "AWA STRONGLY SUPPORTS THE DEVELOPMENT OF TRAINING COURSES AND GUIDELINES THAT ARE MORE CONSISTENT NATIONALLY"

7.8. Emerging Issues

There are a number of emerging issues that will impact on the future planning and delivery of water efficiency policy and practices across Australia.

Many river systems in Australia are over-allocated. Much effort is currently directed to reducing this over-allocation, the Murray–Darling Basin Plan being a prime example. This Plan and others – required to be developed for each catchment across Australia – will need to take into account climate change, population increase, environmental water requirements and the strong link that exists between the growing middle classes in Asia and demand for more water-intensive foods. Within this context, the demands made by urban centres on the pool of consumptive water available will need to be balanced against demands for water for irrigation, for the environment and for cultural and economic purposes. Efficient water use in urban areas will be expected if cities are to make a claim on water supplies that appears legitimate to other users and to other demands.

New tools and techniques are being developed to help identify and measure the extent of and demands upon water resources, including the management of aging infrastructure by water businesses as they endeavour to drive aging assets to deliver on rising customer expectations. These tools and techniques will help policy makers and water practitioners better plan for future supply and demand in an increasingly complex water network in parallel with increasing customer expectations.

As Integrated Water Management moves from concept through to execution, the efficient use of water through transport to more highly integrated water networks becomes adopted practice; the efficient use of water will increasingly become better understood and monitored in real time. This will be an exciting space to watch for future developments.

Methodologies for assessing the embodied water in commodities are becoming more sophisticated and help identify the "water footprint" of a region or country, including the trade in virtual water (Hoekstra and Chapagain 2008). Water footprinting is a relatively recent development, but methodologies to assess water footprints are becoming more sophisticated and their use is growing.

Continued reform of the water industry may also impact on the adoption and uptake of water efficiency measures by utilities. With increasing privatisation of the water industry, measures may need to be put in place to ensure the pressure to generate profit does not override the wider community benefits of efficient water use.

A short-term challenge for the water industry is the need to continue to innovate and improve water efficiency to address these emerging issues at a time when many of Australia's cities have moved out of drought. Many of the water businesses throughout Australia invest in innovation both internally and through partnering with Universities, private industry, CRCs and water research funding bodies. Water efficiency research will continue to be a part of this innovation.

8. Conclusions

Water efficiency has been an essential component of Australia's response to drought. Much of what has been attempted has been experimental – although solidly grounded – and there have been many successes. The easing of drought conditions across much of Australia has meant that some water efficiency programs have been wound back and most restrictions lifted. This winding back may be justified, but water efficiency should remain on the national water agenda. Water efficiency can often be a more cost-effective means of ensuring supply security than construction of supply-side options and efficiency produces other benefits such as a reduction in energy use, and a sharing of water with the environment and other users (e.g. farmers).

AWA does not argue for water efficiency to be the solution to all water security or environmental challenges. Water efficiency measures are not always the most cost-effective. AWA does believe, however, that water efficiency measures must always be considered in policy decisions related to water supply security or sustainable water management. In comparing the costs and benefits of each of the options available, non-monetarised values and externalities should be taken into account.

AWA believes that the setting of a price that reflects the full costs of supplying water services to consumers is an essential component of water efficiency. If water is under-priced it will be over-consumed. AWA believes strongly that more effort should be directed to internalising externalities associated with all water security options – both demand- and supply-side. To do otherwise will be to distort decision-making and potentially lead to the selection of less sustainable options.

AWA also believes that it is essential that the price charged to consumers fully reflects the cost of supply, and that price structures be economically efficient. There is a strong case for researching the costs and benefits of alternative approaches, including the provision of a range of service offerings, scarcity pricing and others to ensure that the right incentives are provided for consumers to rationalise water use.

While some water efficiency programs have been curtailed, it remains incumbent on governments to provide information to consumers on the relative water efficiency of appliances and of other means to reduce water consumption. Consumers must have the knowledge to make the decisions that will best reflect their personal preferences. Schemes such as the Water Efficiency Labelling and Standards (WELS) Scheme and the Smart Approved WaterMark are strongly supported.

Continued investment in research and technological development is warranted at many levels ranging from household appliances, consumer behaviour, industrial process reformulation, system management and restoration and water sensitive cities, among others. It will also be important that water monitoring data be used thoughtfully, providing evidence for review and extension of water efficiency initiatives.

It will be important that Australia does not lose skills and abilities in efficient water management, not least because the impact of climate change and population growth may reduce available supply and increase demand overall. To this end, there should be a sharing of information, and the development of accredited training courses and guidelines that are consistent nationally.

To meet its water needs in future, Australia will need to ensure its approach is diverse and tailored to circumstances. Water efficiency measures must always be part of the mix. They will not always be the best choices, but in determining the best approaches it will be vital that efficiency measures be given equal weight and that the costs and benefits of all measures are considered dispassionately and accurately.

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About the Australian Water Association (AWA)

The Australian Water Association (AWA) is the leading water sector body in Australia, representing over 10,000 water sector professionals across all disciplines. Formed in 1962, AWA is an independent and not for profit association, providing a voice for water professionals around Australia on a wide range of sector issues including skills shortages, climate change, water management and reform and regulation.

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