

The **Allen Consulting** Group

## **WELS Expansion — Hot Water Circulators**

**November 2009**

Report to the Department of the Environment, Water, Heritage and the Arts

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## Chapter 1

# Introduction

*This Chapter provides an overview of the policy framework that has resulted in this paper being developed.*

### 1.1 Water in Australia

Water is essential for a country's economic development and social well-being. In Australia, access to water has dictated the way in which cities have grown, and the population density around coastal areas. It is therefore no surprise that water management has become a priority across all levels of government in Australia in the last two decades. In recent years, given the prolonged drought and the uncertainty resulting from climate change, attention to water management has become more urgent.

*Water for the Future* is the Australian Government's ten-year plan for water management that aims to secure the long-term water supply of all Australians. It identifies the following four priorities:

- taking action on climate change;
- using water wisely;
- securing water supplies; and
- supporting healthy rivers (Department of the Environment Water Heritage and the Arts 2008).

The *National Water Initiative* (NWI) is a vital element in this national framework. The NWI is a cross-jurisdictional blueprint for water reform. Underpinned by an Intergovernmental Agreement, the NWI commits its signatories to:

- prepare water plans with provision for the environment;
- deal with over-allocated or stressed water systems;
- introduce registers of water rights and standards for water accounting;
- expand the trade in water;
- improve pricing for water storage and delivery; and
- meet and manage urban water demands (National Water Commission 2009).

The overall objective of the NWI is 'to achieve a nationally compatible market, regulatory and planning based system of managing surface and groundwater resources for rural and urban use that optimises economic, social and environmental outcomes' (National Water Commission 2009).

It is into this overall policy framework that the Water Efficiency Labelling and Standards (WELS) scheme fits.

## 1.2 Water Efficiency Labelling and Standards Scheme

The establishment of the WELS scheme was identified in the NWI as a ‘key action for the implementation of demand management measures for urban water reform’<sup>1</sup>. The WELS scheme labels a range of products for water efficiency, providing consumers with information so they can consider water efficiency in their purchasing decisions of certain products. It also has the power to impose minimum water efficiency standards (WES) where appropriate.

The Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) administers the WELS scheme, in partnership with state and territory governments. The WELS scheme is underpinned by the Australian Government *Water Efficiency Labelling and Standards Act 2005*, and supported by the *Water Efficiency Labelling and Standards Regulations 2005*, the *Water Efficiency Labelling and Standards Declaration 2005* and the *Water Efficiency Labelling and Standards Determination 2007*.

The WELS legislative framework gives the Minister the authority to select products for inclusion in the WELS scheme, and to set the applicable standards and requirements. The legislation also provides for registration and labelling of WELS products (including setting the fee to register a product) and enforcement (including the employment of WELS inspectors and procedures for penalising and prosecuting offences under the Act). The AS/NZS 6400 is currently determined as the WELS standard. AS/NZS 6400 specifies the methods of testing for water efficiency and is the guideline underpinning the star-rating scheme for WELS.<sup>2</sup>

Table 1.1 summarises products currently covered by the WELS scheme. Registration and labelling became mandatory for all new products from 1 July 2006<sup>3</sup>. Prior to this, registration and labelling had been available to industry on a voluntary basis until July 2006. At present toilets are the only product for which a minimum WES has been applied.

<sup>1</sup> <http://www.nwc.gov.au/www/html/507-water-efficiency-labelling-and-standards-wels-schemephase-2.asp>

<sup>2</sup> The AN/NZS 6400 standard is named as the WELS standard in the 2007 Determination. The Commonwealth Minister can change the WELS standard by issuing a new determination.

<sup>3</sup> Manufacturers and retailers were allowed a ‘grace period’ until 31 December 2006 to sell existing plumbing products and until 31 December 2007 to sell existing whitegoods products. After the ‘grace periods’ were over, old stock that had not been sold had to be either registered or disposed.

Table 1.1

**CURRENT SCOPE OF WELS SCHEME**

Product	Registration	Water Efficiency Labelling	Water Efficiency Standard	Primary basis for rating (c)
Shower heads	Mandatory	Mandatory — stars (b)	No	l/min
Toilets	Mandatory	Mandatory — stars	Yes	Wtd l/flush (d)
Clothes washing machines	Mandatory	Mandatory — stars (b)	No	l/kg clothes
Dishwashers	Mandatory	Mandatory — stars (b)	No	l/place setting
Taps (a)	Mandatory	Mandatory — stars (b)	No	l/min
Urinal equipment	Mandatory	Mandatory — stars (b)	No	l/flush (e)
Flow Controllers	Optional	Optional	No	l/min

Source: (a) For use over a basin, ablution trough, kitchen sink or laundry tub. (b) Zero star label for models not meeting performance requirements. (c) See AS/NZS 6400:2005 *Water efficient products - Rating and labeling*. (d) Average of 1 full and 4 partial flushes (e) Secondary rating criterion is mode of activation.

In the 2008/09 financial year 1,676 product models were registered under the WELS scheme, bringing the total number of product models registered since its introduction to 12,088.

### 1.3 Expanding the WELS scheme

In November 2006, the Environment Protection and Heritage Council (EPHC) agreed to a long-term program of work to investigate the possible introduction of minimum water efficiency standards for existing WELS scheme products outlined in Table 1.1, and the potential inclusion of new products into the scheme. Products considered for inclusion in the WELS scheme were combination washer/dryers that use water in dryer mode<sup>4</sup>, evaporative air conditioners, instantaneous gas water heaters, hot water circulators and domestic irrigations event controllers. The program of work also involves consideration of raising the existing minimum WES for toilets.

Products considered for possible inclusion into the WELS scheme were chosen based on the recommendations of a 2005 concept report prepared by George Wilkenfeld and Associates for DEWHA: *Expanding the Water Efficiency Labelling and Standards Scheme*. This report found that evaporative air conditioners, hot water circulators (on their own and interacting with water heaters) and condensing clothes dryers were products with the highest priority for inclusion into the WELS scheme.

### 1.4 This report

This report is a paper commissioned by DEWHA to analyse the appropriateness of including hot water circulators (HWCs) in the proposed expansion of the WELS scheme for labelling and minimum WES. It uses the guidelines outlined by the Office of Best Practice Regulation as the framework for this analysis.

<sup>4</sup> Combination washer/dryers are already required to be registered and labelled for their washing mode. The program of work for the EPHC is investigating further labelling of combination washer/dryers that use water for their dryer mode.

## Chapter 2

# Product description

*This Chapter provides a brief description of hot water circulators and summarises the key technical aspects that may result in unnecessary water usage.*

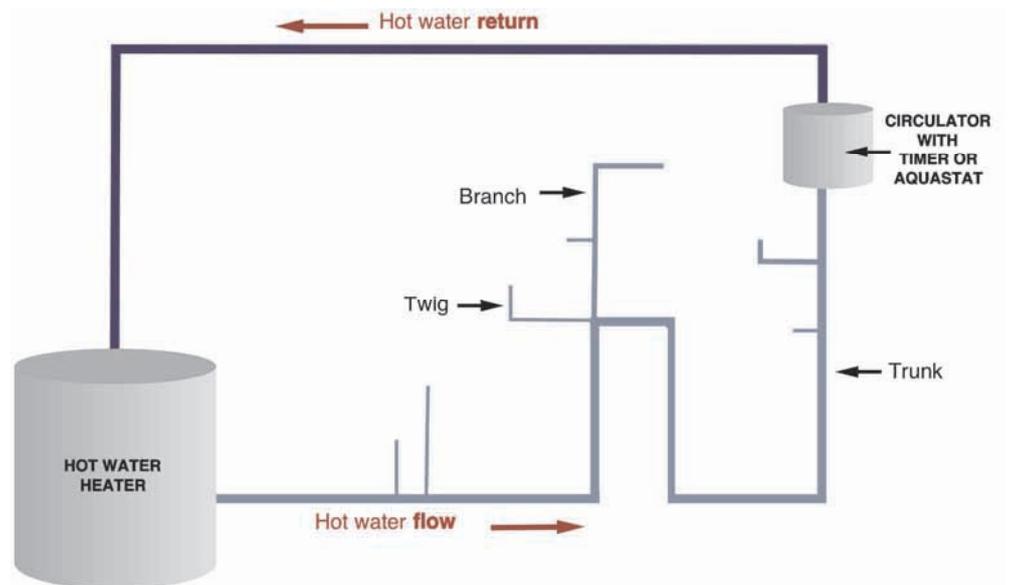
Coomes Consulting (2008) states that, a HWC:

is a pump (or other mechanism) which transfers hot water from the water heater to outlets at the end of the hot water distribution system, sending cooled water back to the water heater, minimising both the time spent waiting and the volume of water wasted while waiting for optimum temperature hot water to arrive.

HWCs can either circulate water continuously, or as the result of some form of regulation (such as pre-programmed timers, thermostatic controls, and ‘on demand’ switches). Figure 2.1 provides a schematic layout of a hot water distribution system with a regulated HWC.

Figure 2.1

### SCHEMATIC LAYOUT OF REGULATED CIRCULATION



Source: (Coomes Consulting Group Pty Ltd 2008)

## 2.1 Water wastage issues

Unlike other product types (such as instantaneous gas water heaters and evaporative air conditioners), HWCs are not under consideration for inclusion in the WELS scheme because of water wastage concerns with the circulators themselves. Rather, HWCs are under consideration because of their potential to reduce the water wastage associated with draw off from hot water systems.

This paper defines *draw off* as the water that flows through an outlet from the time the outlet is activated until the flow has reached an optimum temperature during a hot water event. Draw off can be wasted if the user is sensitive to water temperature (e.g. if they are in a shower) and, consequently, let the draw off drain while they wait for optimum temperature hot water.

The extent to which a hot water system produces draw off is generally dependent on two factors. The first of these is plumbing design. The further a hot water fixture is located from a water heater and/or the greater the diameter of the relevant pipe, the greater the volume of water that has a chance to cool below optimum temperature and, in turn, the greater the potential draw off. The location of water heater installation relative to major hot water fixtures (e.g. the primary bathroom and kitchen) will thus play a considerable role in determining the amount of draw off produced by a hot water system.

The second factor is the temperature of the water in the pipe between the hot water fixture and the water heater. The colder the water the greater the potential draw off. The temperature of the water in the pipe is contingent on the interval since the previous use of the water heater and ‘the rate of heat loss from the pipe’ (George Wilkenfeld and Associates 2005). The latter can be affected by the type and quality of plumbing material and the extent to which the pipe is insulated.

There is much debate in the water heater industry about:

- how much draw off is produced by hot water systems; and
- the extent to which draw off is actually wasted (for more information about this debate, see (Allen Consulting Group 2009).

As a consequence, data about the volume of draw off that is wasted by the average household is paltry. One of the few estimates is provided by Coomes Consulting (2008). It calculates that, based on research conducted by Yarra Valley Water in October 2007, the average household wastes 2 kilolitres of water per year from draw off that is allowed to drain while showering (see Box 2.1).

Box 2.1

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**WATER WASTAGE OF WATER HEATERS — ASSUMPTIONS**

Coomes Consulting’s estimate of 2 kilolitres of water per year is based on the following assumptions:

- according to Yarra Valley Water, each person in an average household waits 14 second before the flow of water has reached an optimum temperature when showering;
- an average flow rate of 9.5 litres per minute;
- an average household size of 2.48 people; and
- each person has one shower per day.

Source: (Coomes Consulting Group Pty Ltd 2008)

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An alternative figure is provided by George Wilkenfeld and Associates, which estimates that water heaters waste on average 7.9 kilolitres of draw off per year, or 11 per cent of all water supplied to a residential water heater (George Wilkenfeld and Associates 2005). This paper will utilise the estimate provided by George Wilkenfeld and Associates, as it covers all household water use, not just shower use. It is important to note that industry stakeholders consulted as part of the development of this report were not able to provide validation or alternative estimates about the volume of draw off that is wasted by the average Australian household.

HWCs are seen as a potential means of reducing draw off from a hot water system. By keeping the water in a hot water distribution system at optimum temperature, HWCs ensure that ‘the user never receives sub-optimal temperature water’ (Coomes Consulting (2008)). Water loss associated with draw off is thus minimised.

Data about the extent to which HWCs can reduce water wastage associated with draw off is limited. In its review of the suitability of including HWCs in the WELS scheme, Coomes Consulting (2008) conclude that the use of a HWC:

will significantly reduce or eliminate draw off, which could have volumes in excess of 2kL per year. The use of a hot water circulation system, whether continuous, regulated, or on demand, will effectively remove the majority of losses by providing hot water at the fixture as it is turned on.

Likewise, in its concept report exploring the possibility of expanding the WELS scheme, George Wilkenfeld and Associates (2005) estimated that the installation of a HWC could save approximately 6.6 kiloliters per year in an average household, or 83.5 per cent of the total volume of water wasted as draw off. In terms of water heater type, George Wilkenfeld and Associates (2005) estimated that the ‘installation of a recirculation system could save about 15.5 kl/yr in the average [instantaneous gas water heater] household, and about 5.5kl/yr in the average storage water heater household.’ The authors also estimated that ‘[i]f 23% of households had [HWCs] in 2001 (the reference year for this study) the water savings would have been about 14.1 GL/yr, or an average of 7.8 kl/yr per [household] with a [HWC].’

## **2.2 Energy usage and emissions intensity**

In order to pump water through a hot water distribution system, HWCs require energy – primarily in the form of mains power. Using a HWC thus increases a household’s energy consumption. Unfortunately, there is little quantitative data about the energy use of HWCs. Both Coomes Consulting (2008) and George Wilkenfeld and Associates (2005), however, suggest that there is likely to be variation in the energy efficiency performance of different types of HWCs.

This variation is likely to be affected by two factors. First, the operating efficiency of the pump itself – i.e. how much energy each type of pump needs to circulate a set volume of water around a similar hot water distribution system. There is currently little information – both from the available literature and industry stakeholders – about the comparative performance of different HWCs in this regard.

Second, whether the HWC operates continuously or is regulated in some manner. The former is generally considered to be the ‘most wasteful of energy’, as they are in operation all the time, irrespective of demand and the temperature of the water in the pipes (Coomes Consulting Group Pty Ltd 2008). Temperature and timer regulated HWCs are likely to be more energy efficient, as the circulation of water is limited to either certain times in the day or when the temperature of the water in the pipes drops below a set point. On demand HWCs, meanwhile, are ‘traditionally seen as the most efficient of the pumping systems because of their brief operational time’ – as manually controlled by the user. This view is indirectly supported by testing undertaken by Wendt et al (2004). They compared the energy wastage of a number of hot water distribution systems, some of which included a continuous or on demand HWC. According to their analysis, systems with an on demand HWC wasted on average 216 kWh of electricity per year, compared to 2,414 kWh of electricity per year for the systems with a continuous HWC.

### **2.3 Australian Market for HWCs**

There is little publicly available data about the market for HWCs in Australia. According to George Wilkenfeld and Associates (2005), ‘[u]nlike the USA, [hot water] recirculators are relatively rare in [Australian] household applications.’ Coomes Consulting (2008) similarly notes that ‘[a]t present, hot water circulators are not commonly installed in domestic hot water distribution systems in Australia.’ There are no quantitative estimates of HWC sales and the HWC stock in the literature.

Given this lack of information and based on our research and consultations, this paper has assumed that annual sales of HWCs in Australia are equal to 2.5 per cent of all water heater sales. Current estimates suggest that 700,000 water heaters are sold in Australia each year (National Appliance and Equipment Energy Efficiency Committee 2004; Rheem Australia 2007). On the basis of the figure and the assumption above, it is estimated that 17,500 HWCs are sold in Australia annually.

As Coomes Consulting (2008) state, HWCs are ‘sourced worldwide, with models coming into Australia from Asia, Europe and the USA as well as those manufactured locally.’ The major domestic suppliers of HWCs include Grundfos, Rinnai, Dux, and Everwater. Consumers generally buy HWCs through authorised resellers (such as Reece and Marbletend) or directly from the manufacturer. The cost of a HWC ranges from \$200 to \$1,200, though most are priced at the \$300-\$400 level (Coomes Consulting Group Pty Ltd 2008).

HWCs need to be installed by a registered plumber. The type of HWC to be installed is dependent on whether it is being installed in a new or existing dwelling, and in conjunction with an instantaneous or storage water heater (for more detail, see: Coomes Consulting Group Pty Ltd 2008).

Regarding the useful life of HWCs, industry estimates vary. ACT Metlund D’MAND and Chilipepper models of HWCs are estimated to have a life expectancy of 15 to 20 years (Chilipepper 2009), while the SM Laing’s Autocric model has a reported useful life of eight years (though this can be extended to 16 years if certain parts are replaced) (Coomes Consulting Group Pty Ltd 2008).

## **2.4 Existing regulation**

There are no current programs that seek to regulate the water use or efficiency of HWCs in Australia. There are, however, two rebate schemes operating:

- Victoria: \$150 for a hot water circulator, limit one per property; and
- Toowoomba City Council (Qld): \$200 for a WaterMarked circulator conforming to the Australian Standard.

## **2.5 Standards**

The primary standards relating to HWCs are:

- *AS/NZS 3350.2.51:1998* Safety of household and similar electrical appliances;
- *ATS 5200.464-2004* Technical specification for plumbing and drainage products — Hot water manual or sensor-activated pumping systems; and
- *ATS 5200.472-2006* Technical specification for plumbing and drainage products — Heated water system recirculation device.

## Chapter 3

# Methodology

The Allen Consulting Group utilised a range of approaches to collect data for this paper. These included:

- reviewing literature;
- teleconferences with stakeholders; and
- information requests.

### 3.1 Sources reviewed

A review of the available literature was undertaken. For a full list of documents referred to during this study please see Appendix A.

### 3.2 Stakeholders consulted

Consultations were undertaken with suppliers, industry associations, technical experts, regulatory bodies and government. Table 3.2 provides a list of the stakeholders consulted for this paper (including method of consultation).

Table 3.2

#### STAKEHOLDER CONSULTATIONS

Name	Institution	Method of Consultation
Mark Amos	Australian Industry Group	Telephone, email
Chris Blogg	Rinnai	Telephone
Susan Nevill	Rinnai	Telephone
Michael McGuinness	National Plumbing Regulators Forum	Telephone
Lance Glare	Department of Infrastructure and Planning, Queensland	Telephone
Gark Workman	Green Plumbers	Telephone
Mark Roberts	Author of the Coomes Consulting report	Telephone

Source: (Allen Consulting Group)

## Chapter 4

# The nature and extent of the problem

Best practice regulation aims to address failures pertaining to market outcomes at minimum cost to consumers and industry.

In order to make a case for government intervention, it must first be established what problem the proposed regulations are seeking to address. This is necessary in order to develop options (whether regulatory or not) that can directly address the problem, and establish an objective framework within which the relative performance of options can be compared.

This chapter considers the extent to which there is a need for government intervention to reduce water consumption in the residential sector related to HWCs. This assessment finds that:

- water management is a priority in Australia, across all levels of government;
- allowing variations in price to clear the market for water is problematic since water prices tend not to reflect water scarcity, or the value that users place on water availability;
- water restrictions are a costly method of responding to ‘excess’ demand;
- there are a number of water efficient and water saving products that can reduce household demand for water without adversely affecting social welfare or household utility in the way that quantitative restrictions do; and
- uptake in the sale and installation of these water efficient and water saving products is affected by a range of market failures.

It also finds, however, that the quantity of water saved from installing a HWC is the same for all models and that regulation under the WELS scheme for the water efficiency of this product is not warranted.

### 4.1 The market for water

Drought conditions in many areas of Australia over the past several years, combined with the prospect that future climatic conditions could lower further water availability, have led to renewed interest in the way residential water is managed.

In the current market for residential water, governments operate as planners, suppliers, distributors and retailers of water. They make supply investments and manage available water with only limited knowledge about the value that some users place on the resource.

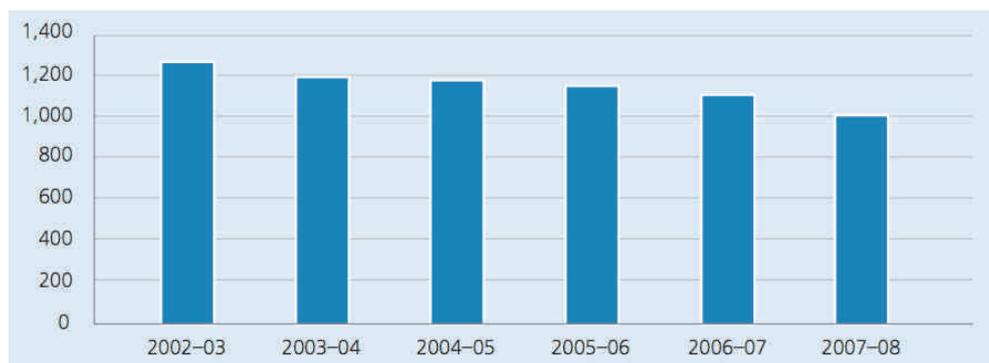
On the demand side, water is essential for wellbeing, and is an input into almost all activities — economic, social and environmental. Given this, demand for water is closely linked to population growth, and the sustainability of cities in the long run hinges critically on access to suitable water. On the supply side, the prolonged drought, the uncertainty inherent in climate change, and the network of catchments, dams and ground and surface water sources all affect the extent to which this growing demand can be met, and at what cost.

Key problems with the water market include:

- the costs generated by infrastructure investments that augment supply (eg. water recycling, desalination plants, additional or larger catchment and storage facilities) are independent of supply conditions;
- the pricing of water is based on operating costs and a return on assets and, as such, does not reflect the scarcity of water in times of shortage; and
- water markets are not well developed or responsive to demand conditions — particularly in urban areas:
  - a recent survey of relevant econometric studies by the Australian Bureau of Agriculture and Resource Economics (2008) shows price elasticities for residential water in Australia range from minus 0.15 (very unresponsive to price variations) in the ACT to minus 0.94 (relatively unresponsive to price variations) in Perth; and
  - NSW’s Independent Pricing and Regulatory Tribunal argues that ‘the demand for residential water is so inelastic that the price could be subject to wide gyrations if it were the sole means of balancing supply and demand in a drought’ — something that could lead to adverse outcomes in lower income households.

Instead of using price to manage demand for water, demand is managed by placing restrictions on water usage. For the past six years the majority of Australian urban centers have experienced water restrictions (Business Council of Australia 2006; Water Services Association of Australia 2009). These have been effective in reducing total and per capita water usage. Figure 4.2 indicates that total residential water supplied has decreased by 21 per cent since 2002–03. This is despite, over the same time period, the number of connected properties growing by 9 per cent, or around 500,000 properties. These figures imply that the average volume of water supplied to residential customers by those utilities has fallen by 37 per cent in six years (National Water Commission and Water Services Association of Australia 2009).

Figure 4.2

**VOLUME OF RESIDENTIAL WATER SUPPLIED (GL)**

Source: (National Water Commission and Water Services Association of Australia 2009)

Note: The National Water Commission and Water Services Association of Australia do not identify from which utilities the above data are drawn, except to note that they originate from utilities that accounted for 80 per cent of residential water supplied in 2007-08.

While water restrictions have been effective in reducing water consumption in times of scarcity, they come at a considerable cost to the community. Several studies estimated the economic cost of water restrictions for different Australian cities. The findings from these studies are presented in Box 4.2. Due to the differences used to develop these estimates it is not appropriate to compare them directly. However, they do suggest that economic costs increase with the severity of the restriction. It should also be noted that none of these studies include all of the potential costs of water restrictions, such as:

- the deterioration of lawns and gardens, which have a replacement cost;
- costs of purchasing and installing new watering systems as changes occur in allowed methods of watering;
- the need to adopt labour-intensive methods of watering when watering is permitted, which incurs time costs;
- loss of sleep and/or leisure as a result of setting alarms to arise and water gardens in permitted time periods;
- having to water in the dark;
- canceling or rearranging other activities in order to water gardens at permitted times;
- inability of children to play under garden sprinklers and to use water toys;
- carrying 'greywater' in buckets from showers to outdoor plants;
- the need to drive cars to a car wash to clean them; and
- increased damage to buildings, other structures and pipes through cracking (Productivity Commission 2008).

In a recent discussion paper the Productivity Commission estimated the full economic cost of water restrictions in Australia amounted to billions of dollars (Productivity Commission 2008). This, of course, is far above the dollar cost of the water that households would have purchased if water was still in abundant supply. This valuation also illustrates the onus that householders are likely to place on ‘freeing up’ water from within a restricted supply regime.

Box 4.2

#### ESTIMATES OF THE COSTS OF WATER RESTRICTIONS FOR HOUSEHOLDS

**Sydney:** Using a Marshallian consumer surplus approach, Grafton and Ward (2007) estimated the welfare cost per Sydney household in 2005 at about \$150 above the cost of achieving the same level of water use with higher water prices. This reflects the effect of prescriptive water restrictions in preventing households using a given volume of water for the purposes they value most highly.

**Perth:** Assuming typical preferences for ‘greenness’ and valuing time spent holding hoses at its opportunity cost, Brennan, Tapswan and Ingram (2007) estimated the annual costs of water restrictions at \$67 per household for restrictions that allow watering twice a week using sprinklers, and \$347 (opportunity cost of time equal to 33 per cent of mean wage) to \$870 (opportunity cost equal to mean wage) for bans on the use of sprinklers. The costs were lower for people who placed a lower value on greenness, and higher for those who valued it more highly. The baseline is no water restrictions and the same water price (and hence higher water use) as with restrictions.

**Canberra:** Hensher, Shore and Train (2006) used choice experiments to estimate Canberra households’ willingness to pay to avoid water restrictions. They found respondents were unwilling to pay to avoid low-level restrictions, including restrictions that allowed watering only on alternative days. To have stage one or two restrictions rather than stage three, four or five restrictions, respondents were willing to pay an average amount of \$109, \$130 and \$268 per year, respectively, given that restrictions were applied once in every ten years.

Source: (Productivity Commission 2008)

## 4.2 Potential benefits of improved water efficiency measures

Current methods of managing water scarcity, including water restrictions or investing in new infrastructure (such as desalination plants, water recycling systems and additional water storage areas), impose costs on the community. Recognising the need for alternatives to these measures, governments have sought to improve the efficiency of residential water use by introducing alternative strategies such as encouraging the uptake of water efficient products. This promises to reduce demand for water in individual households and at the communal level. This approach to reducing demand for water does not necessarily require consumers to change the way in which they use water (through appliances such as washing machines) — ideally the consumer has the option (though sometimes at a higher up front price) of using less water to deliver the same result. The consumer, therefore, experiences no direct impact on utility — while at the same time, their use of water is reduced.

Significant water savings can be achieved through encouraging consumers to switch to more water efficient products. The amount of water used by products that are designed to perform the same task can vary widely. For example, at least 25 per cent of indoor residential water use is a result of toilet flushing (this proportion tends to increase during drought situation when water restrictions are in place). The amount of water used by toilets that are sold today ranges from an average flush volume of 5.5L to 3L. Even the most water inefficient toilet available today is about 50 per cent more efficient than those available on the market 25 years ago (Institute for Sustainable Futures 2008). If a person uses the toilet seven times a day, the amount of water saved over the course of a year as a result of switching from a very inefficient toilet to a very efficient one is 6.4kL per person. Even larger water savings will be made if the consumer is switching from an older style toilet to a water efficient modern toilet (Institute for Sustainable Futures 2008).

The uptake of water efficient appliances and the subsequent reduced demand for water by households has a number of benefits, including:

- reducing the likelihood of water restrictions being imposed and reducing the severity and longevity when they are imposed;
- contributing to efforts to ensure a secure water supply without recourse to new supply infrastructure;
- a reduction in water usage — this reduction is unlikely to compensate the household for the initial investment required to purchase a more water efficient appliance, but becomes more important against the backdrop of expected increases in future water prices; and
- psychic income to consumers associated with voluntary efforts to take a more socially responsible approach to water consumption and conservation.

Hence, improved water efficiency through investment in more water efficient products presents an opportunity to reduce consumption without impacting on quality of life and to generate savings through the avoided costs of water restrictions and small household water bills. Appropriate water efficiency labelling provides a basis for assessing and comparing the relative efficiency of water using appliances, and is the starting point for accessing the benefits identified above.

#### **4.3 Market failures that may impede the purchase of water efficient products**

The preceding discussion highlights the potential benefits of investing in more water efficient products in Australia.

In order to determine the best course of action, if any, for government to address a problem, RIS analysis needs to identify:

- first, whether market failures exist; and
- second, whether there is a need for change.

Market failures exist when there is a divergence between the marginal social costs and benefits and the marginal private costs and benefits of investing in conservation. In the presence of this divergence, there is a *prima facie* case for government intervention.

Market failures are typically considered to fall within the following three categories:

- Public goods — public goods are those which are non-rivalrous and non-excludible, significantly limiting the incentive for private providers to supply these goods and resulting in an undersupply or no supply at all without government intervention;
- Externalities — externalities occur when a transaction results in a cost or a benefit for a party that is not directly involved; and
- Information asymmetries — information asymmetries occur when one party in the market, usually the buyer, does not have sufficient information about the good they are considering purchasing, or the actions of the seller, to make a decision in their best interest.

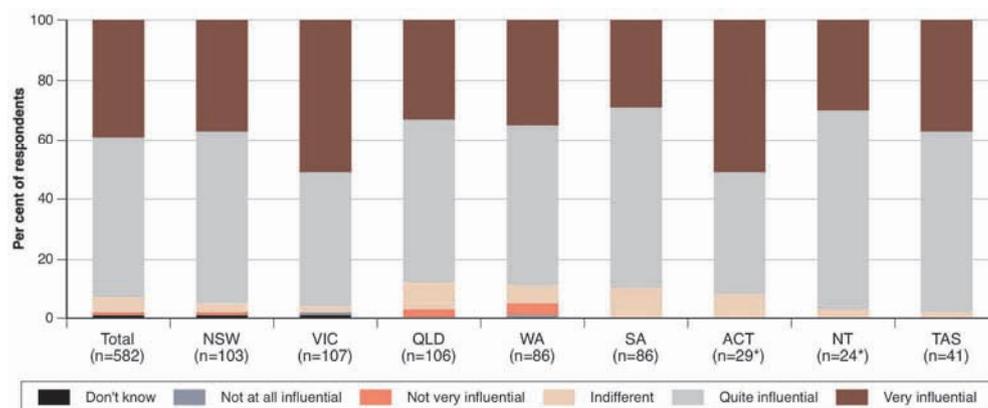
### **Public goods**

Public goods are often under supplied or not available at all in unregulated markets because there is not sufficient private benefit generated by these goods for private providers. Information is one such public good.

Testing to ascertain the relative water efficiency of products within the market is too expensive for an individual consumer to collect. As such, if industry does not supply this information, either voluntarily or in response to a mandatory scheme, consumers do not have a reasonable recourse to acquire it. Once information on water efficiency has been generated it can be shared at low cost. The subsequent value of the information to each individual will be lower than the cost of generating it. The cumulative benefit, however, to all consumers of the information — where a sufficient number of consumers value the information — can be powerfully beneficial.

Market research indicates that for a considerable proportion of the community the provision of water usage information at the point of sale is influential in encouraging investment in water efficient products. A recent study on the impact of the water efficiency labels that are applied to products captured by the WELS scheme indicated 93 per cent of those surveyed considered the information either very or quite influential in their decision-making process (Quantum 2008). Figure 4.3 illustrates the results of this survey in more depth.

Figure 4.3

**IMPACT OF WATER EFFICIENCY LABELLING ON PURCHASING DECISION**

Source: (Quantum 2008)

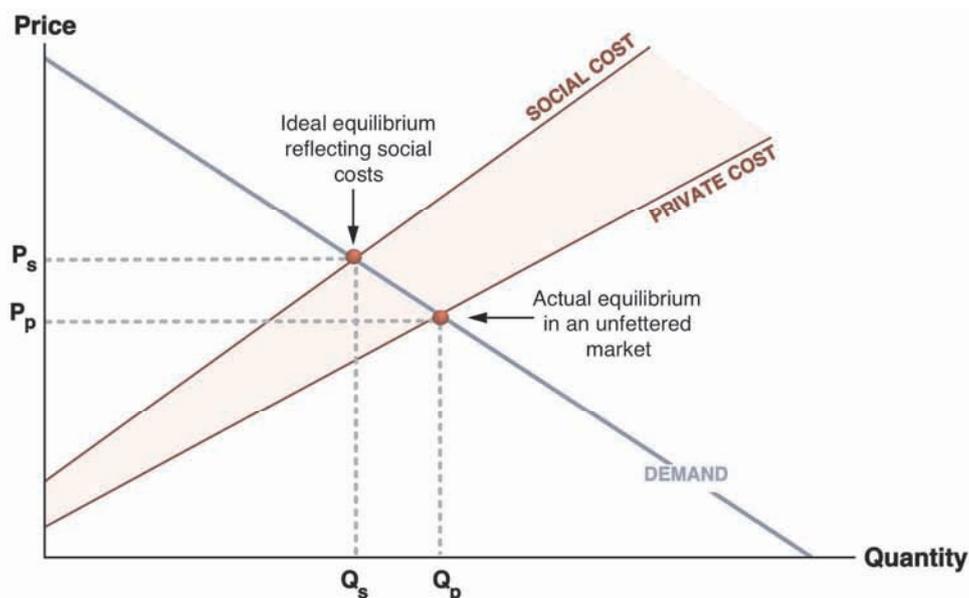
This survey is supported by another study conducted by BIS Shrapnel (2008) which found that consumers considered the water efficiency label of a product second only to the cost of a dishwasher or washing machine when making a purchase. Hence, for a large proportion of Australian society the provision of information at the point of sale is sufficient for them to voluntarily consider and account for some or all of the social cost associated with inefficient water use when investing in new water using appliances. As the surveys also imply however, not all consumers are motivated by the cost to the community of their water usage and there are limits to the extent of the social cost they are willing to voluntarily bear.

**Externalities**

Externalities occur when a transaction has an impact on a party that is not directly involved. In the case of residential water in Australia, the price of water is a function of the cost of infrastructure and does not reflect the scarcity of the resource. This generates an external cost, as a consumer in the market does not bear all of the costs of consuming water. The use of water by one consumer reduces the available supply of water for all and may lead to over-consumption. Over-consumption results in reduced security of supply for all and to governments applying water restrictions that impact on the way water is used. Thus a poorly functioning market, as with water, results in poor coordination of efficient supply and consumption decisions. Choices that alleviate demand pressures can also alleviate the problems associated with this aspect of market failure.

Figure 4.4 illustrates the gap between the private cost and the social cost that results from this kind of externality and the resulting over-consumption. If the consumers only take into account their own private cost, they will end up at price  $P_p$  and quantity  $Q_p$ , instead of the more efficient price  $P_s$  and quantity  $Q_s$ .  $P_s$  and  $Q_s$  reflect the idea that the marginal social benefit should equal the marginal social cost. Under this paradigm, production should be increased only as long as the marginal social benefit exceeds the marginal social cost. The result is that a free market is inefficient since at the quantity  $Q_p$ , the social benefit is less than the social cost, so society as a whole would be better off if the goods between  $Q_p$  and  $Q_s$  had not been produced. In this instance, the problem is that people are buying and consuming too much water.

Figure 4.4

**IMPACT OF NEGATIVE EXTERNALITIES ON CONSUMPTION**

Source: (Allen Consulting Group)

**Information asymmetries**

The lack of information, or the existence of barriers and costs associated with obtaining that information, can lead to sub-optimal market outcomes. In order to achieve an efficient outcome, markets rely on all parties having sufficient (but not necessarily perfect) information to make decisions in their best interests. In some cases, information is not just imperfect, but is asymmetric. Information asymmetries occur when one party in the market, usually the buyer, has less information than another – usually the seller. It is a further complication to the public good dimension of information provision because it recognises that some suppliers (with inferior goods) may be reluctant to provide information that is not favourable to their product.

This information asymmetry problem can create a situation of ‘adverse selection’. Adverse selection occurs when a buyer is not able to differentiate between high quality and low quality goods in the market at the time of purchase, and perhaps also not until a significant period of time after purchase. In the presence of this uncertainty, high quality products can be driven out of the market.

This phenomenon is known as the ‘market for lemons’, first noted by Akerlof (1970), who explained how the pressure of competition, in the presence of information asymmetries, may cause quality to deteriorate to such low levels that the market may fail to exist. This concept is most commonly described using the example of a used car market, where there are both good quality cars and poor quality cars (‘lemons’). Purchasers know that there is a risk that they will purchase a ‘lemon’, but they have no reasonable means of identifying the ‘lemons’ from the high quality cars until they have driven the car for several months after purchase (in the absence of any other third party assistance). This scenario can lead to a less than efficient social outcome because:

- buyers do not have sufficient information to make a rational informed decision about quality of a good, and therefore risk inadvertently purchasing a ‘lemon’;
- as a result, consumers will offer a price which is less than what they would be willing to pay for the high quality product, as they are uncertain as to the quality of the product that they will receive; and
- this, in turn, drives higher quality goods out of the market (as the price is too low to make a positive return).

The result is that consumers, by favouring a lower price given the risk of purchasing a ‘lemon’ inadvertently increase their chances of purchasing a ‘lemon’, as at the lower price only ‘lemons’ will be sold. At the extreme, only the lowest quality products will be sold, and all higher quality products will be removed from the market. Warranties can alleviate, but not totally correct, this problem because they themselves suffer from enforcement costs. These problems (and transaction costs) are a fact of life. But that does not mean policymakers should not continuously explore options for reducing these costs and their impacts.

#### *Adverse selection in products that use water*

Adverse selection is most common for those products where it is difficult for consumers to ascertain quality at the time of purchase (and even for some period after purchase), and where they do not have sufficient prior experience on which to base their decision. There are a number of characteristics of water efficient products that increase the risk of adverse selection in the market for products that use water:

- water efficiency is a difficult attribute to identify without specialist advice;
- many products that use water do so in a way that is not obvious or measurable by the user in the absence of information or labelling. As with some products, once they are installed, consumers may forget or not pay any attention to the water usage associated with each usage or event; and
- products that use water often have a long useful life and the products available are likely to have undergone significant technical change. As such, the purchaser cannot rely on significant previous personal experience to determine the quality of the good.

In markets where there are information asymmetries, adverse selection can drive down the degree of water efficiency that voluntarily occurs.

#### **4.4 The problem**

In this instance the problem is defined as unequal access or the absence of, information on water use and efficiency of HWCs. In order to assess the extent of this problem it is necessary to quantify the:

- variation in water efficiency performance between different models; and
- savings that HWCs can yield due to improved water efficiency.

#### 4.5 Water efficiency performance of HWCs

In considering HWCs for inclusion in the WELS scheme, this paper is focusing on the effectiveness of HWCs in reducing draw off, and whether different HWC types have different levels of performance in this regard.

In terms of including HWCs in the WELS scheme, George Wilkenfeld and Associates (2005) noted that '[a]ll general-purpose recirculators (serving more than one drawoff point) are likely to save about the same amount of water if applied to a given household plumbing layout, so there is no reliable basis for a comparative rating.' George Wilkenfeld and Associates suggest, alternatively, that the 'real difference between models may well be in their energy use rather than in their water saving impacts, so this could be used as a secondary criterion for rating.'

In addition to the concept report produced by George Wilkenfeld and Associates, DEWHA commissioned Coomes Consulting (2008) to examine the feasibility of including HWCs in the WELS scheme. Coomes Consulting concluded that while HWCs can make a contribution to national water conservation, they are not a suitable product for inclusion in the WELS scheme for labelling or minimum WES scheme. Underlying this conclusion is the central observation that there is no clear distinction between HWC types on the basis of water efficiency. As Coomes Consulting states:

Each type of system and each model of pump should ostensibly provide useable hot water at the fixture, removing the cause of wasted water

and

If a pump is expected to be tested during times of full operation, it is expected that there should be little difference in water loss, irrespective of the system or particular pump in use. This would compress or eliminate the possible range of water efficiencies of hot water circulator pumps.

Consultations undertaken as part of this paper tested the veracity of the argument put forward by George Wilkenfeld and Associates (2005) and Coomes Consulting (2008) and no information to the contrary was presented.

As noted previously (see Section 2.1), the volume of avoided water wastage generated by the installation of a hot water circulator varies with respect to the type of water heater it is coupled with. In addition, there may be variances in water consumption/conservation of HWC systems in practice, but these should be considered 'more a product of user behaviour than product effectiveness' (Coomes Consulting Group Pty Ltd 2008). The actual HWC unit, however, does not use water and if working properly any model will generate the same level of savings.

It is the finding of this paper that it is not possible to differentiate and rate HWCs with respect to their water efficiency and they are not appropriate for inclusion in the WELS scheme for labelling or minimum WES.

#### 4.6 Cost effectiveness

It has also been suggested that water savings could be induced through the introduction of legislation mandating the installation of HWCs with all new hot water systems. Although they do not use water per se, and are effectively an add on to a hot water system, the fact remains that their addition would result in water savings. It might be feasible to require this under the Plumbing or Building Code.

However, a simple cost benefit calculation based on the estimated annual water savings generated from use of a HWC and the purchase cost of a HWC suggests that a mandatory approach would not be cost effective. Based on an average Australian water price of \$1.16 /kL<sup>5</sup>, the NPV of water savings per unit over 10 years of installing HWC would be \$41.57 in the average storage water heater household and \$117.14 in the average instantaneous water heater household. For a \$300 HWC to represent a breakeven proposition for the average householder, the price of water would have to rise to:

- \$2.97 per kL, a 250 per cent increase on current prices for households with instantaneous gas water heaters; and
- \$8.37 per kL, a 720 per cent increase on current prices for households with storage water heaters.

It should be noted that this calculation underestimates the full cost of mandating the installation of HWCs because it does not take into consideration the impact of increased energy consumption and greenhouse gas emissions and government compliance and enforcement. Despite the costing being incomplete, it is sufficient to demonstrate that this course of action is not cost effective.

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<sup>5</sup> This price is derived from the list of capital cities' water prices, provided in the Water Services Association of Australia (2008) *Report Card* for 2007/08, cross referenced against the ABS's (2006) estimates of average household water use.

## Chapter 5

# Conclusion

Under best practice regulation guidelines, government intervention can be justified when:

- there is an inherent failure in the market's ability to deliver fair and equitable outcomes, and
- the benefits from correcting the failure are greater than the costs associated with doing so.

Neither of these criteria are sustained when considering water use and efficiency of HWCs. HWCs cannot be rated for water efficiency because, when working correctly they all provide the same level of savings. As such, there is no danger that consumers will inadvertently invest in a water inefficient model, where they otherwise would have invested in a more water efficient model if they had been provided with the information. The Allen Consulting Group supports the conclusion made in the Coomes (2008) report that while HWCs can make a contribution to national water conservation, they are not a suitable product for inclusion in the WELS scheme — because the notion of relative performance (of HWCs) does not apply.

Further to this, the costs of the alternative approach of mandating through the Plumbing or Building code, the installation of HWCs in new homes, are considerably more than the water savings this approach would generate. As such, this approach cannot be justified under the Office of Best Practice's guidelines.

## Appendix A

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