REGULATION IMPACT STATEMENT:

Proposed National System of Mandatory Water Efficiency Labelling and Standards for Selected Products

Prepared for the

Department of the Environment and Heritage, Australia

by

George Wilkenfeld and Associates Pty Ltd

February 2004

GEORGE WILKENFELD AND ASSOCIATES Pty Ltd
ENERGY POLICY AND PLANNING CONSULTANTS
PO Box 934 Newtown NSW 2042 Sydney Australia
Tel (+61 2) 9565 2041 Fax (+61 2) 9565 2042 e-mail: geosanna@ozemail.com.au

Executive Summary

The growing demand for water in urban areas is a major policy challenge for all Australian jurisdictions. Technologies to increase the efficiency of water use in urban areas are readily available, but they are not being adopted as rapidly as is necessary to limit growth in water use. The issue is particularly pressing for household water use.

Households account for about 16% of the consumption of mains-supplied water in Australia, the second largest share of mains water use after agriculture. A further 4% is used in the commercial and other sectors, much of it for similar purposes as in households and employing similar end use devices.

Cost-effective options to increase water-efficiency are being passed up because of low awareness of water issues and water prices, poor access to water efficiency information during product search and selection and because products are often chosen by intermediaries such as builders or plumbers, rather than by the party who will bear the ultimate running costs.

Water Efficiency Labelling

One of the means of overcoming lack of information in the market is through water efficiency labelling, the aim of which is to ensure that buyers are presented with information on water efficiency and/or water use at the time and in the form that is most likely to influence their purchase decision.

A voluntary water efficiency labelling scheme has been in existence since 1988. It is now managed by the Water Services Association of Australia (WSAA). The WSAA program covers shower heads, toilets, taps, clothes washers, dishwashers, urinal flushing devices and flow regulators. The test requirements for each product type, the water efficiency levels required for each rating and the label design are all specified in Australian and New Zealand Standard AS/NZS 6400*, Water efficient products – Rating and labelling*, the latest version of which was published in February 2003.

The coverage and impact of the existing program are limited. Because the scheme is voluntary, few suppliers have chosen to label, and those that have only label their better performing products. The main incentive for labelling has been the support of the water utilities (the members of WSAA), many of whom have publicised the scheme, or offered cash rebates to their customers for the purchase of labelled appliances. These limitations are inherent in any voluntary approach.

In late 2002 the Department of the Environment and Heritage (DEH) commissioned a feasibility study to examine the potential for, and impacts of, introducing a national mandatory water efficiency labelling (WEL) scheme and minimum water efficiency standards (WES) for appliances, fixtures and fittings as a method of reducing urban water consumption. One example of such a scheme is the National Appliance and Equipment Energy Efficiency Program (NAEEEP) where labelling and minimum efficiency requirements are specified in relevant Australian Standards, given effect by regulation and managed by government agencies.

Proposed Regulation

On 2 October 2003, the Environment and Heritage Ministers of the Commonwealth, State and Territory governments and of New Zealand agreed to pursue implementation of a national mandatory water efficiency labelling scheme covering showerheads, washing machines, dishwashers and toilets. Other products would be covered on a voluntary basis. The Ministers agreed to a collaborative approach to implement the scheme nationally (implementation in New Zealand is up to the New Zealand Government). The Commonwealth announced it will draft national legislation in partnership with the States and Territories to underpin the scheme. The legislation is expected to be in place in 2004 to enable the scheme to commence in 2005.

This document is a Regulation Impact Statement (RIS) on the proposed Commonwealth regulations. In accordance with *A Guide To Regulation* (ORR 1998), it estimates the benefits, costs and other impacts of the proposal, assesses the likelihood of the proposal meeting its objective, and considers a range of alternatives to the proposal.[1]

At the time of preparation of this RIS, the Commonwealth legislation that would be used to implement the scheme was still being drafted, and the Australian and New Zealand standard that would form the technical basis of the scheme was being revised. The RIS relies on advice from DEH on the details of the proposed regulations, and on the likely contents of the final Standard.

Policy Objective and Options

The main objective of the proposed regulation is to bring about reductions in the consumption of water in households and in non-residential buildings in Australia and New Zealand below what it would otherwise be (the "business as usual" or BAU case), in a cost-effective manner. The secondary objectives are to bring about reductions in the energy use associated with water use and the environmental impacts associated with both water and energy use, below the BAU case.

The following options for achieving the objectives are considered in this RIS:

1. Status quo: this incorporates the assumptions that water demand will continue to increase and that the current voluntary water efficiency labelling program will be maintained;

2. The proposed regulation, providing for the mandatory *registration* of the water efficiency of selected products, the mandatory water efficiency *labelling* of selected products and mandatory water efficiency *standards* for toilets, all to take effect at mid 2005, and providing for the possible introduction of mandatory water

[1] This document is also intended to inform the consideration of mirror regulation by the States, Territories and New Zealand, by meeting the requirements for RISs on regulatory proposals by Ministerial Councils in accordance with the guidelines of the Council of Australian Governments (COAG 1997). It also covers cost recovery, as required by the *Commonwealth Cost Recovery Guidelines for Regulatory Agencies* (Department of Finance website, not dated)

efficiency standards for additional products in the future (see Table S1);

3. The development of a voluntary agreement between industry and government on labelling;

4. The use of economic instruments such as increasing the cost-reflectiveness of water pricing, or customs duties or tax rates which influence the relative prices of water-using products according to their water efficiency.

Table S1. Proposed initial schedule of products and application of provisions

Product	Registration	Water Efficiency Labelling	Water Efficiency Standards
Shower heads and assemblies	Mandatory	Mandatory	Not at present
Toilets	Mandatory	Mandatory	Mandatory
Clothes washers	Mandatory	Mandatory	Not at present
Dishwashers	Mandatory	Mandatory	Not at present
Taps	Optional	Optional	Not at present
Flow regulators	Optional	Optional	Not at present
Urinal systems	Mandatory	Optional	Not at present

Impacts on Water Consumption

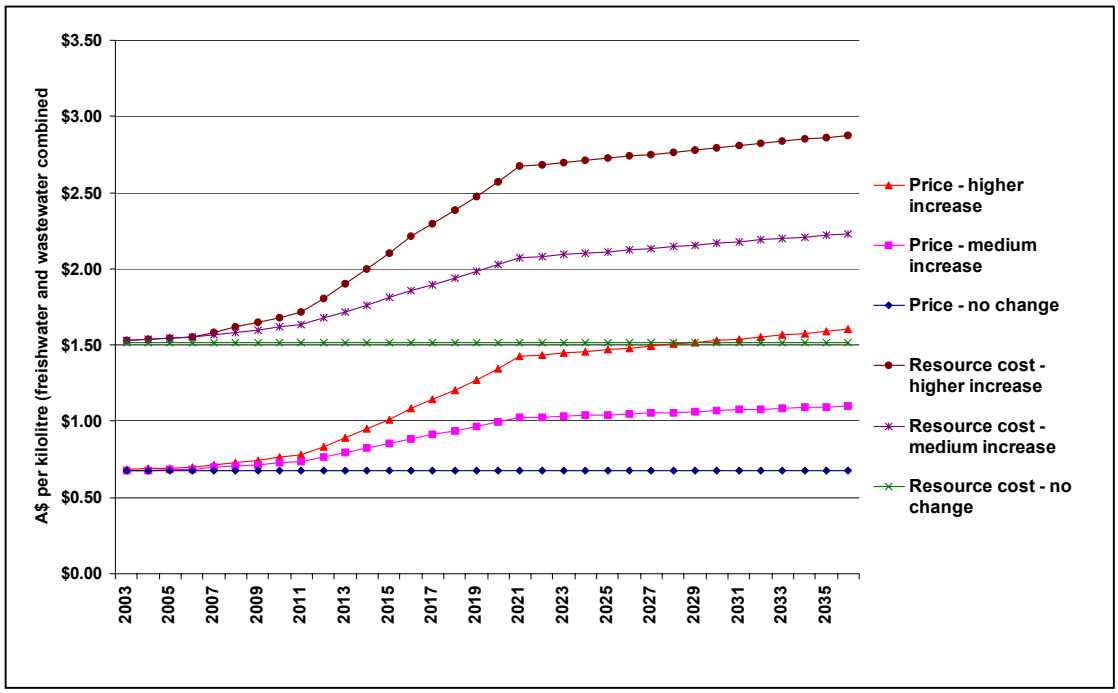
Extensive modelling was undertaken of the likely impact of mandatory water efficiency labelling on product purchases and hence on water consumption, based on the experience of the market changes induced by mandatory energy labelling.

The major quantifiable economic benefits of water efficiency labelling are the value of the water saved (both freshwater supply and wastewater disposal) and the value of the energy saved through the purchase and installation of products that are more water efficient than would be the case without labelling. The major economic costs are the increase in the cost of products due to consumer preference for more water-efficient models, and the program administration costs.

The projected costs and benefits of WEL need to be evaluated from two points of view – the impacts on the economy and the impacts on end users of water services. The program should at least be cost-effective on the basis of economic (resource) costs, and ideally it should be cost-effective on both criteria.

There is considerable uncertainty regarding the future resource costs and prices of water services. Information from WSAA indicates that demand already exceeds "safe yield" in some capital cities, and if demand grows at the BAU rate major supply augmentation will be necessary in most capitals between 2010 and 2020. A range of *marginal* cost and price scenarios consistent with these projections was developed for each State, Territory and New Zealand. Figure S1 illustrates the range of scenarios used in the benefit/cost analysis, expressed as national weighted average values for Australia. Note that these indicate the value of using or saving water at the margin, not average costs or prices, and the projected increases reflect the high capital and operating costs of supply augmentation.

Figure S1. Marginal water service cost and price projections used in cost-benefit analysis (volume-weighted, Australia)



The projected impact of WEL on water consumption is illustrated in Figure S2. It is estimated that total Australian water consumption will be about 18,900 million litres (ML) per annum below BAU by 2011 and about 87,200 ML below BAU by 2021, the end of the projection period. The corresponding reductions for New Zealand are projected to be 3,500 ML and 15,800 ML per annum respectively.

The reduction in total household water use is projected to reach about 5% by 2021, with the impacts ranging from about 9% for clothes washers to less than 0.3% for taps (Figure S3).

It is projected that water savings over the period 2003 to 2021 will total about 610,000 ML. Nearly half of this would come from clothes washers, about 25% from showers and 22% from toilets. Over 86% of the water savings would occur in the residential sector, and the rest in non-residential buildings.

Greenhouse Gas Impacts

WEL is projected to reduce greenhouse gas emissions from electricity and gas use by reducing the amount of hot water used in showers, taps, clothes washers and dishwashers. This is calculated from the share of water heaters in each jurisdiction that are electric, solar-electric and gas. WEL will also reduce the electricity required for pumping freshwater and wastewater. Showers account for about 57% of the projected electricity savings (4,380 GWh over the period) and nearly 64% of the gas savings (14.3 PJ). The total reduction in greenhouse gas emissions for Australia is projected to reach about 135 kt CO_2-e per annum in 2010 and 570 kt CO_2-e per

annum in 2021. The corresponding values for New Zealand are 20 and 95 kt CO_2-e respectively.

Figure S2. Projected water savings by product, Australia – All sectors

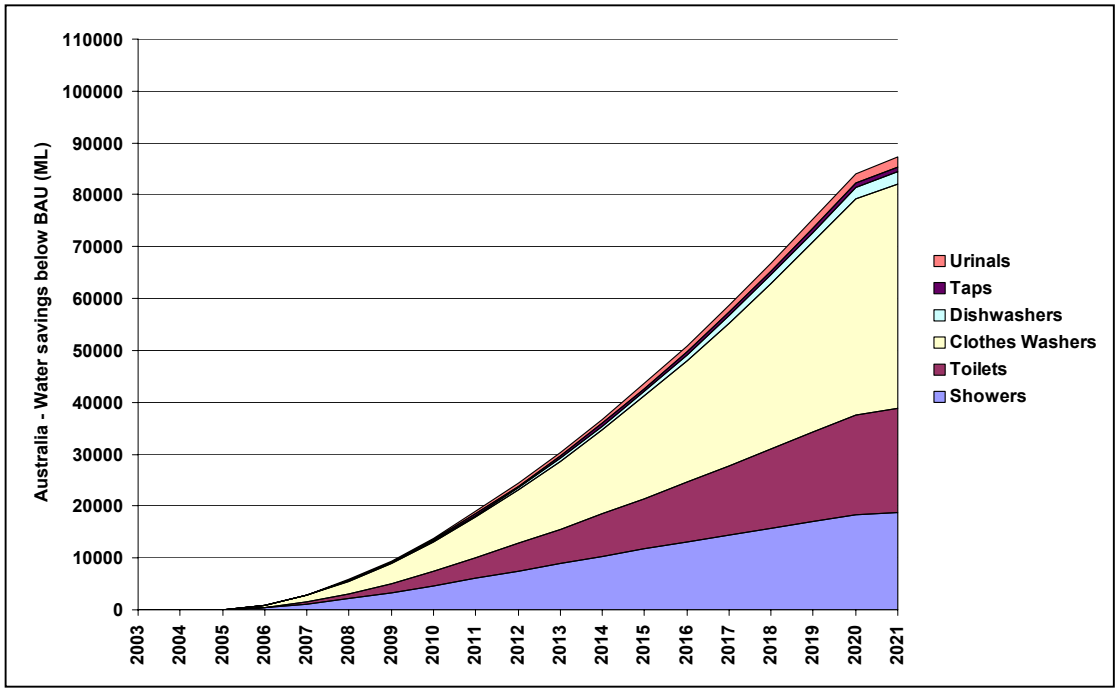
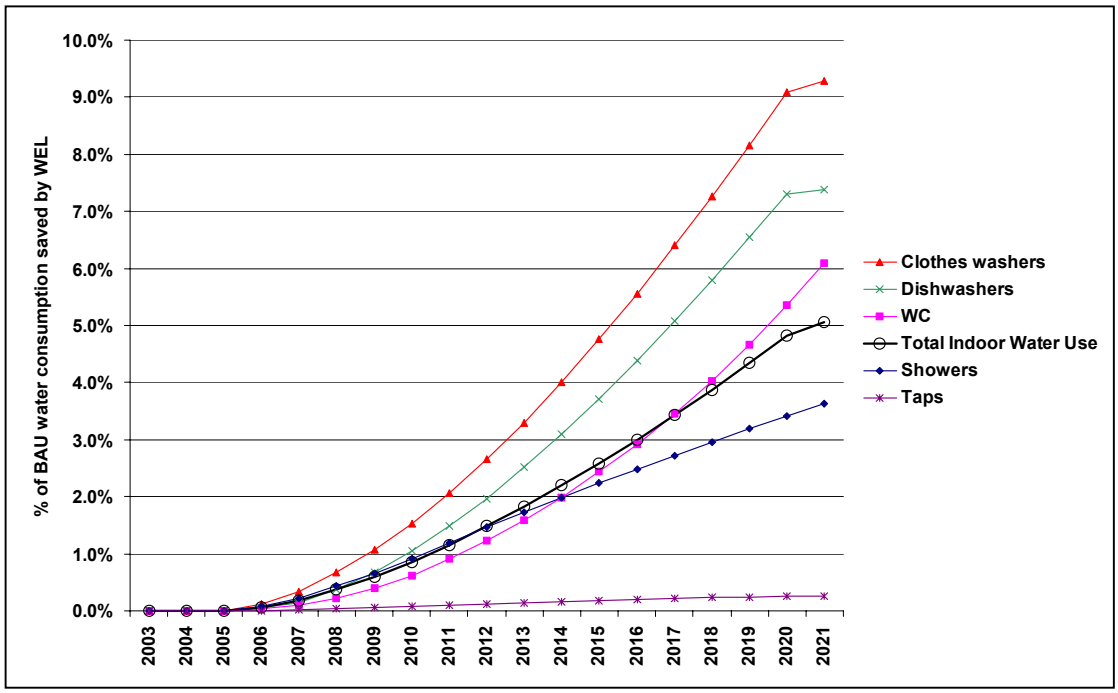


Figure S3. Projected % water savings below BAU – Residential Sector



Other Environmental Impacts

The environmental benefits of avoiding, deferring or reducing the scale of additional water supply and wastewater disposal infrastructure would be significant, though unquantifiable, benefits of the proposed program. (The quantifiable economic benefits are embodied in the projections of rising costs and prices).

The projected reduction in annual water demand from WEL is equivalent to about one year's annual growth in water demand over the period 1997 to 2001. All else being equal, this would delay the need for new water supply infrastructure in each capital city by about one year. Labelling alone is not likely to avoid the need for augmenting water supply capacity indefinitely: economic measures such as more cost-reflective water pricing, and programs such as WES (for which the proposed regulation provides a framework) would still be required.

Costs and Benefits

The main findings are:

- From the resource cost perspective, the projected benefit for Australia from mandatory water efficiency labelling is about $M 386 and the projected cost is about $M 119. This indicates a net benefit of about $M 267, at a benefit/cost ratio of 3.2;

- The program would be cost-effective for every product covered, except for dishwashers, for which cost-effectiveness is slightly below 1;

- About 89% of the costs of the program would be the additional resource costs of increasing product water-efficiency. Testing, registration and labelling costs would account for about 9%, and other administration costs for about 2%;

- The value of savings in water services account for nearly 72% of the benefit, electricity cost savings for about 19% and gas cost savings for about 9%;

From the retail price perspective, the projected benefit for water services users as a group is about $M 900 (NPV at 2003, 10% discount rate), and the projected cost is about $M 225. This indicates a net benefit of about $M 674 at a benefit/cost ratio of 4.0. This compares favourably with the estimated benefit/cost ratio of 2.4 (at 10% discount rate, retail price perspective) for the mandatory energy labelling and minimum energy performance standards program (NAEEEC 2003a).

From the retail price perspective WEL is cost-effective for all products, including taps and dishwashers, for which WEL appears to be not cost-effective from a resource perspective. On balance, dishwashers should be subject to mandatory WEL, especially as their inclusion would greatly reinforce the impact on consumers of the program as a whole, while WEL for taps should be optional.

The program appears to be cost-effective under a range of price increase projections and discount rates, including the most severe combination of conditions modelled: *no* increase in the real resource costs of water services or energy, and a discount rate of 10% (see Table S2). Under these conditions the combined benefit/cost ratios for the

program as a whole are still 2.5 and 3.3. On the other hand, if resource cost and price increases are high the program's cost-effectiveness would rise to 4.1 and 4.7.

Table S2. Summary of Benefit/Cost Ratios

Perspective	Cost/Price Growth	Discount rates		
		0%	5%	10%
Resource Cost (Economic)	No change	5.3	3.5	2.5
	Medium increase	7.3	4.7	**3.2**
	High increase	9.6	6.0	4.1
Retail Price (Consumer)	No change	7.0	4.6	3.3
	Medium increase	8.8	5.7	**4.0**
	High increase	10.6	6.8	4.7

Source: Appendix 2: shaded cells correspond to "reference" scenarios in Table 21 and Table 22

It is projected that, over the period 2003-2021, consumers would spend about 2.5% more on the purchase of water-using products for the residential sector compared with the BAU case: about 10.1% more on showers, 0.5% more on toilets, 4.4% more on clothes washers, 1.3% more on dishwashers and 7.6% more on taps (assuming that suppliers opt to participate and that tap labelling is moderately effective).

The testing, registration and administration costs of WEL are largely fixed, in that they would be incurred whether or not product buyers actually use the labels to change their purchase behaviour. The product costs, however, are variable in that they closely correlate with buyer behaviour. If buyers made less use of the label then average product costs would not increase as much. The very high ratio of variable to fixed costs means that the program benefit/cost ratios are relatively insensitive to program impact, although of course the projected reduction in water and energy would be lower if program impact were lower.

Consultations

During the development of the WEL proposal an extensive program of consultations were held with a wide range of stakeholders. Most parties consulted, including product suppliers and retailers, actively supported the introduction of a mandatory WEL program and none opposed it.

Many of the water authorities and the plumbing industry regulators also advocated the immediate introduction of mandatory WES, coupled with mandatory standards to enforce compliance with aspects of plumbing fitting safety and performance not directly related to water consumption. The manufacturers of clothes washers and dishwashers, while supporting mandatory WEL, are opposed to WES for the time being and particularly opposed to the use of WEL or WES as a way of ensuring compliance with unrelated requirements.

Impacts on Competition and Trade

The implementation of mandatory WEL is not likely to lead to either a significant increase or decrease in the number of manufacturers, importers, wholesalers or retailers regularly supplying the market for water-using fittings and appliances.

The effect of mandatory WEL on supplier competition is likely to be minimal. As the purpose of WEL is to overcome information failure in the market, competition should be enhanced, since water-efficiency will become a stronger factor in product differentiation.

The proposed regulation would apply equally to imported and locally manufactured products, and there are no equivalent international test standards that could conflict with the proposed test standards, so the proposal is consistent with international trade rules. Products manufactured in Australia and New Zealand tend to be among the most water-efficient of their type, so would not be disadvantaged by the proposal.

Because of the requirements of the Trans Tasman Mutual Recognition Agreement, the harmonisation of WEL requirements and implementation timetables between Australia and New Zealand would be desirable. However, lack of harmonisation is unlikely to seriously threaten the integrity or effectiveness of the program in Australia due to competitive pressures.

Impacts on Small Business

Most suppliers of the products that would be affected are medium sized enterprises, although a few manufacturers, importers and distributors of showers, tapware and flow control devices are in the small business category. The only category of products supplied by such businesses that would be subject to mandatory WEL would be showers – for tapware and flow control devices, participation would be optional.

There is likely to be a higher representation of small businesses among product retailers. Unincorporated entities not involved in interstate trade would not be subject to the proposed Commonwealth regulation until the States and Territories pass the required mirror legislation, so the initial onus of compliance would be not on them but on their suppliers.

Small business retailers, like other retailers, who choose to stock more water-efficient products in response to changing buyer preference would be able to benefit from higher average sales prices.

Assessment Against Evaluation Criteria

Reduce water consumption below business as usual

The proposed regulation is the only one of the options likely to be effective in reducing water consumption below BAU. Voluntary labelling already exists, and changing the nature of the agreements supporting it is not likely to increase its effectiveness.

Economic instruments could be complementary to, but not substitutes for, the proposed regulation. Increasing the cost-reflectiveness of water pricing would increase buyer incentive to consider water efficiency, but buyers would still require product information in the form of labelling to respond effectively.

The proposed regulation is the only one of the options for which impacts, costs and benefits can be quantified. The benefit/cost analysis indicates that the proposal is likely to be cost-effective under a wide range of assumptions, and so meets the economic and community interest tests.

Reduce other environmental impacts below business as usual

The consumption of energy (for water heating and pumping) and the emissions of energy-related greenhouse gases would be reduced in proportion to the reduction in freshwater demand, and these impacts have been quantified in the analysis. It is assumed that the production of wastewater would be reduced in direct proportion to the reduction in freshwater demand, so the environmental impacts of wastewater disposal would also be reduced. The costs or environmental impacts of the proposal outside urban water supply systems have not been assessed, but any reduction in urban water demand should increase the availability of fresh water for other purposes, whether for agriculture or environmental flows in natural waterways.

Address market failures

The proposal addresses information failure in the market for household water services, in a far more effective way than voluntary labelling. The proposal does not directly address the split incentives problem, since plumbers and builders will still be free to select less water-efficient products and remove the label before the end user sees it. Over time the proportion of purchase decisions in which customers take a direct interest should increase, so putting pressure on intermediaries to select water-efficient products.

The proposal does not address deficiencies in the pricing of water services. These can only be addressed by economic instruments, but there would still be a need for reliable information on the relative water efficiency of products, so buyers can act on the pricing signals.

Minimise negative impact on product quality

The BAU option and the voluntary labelling option should have no impact on product quality either way, since they will have no impact on "business as usual" behaviour of suppliers or product buyers. The proposal should significantly change the pattern of market demand for products of various types and levels of water-efficiency, and will create an incentive for some suppliers to increase apparent water efficiency at the expense of other aspects of product performance. The safeguards embodied in the test standards appear to adequately protect consumers against any risk of deterioration in product performance. Indeed, the additional tests being developed to support mandatory WEL – eg the clothes washer rinse performance test – could increase product quality compared with the BAU case.

Minimise negative impacts on suppliers

The BAU option and the voluntary labelling option would have no impact on suppliers, since they will have no impact on "business as usual" behaviour of suppliers or product buyers.

The proposed regulation will have some impact on all participants in the water services sector: product manufacturers, importers and retailers, plumbers and builders and water service suppliers. There will be initial compliance-related costs, and further impacts as consumers change their product preferences and purchasing behaviour. The initial costs to suppliers should be modest, and greatly exceeded by the additional revenues from the sale of more water-efficient products.

The effect on supplier and product competition is expected to be modest. The suppliers of more water-efficient products (this includes most Australian and New Zealand manufacturers) will have a competitive advantage, and suppliers with less efficient products will have a competitive disadvantage, but suppliers have both flexibility and time to change their product range as consumer preference changes.

Consistency with other policy constraints and objectives

The proposed regulation is consistent with international trade rules, since it will apply equally to imported and locally manufactured products, and does not use test standards that are at variance with internationally accepted test standards (largely because there are none in this area).

The regulation is consistent with State plumbing regulations, assists their objectives and facilitates their enforcement, although it does not seek to enforce them directly.

With regard to the Trans Tasman Mutual Recognition Agreement, harmonisation of WEL requirements and implementation timetables between Australia and New Zealand would be desirable, but lack of harmonisation is unlikely to seriously threaten the integrity or effectiveness of the program in Australia as detailed on page 97.

Conclusion

The proposal to implement a mandatary water efficiency labelling program is likely to meet the objectives of the regulation, with net economic benefit to the community. None of the other options considered in this RIS is likely to meet the objectives of the regulation.

Recommendations

It is recommended that:

1. The proposed regulatory framework to support a mandatory water efficiency labelling (WEL) program and a mandatory water efficiency standards (WES) program should be implemented;

2. The regulatory framework should incorporate powers to schedule products for which registration would be mandatory, products for which WEL would be mandatory, products for which registration would be optional, products for which WEL would be optional and products for which WES would be mandatory;

3. The target implementation date for the regulations should be mid 2005, to give adequate notice and lead time from the finalisation of the regulatory framework, tests, algorithms and label designs;

4. Shower heads should be scheduled for mandatory registration and mandatory labelling, with effect from the date of implementation of the regulations;

5. Clothes washers should be scheduled for mandatory registration and mandatory labelling, with effect from the date of implementation of the regulations;

6. Dishwashers should be scheduled for mandatory registration and mandatory labelling, with effect from the date of implementation of the regulations;

7. Toilets should be scheduled for mandatory registration, mandatory labelling, and mandatory water efficiency standards (expressed as a maximum weighted average flush volume of 5.5 litres) with effect from the date of implementation of the regulations;

8. Urinal flushing systems (ie combinations of stalls, flush mechanisms and sensors) should be scheduled for mandatory registration and optional labelling, with effect from the date of implementation of the regulations;

9. Taps (or selected subgroups of household taps) should be scheduled for optional registration and optional labelling, with effect from the date of implementation of the regulations, subject to satisfactory product definitions being included in the relevant test standard;

10. Flow control devices (or selected subgroups of flow control devices) should be scheduled for optional registration and optional labelling, with effect from the date of implementation of the regulations, subject to satisfactory product definitions being included in the relevant test standard;

11. Showering systems (ie combinations of shower heads, taps and/or flow control devices) should be scheduled for optional registration and optional labelling at such time as a satisfactory Standard incorporating product definitions, water efficiency tests and performance standards is finalised;

12. The technical basis of the program (apart from showering systems) should be Australian and New Zealand Standard AS/NZS 6400 *Water efficient products – Rating and labelling* as currently being revised, subject to the revision meeting the needs of the regulation;

13. The Standard should retain the present links between the water consumption tests and the energy consumption tests for clothes washers and dishwashers (noting the recent and proposed revisions of those tests);

14. The Standard/s should retain the present links between the water efficiency rating tests and other essential product performance requirements (eg shower performance, clothes washer and dishwasher cleaning, drying and rinse performance), but products should not be excluded from the market solely as a

result of failure to meet performance criteria that are not related to water consumption or efficiency;

15. For the scheduled products, the regulations should prohibit any form of water efficiency labelling other than the regulated form;

16. Suppliers of taps, flow regulators, urinal flushing systems and (once the Standard is developed) showering systems should be encouraged to take up the option of participating in the program, and/or to include water efficiency data and ratings in their product catalogues and websites;

17. If suppliers choose to take up the option of participating in the program, they should be subject to the same compliance obligations as for products for which WEL is mandatory;

18. There should be a large-scale promotional program to establish and support the mandatory WEL program when it is implemented;

19. The case for mandatory WES for showers, clothes washers, dishwashers and urinal flushing systems should be reviewed once the WEL program has been established and its effectiveness has been evaluated;

20. The case for mandatory rather than optional labelling for taps and flow control devices should be reviewed once the WEL program has been established and its effectiveness has been evaluated;

21. WSAA and the water authorities should be encouraged to maintain the voluntary water efficiency labelling program until the mandatory program takes effect.

*****

Contents

EXECUTIVE SUMMARY 2

Glossary *16*

1. THE PROBLEM 17

1.1 URBAN WATER USE 17

1.2 WATER USE IN HOUSEHOLD PRODUCTS 21
Shower heads *21*
Toilets *24*
Clothes washers *27*
Dishwashers *31*
Taps *32*
Flow regulators *33*

1.3 WATER USE OUTSIDE THE HOUSEHOLD 34
Urinal Flushing Systems *34*
Showering Systems *36*

1.4 THE MARKET FOR WATER USING PRODUCTS 38
Evidence of Market Failure *38*
Options to Address Market Failure *39*

2. OBJECTIVES OF THE REGULATION 43

2.1 OBJECTIVE 43

2.2 ASSESSMENT CRITERIA 43

3. PROPOSED REGULATION AND ALTERNATIVES 44

3.1 STATUS QUO (BAU) 44

3.2 MANDATORY WATER EFFICIENCY LABELLING 44
Proposed Regulation *44*
Rationale for Scope of Regulation *47*

3.3 VOLUNTARY LABELLING AGREEMENT 52
Government-Industry Agreements *53*
Industry-run Labelling *53*
Conclusion *55*

3.4 ECONOMIC INSTRUMENTS 55
The Pricing of Water Services *55*
Measures Affecting Product Prices *56*
Conclusions *56*

4. COSTS, BENEFITS AND OTHER IMPACTS 58

4.1 BENEFITS AND COSTS OF MANDATORY WEL 58
Modelling Approach *58*
Projecting costs and prices *63*
Analysis of WEL Impacts *70*
Overview of National Benefits and Costs *76*
Impacts by Jurisdiction *81*

4.2 INDUSTRY, COMPETITION AND TRADE ISSUES 84
Supplier and Market Issues *84*
Impacts on Industry Participants *89*
Compliance Issues *93*
Trade Issues *96*

5. CONSULTATIONS 99

5.1 CONSULTATIONS 99
Chronology of Previous Reports and Consultations 99
Points raised in Consultations 101
Proposed public consultations on the RIS 102

5.2 PUBLIC COMMENTS ON RIS 102

5.3 REVIEW 102

6. EVALUATION AND RECOMMENDATIONS 104

6.1 ASSESSMENT 104

6.2 RECOMMENDATIONS 108

REFERENCES 110

APPENDIX 1 MODEL INPUTS 113
APPENDIX 2 MODEL OUTPUTS 123

Glossary

AD	All Directional (traditional non-flow controlled shower design)
AGA	Australian Gas Association
Algorithm	A formula which converts the results of a water consumption test or flow test into a rating
ANZ	Australia and New Zealand
AS/NZS 6400	Australian and New Zealand Standard 6400:2003 *Water efficient products – Rating and labelling*
BAU	Business as Usual
COAG	Council of Australian Governments
Comparative label	A sticker or other means of conveying water or energy ratings that is intended to influence purchasers to prefer more highly rated products
DEH	Department of the Environment and Heritage
Disendorsement label	A sticker or other means of informing prospective purchasers that a product has a low level of water or energy efficiency
Endorsement label	A sticker or other means of informing prospective purchasers that a product has a high level of water or energy efficiency
EPHC	Environment Protection and Heritage Council (of Ministers)
Flow control	Any method of controlling the rate of water flow in an appliance (other than by adjustment of the taps supplying the appliance)
Flow regulation	A method of controlling water flow that is relatively independent of water pressure
Flow restriction	A method of controlling water flow such that flow varies with water pressure
kPA	kilopascals – a measure of water pressure
Marking	Information fixed permanently to a product (unlike labels, which are designed to be removed after purchase)
MEPS	Minimum Energy Performance Standards - enforceable minimum levels of energy efficiency
MP52	AS/NZS MP52 *Manual of Authorisation Procedures for Plumbing and Drainage Products*.
NAEEEP	National Appliance and Equipment Energy Efficiency Program
NPV	Net Present Value
Rating	An indication of comparative efficiency or performance (eg AAA, or 2 stars)
TTMRA	Trans Tasman Mutual Recognition Agreement
WEL	Water Efficiency Labelling – a complete information disclosure system intended to influence purchasers, that may include comparative, endorsement and disendorsement labelling
WES	Water Efficiency Standards – enforceable minimum levels of water efficiency
WSAA	Water Services Association of Australia

1. The Problem

1.1 Urban Water Use

The growing demand for water in urban areas is a major policy challenge for all Australian jurisdictions. A number of States have adopted plans that, among other things, seek to limit the growth in demand for urban water. For example, The Victorian Government has adopted a 10 year plan for the State, *Water for the Future,* and a plan for Melbourne (WRSC 2002). The Western Australian government has also adopted a 10 year plan, *Our Water Future*, and a plan for Perth.

In 2002 the Senate Environment, Communications, Information Technology and the Arts Reference held an inquiry into *Australia's management of urban water* (ECITARC 2002).

One of the common themes in these plans and inquiries is that technologies to increase the efficiency of water use in urban areas are readily available, but they are not being adopted as rapidly as is necessary to limit growth in water use. The issue is particularly pressing for household water use.

Households account for about 16% of the consumption of mains-supplied water in Australia (Figure 1), the second largest share of mains water use after agriculture. A further 4% is used in the commercial and other sectors, much of it for similar purposes as in households and employing similar end use devices.

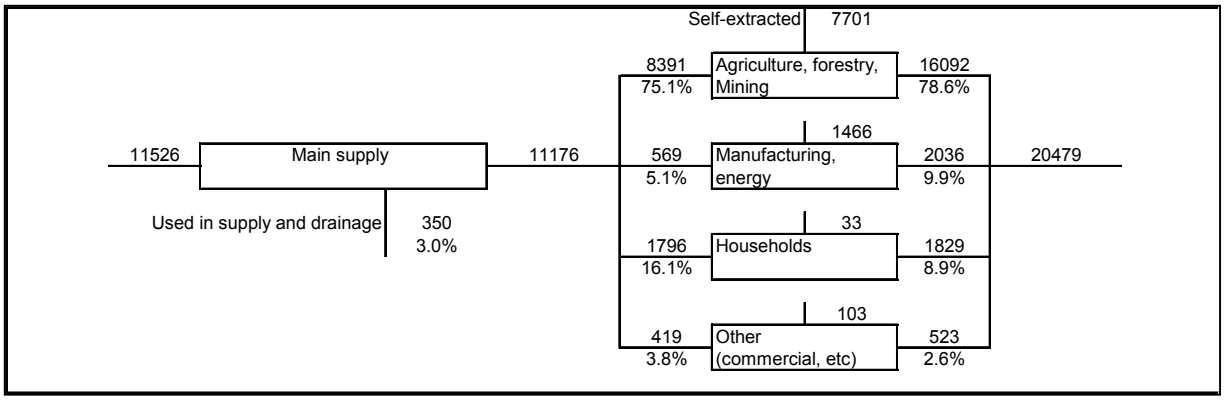
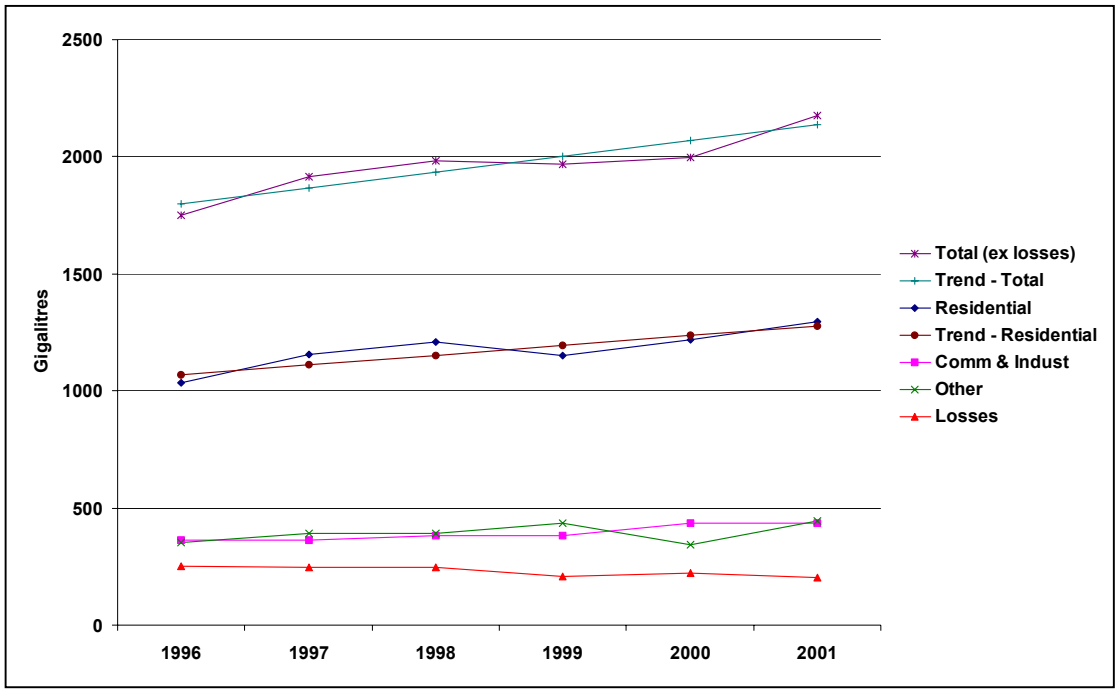


Figure 1 Mains Water Use by Sector, Australia 1996/97

Source: ABS 4610.0 *Water Accounts for Australia 1993-94 to 1996-97*; All values Gigalitres

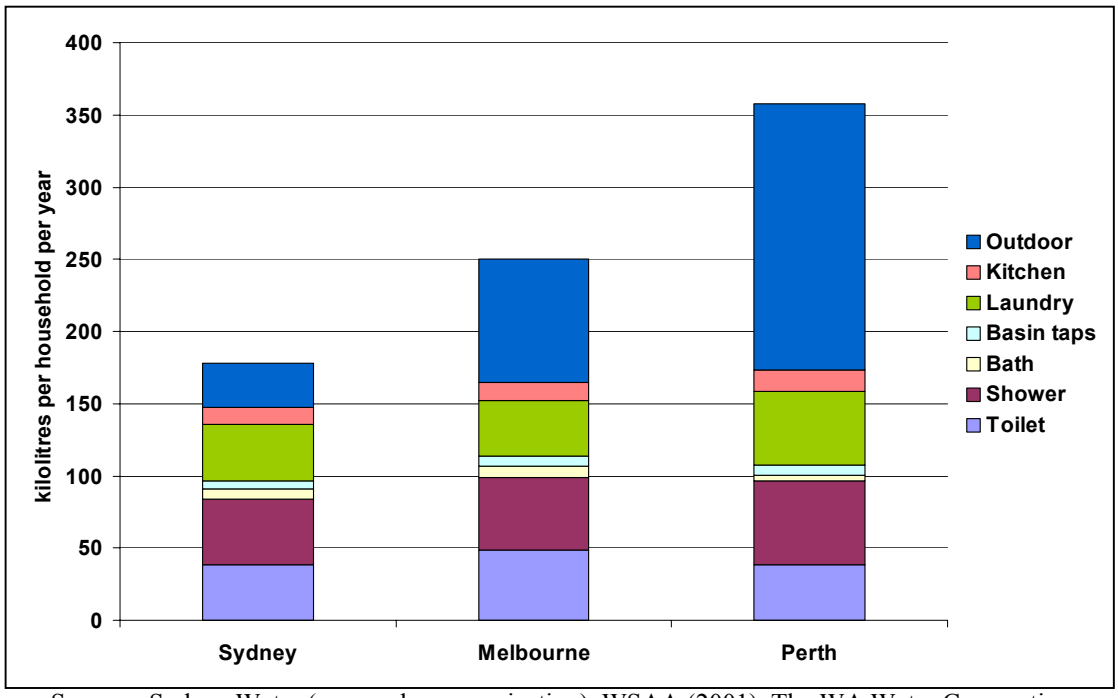
Between 1996 and 2001, the supply of water to households in the main urban areas increased at a rate of about 3.4% per annum, while total water supplied in those areas (excluding losses) increased at 3.3% per annum (Figure 2).

Figure 2 Supply of water to customers in main urban areas, 1996 - 2001



Source: WSAA (2001) – excludes Tasmania, North Queensland and most regional areas

Figure 3 Estimated use of water by households in Sydney, Melbourne and Perth



Sources: Sydney Water (personal communication), WSAA (2001), The WA Water Corporation Domestic Water Use Study

Outdoor use of mains water varies considerably between Australian cities, with factors such as climate, the size and style of gardens, pool ownership and the availability of alternative water sources such as bores (Figure 3). However, there is much higher consistency in the amount of indoor water use per capita and the main purposes for which it is used. The available data for Sydney, Melbourne and Perth are

illustrated in (Figure 4). WSAA advises that a similar pattern of indoor water use may be used for the other capital cities a well. The change in the pattern over time is gradual, and mainly related to long-term trends in water use habits and in the stock of water appliances.

Outdoor water use patterns vary more widely because of differences in climate, garden size and styles and (in Perth) the use of bore water. The low average outdoor use in Sydney is due to the higher share of apartments with no gardens. Outdoor water use is more volatile from year to year than is indoor use, in response to rainfall and other weather factors.

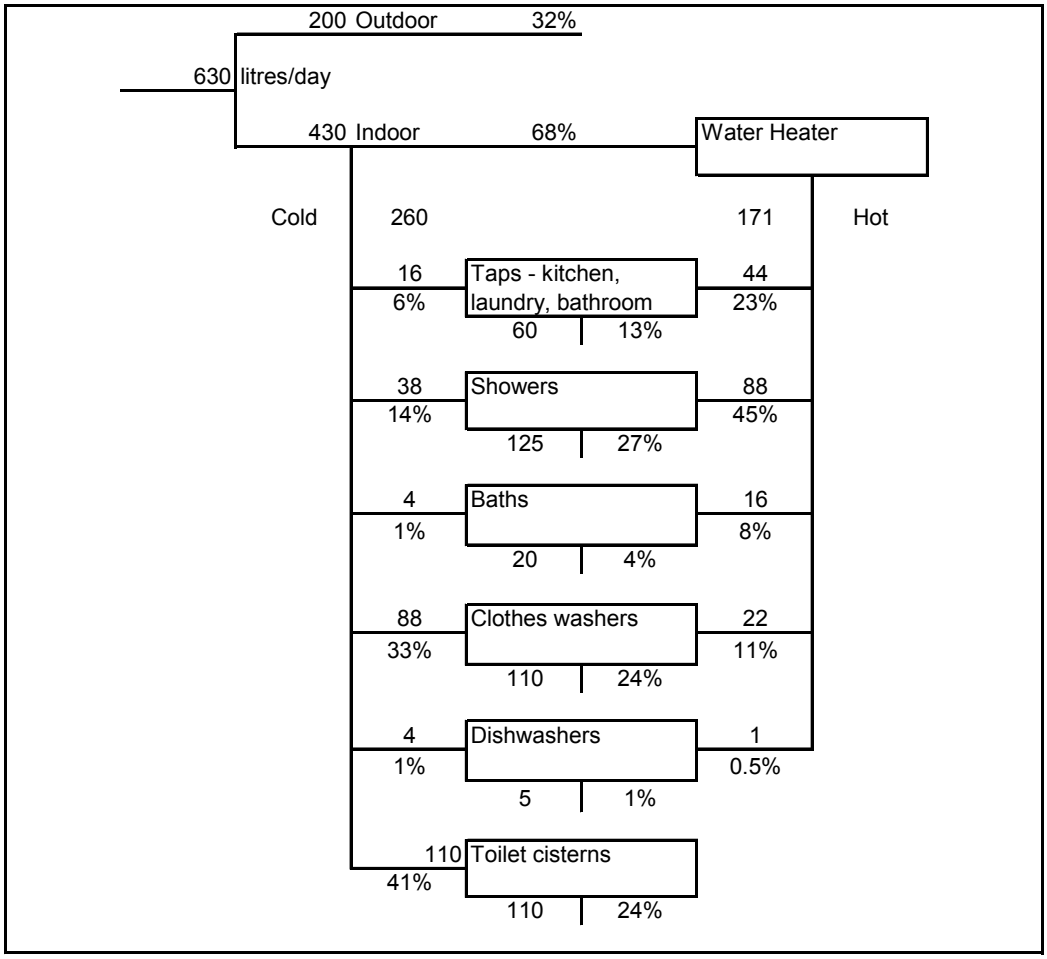
The main indoor use is showering, accounting for about 29% of indoor consumption, followed by toilet flushing and clothes washers (about 26 % each), taps over baths, sinks, handbasins and laundry tubs (18%) and dishwashers (1%).[2] Nearly 40% of indoor water passes through the water heater, and some additional water heating is done by the internal heating elements in clothes washers and dishwashers.

Figure 5 illustrates the breakdown of indoor water use by main end use. About a third of indoor water use is "free flow", and about two thirds is "volumetric". The quantity of water used in free flow applications is determined largely by users' settings of the flow controls (eg how far they open the tap), length of use (eg how long they shower) and characteristics of the flow device: if a tap allows a greater flow, it will run more water if left on for the duration of an activity such as brushing teeth.

In volumetric water applications the flow stops automatically (eg when a clothes washer senses that the wash load is immersed, or a cistern valve shuts off) or the user stops it when the desired volume is reached (eg in a bath or a sink). Most water using devices operate exclusively in one mode or the other, except for taps. For example, the tap over a kitchen sink may sometimes be used in free flow (to wash hands or vegetables) and sometimes volumetrically (to fill a pot, or fill the sink to an appropriate level for washing dishes).

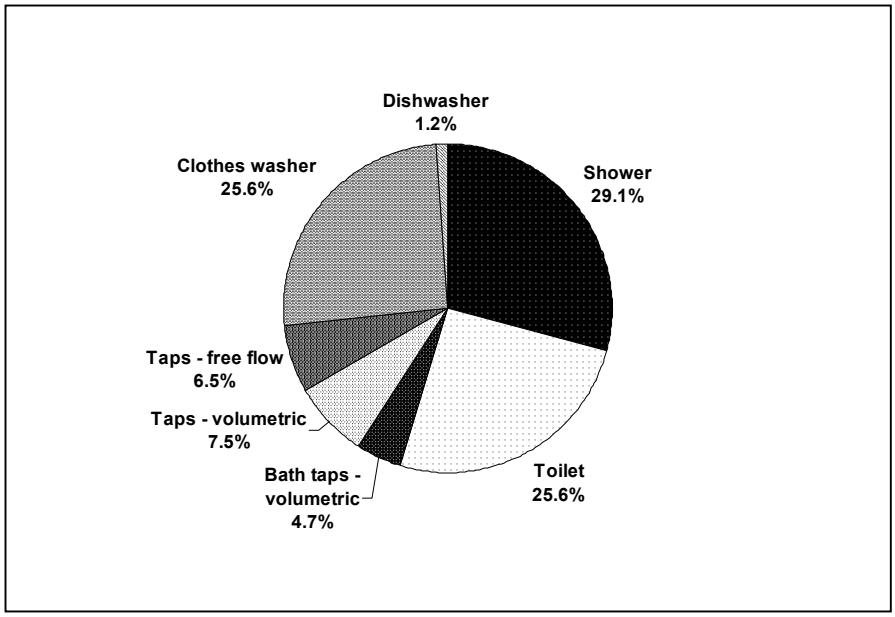
[2] Only about a third of all households currently have a dishwasher. In households that possess a dishwasher the contribution to water use will be higher. Water used for dishwashing by hand is included in the "taps" total.

Figure 4 Flow Diagram of Estimated Average Daily Household Water Use



Source: Author estimates based on Figure 3. All values litres/day

Figure 5 Breakdown of Estimated Household Indoor Water Use



1.2 Water Use in Household Products

The water-efficiency of products varies over a wide range. It is possible to analyse the water-efficiency of the following indoor household products because there is an accepted standard water efficiency test for each product, detailed in AS/NZS 6400:2003 *Water efficient products – Rating and labelling*. It is not yet possible to analyse the water-efficiency of garden watering and other outdoor products in the same way, because there are no equivalent standard tests at present.

Shower heads

Technology

Showerheads tend to fall into the following categories:

- The traditional flat-faced disc with a large number (over 150) small holes, and no flow control device. This is called the "all-directional" (AD) shower. The flow rate varies with pressure: at typical mains supply pressures (around 500 kPA) it is in the range 20 to 25 l/min.

- Shower heads with an aperture-type flow restrictor: essentially, a disc with a small hole bored in it. These may have low flow at moderate pressures, but high flow at high pressures and very low flow at low pressures (perhaps unacceptably low).

- Shower heads with a flow regulator – typically a ring of flexible material that closes the aperture as pressure rises, and reopens as pressure falls.[3]

Shower heads may be entirely of plastic, entirely of metal - typically plated brass – or a combination of the two. Some showers have only a single fixed spray pattern, while others have a range of patterns and modes, such as wide spray, narrow spray and pulse or "massage" settings. AS/NZS 6400 specifies that showers with a range of settings should be tested at the "normal setting (as specified by the manufacturer)."

A standard shower head discharges 15 to 25 litres/minute. There are flow regulated designs giving flow rates as low as 6 or 7 litres/minute, although below 8 to 9 litres/minute user satisfaction may be compromised. Some flow regulated shower heads are unsuitable for low water pressure, and some may be incompatible with some older style instantaneous water heaters, because the flow rate is too low to trigger the main burner flame.

When low-flow showers were first introduced in Australia in the 1980s there were many reports of customer dissatisfaction, partly due to unfamiliarity with the different feel of the shower and partly due to poor design. Householders are now far more familiar with low flow showers (they are present in over one third of dwellings and a

[3] Shower assemblies with flow regulators may have them located either at the shower head or at the point where the arm or flexible hose connects to the wall. Both positions have their advantages. Location at the wall means that the arm, hose and any sockets and elbows are also protected from higher pressures and so are less prone to leakage, but if there are elbows downstream of the regulator these will further restrict the flow, so the spray from the shower head may be unsatisfactory.

large proportion of commercial accommodation) and there is now a standard for showering performance (*AS/NZS 3662 Water Supply – Water efficient mains pressure shower heads*).[4]

Field trials with a control group have found that the installation of a water-efficient shower saves about 14,500 litres per household per annum (Sarac et al 2002). This is equivalent to about 30% of showering water and 16% of all hot water in Figure 4.

Prices and operating costs

There is no direct relationship between price and water-efficiency. Price depends more on material (eg metal vs plastic), build quality, design and features (eg whether there are multiple settings) than on water-efficiency. Nevertheless, higher-price shower heads tend to include water-efficiency among their features.

In the Australian Consumers' Association's last review of water-efficient shower heads in December 1998, the 20 models tested ranged in price from $15 to $173. Half the models tested had two or more settings, and half (including both the cheapest and the most expensive) had only a single fixed spray pattern.

The purchase price of showers is negligible in comparison with the operating costs. Table 1 summarises the costs of water and water heating energy for typical showers of standard, AAA and AAAAA ratings. Energy accounts for over two thirds of showering costs where the water is electrically heated, and over a half of costs where the water is heated by gas. Householders can reduce total 10 year showering costs by about $ 875 by selecting a AAA rated shower in preference to a standard shower if the water is electrically heated, or about $ 560 if the water is gas heated. Of course the showering experience will be different, but indications from consumer surveys are that most users will find it satisfactory.

Table 1 Estimated 10 year operating costs - showers

Shower rating	Tested flow l/min	Estimated % of flow in use	Actual l/min	Estimated min/day/ person	l/day/ person	kl/HH/yr	10 yr water cost	10 yr electricity cost	10 yr gas cost	10 yr total with electricity	10 yr total with gas
Standard	20	70%	14.0	5.0	70.0	71.5	$703	$1,704	$831	$2,407	$1,534
AAA	9	90%	8.1	5.5	44.6	45.5	$448	$1,084	$529	$1,532	$976
AAAAA	6	100%	6.0	6.0	36.0	36.8	$362	$876	$427	$1,238	$789

Assumptions: 2.8 persons per household; water+wastewater tariff $1.60/kl; electricity cost 12c/kWh; gas cost 1.3c/MJ; heat content of showering water 116 MJ/kl; marginal water heating efficiency 100% for electricity, 80% for gas; 10 year costs are Net Present Value at 10% discount rate.

Selection of a AAAAA rated showerhead in preference to a AAA model would reduce 10 year operating costs by a further $ 290 if the water is electrically heated or about $ 190 if the water is gas heated, but there are some concerns about the satisfactory showering performance at very low flow rates.

[4] A recent follow-up survey for a water authority rebate scheme found that a greater share of participants reported an increase in satisfaction with their shower after changing to a low flow design than reported a reduction in satisfaction.

The operating costs of shower heads account for between 90% and 99% of the total lifetime costs. Given this very high ratio, and the magnitude of potential savings from selecting a more water-efficient shower, it would be expected that water and energy costs would dominate shower selection. This does not appear to be the case, although there is a slow trend towards greater adoption of water-efficient showers.

Market trends

ABS data indicate that the proportion of Australian households reporting the presence of a low flow shower head increased from about 22% in 1994 to nearly 35% in 2001 (Figure 6), an increase of 1.8 percentage points per annum.[5]

Shower head purchases typically occur when dwellings are constructed, when bathrooms are refurbished and at times when some external event such as a utility rebate scheme prompts the replacement of an otherwise serviceable shower head. Replacements due to failure are relatively rare.

It is estimated that Australian sales of shower heads are about 1 million each year, of which about 700,000 are installed in the residential sector. Table 2 indicates that about 38% of sales to households are flow controlled and 62% AD types. The flow controlled share is much higher for renovations, where the user takes an interest in the fittings, than in new construction, where the selection is often made by the builder. The ratio is higher still when the shower is replaced independently of bathroom renovation, since many such replacements are in response to water utility incentive programs: Sydney Water alone is currently granting rebates for about 50,000 shower heads per annum – all of them AAA rated.[6]

The value of the market is not known. Single shower head prices range from less than $10 for the cheapest AD types to $200 or more for multi-directional, multi-function models. At an average price of $30 per shower head, the value of the residential market would be over $ 20 M. The shower head will often be purchased in combination with other fittings, such as extension arms or wall rods for sliding adjustments, which could cost more than the shower head itself.

Table 2 Estimated annual shower head sales, Residential Sector, Australia 2003

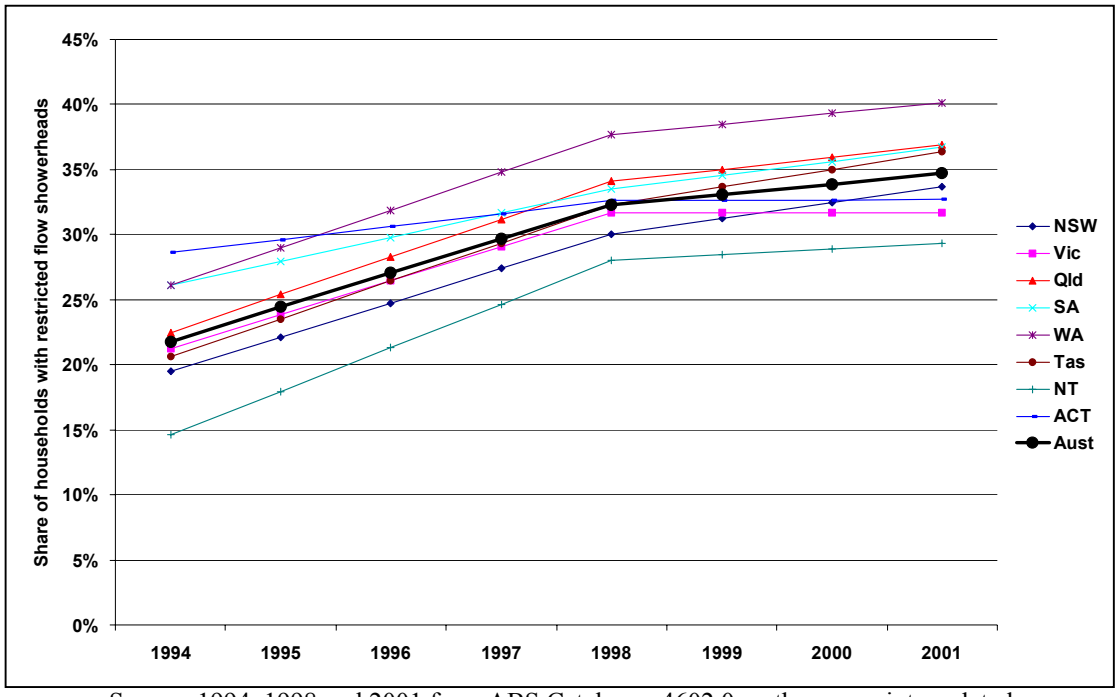
	Dwellings	Shower heads/ dwelling	Shower heads sold	All direct -ional %	Flow controlled %	All direct -ional	Flow controlled
New installations	150,000	1.5	225,000	90%	10%	202,500	22,500
Renovations	220,000	1.5	330,000	60%	40%	198,000	132,000
Replacements			150,000	25%	75%	37500	112,500
Total			705,000	62%	38%	438,000	267,000

Source: GWA et al (2003)

[5] The ABS data do not indicate the average number of showers in the household, whether more than one shower has a low flow head, or whether the shower with the low flow head tends to be the more used.

[6] Some rebates will be for shower head purchases during renovations, and some rebates will be taken by customers who would have purchased AAA shower heads anyway, ie “free riders”.

Figure 6 Share of households with reduced flow shower head/s



Source: 1994, 1998 and 2001 from ABS Catalogue 4602.0 – other years interpolated

Toilets

Technology

Water-activated toilets (water closets) consist of two main components: the pan and the cistern. The volume of water required from the cistern to satisfactorily flush away liquid and solid wastes depends on the design of the pan, which in turn depends on design of the trap, the drainline and the waste system in general.

The two most important ways to make toilets more water-efficient are to reduce the volume of water required to achieve a satisfactory flushing of solid wastes, and to allow users to select a shorter flush for liquid wastes.

In general, the older the pan, the more water needed to flush solid wastes. Older style cisterns discharge about 12 litres per flush. By the 1980s, the typical cistern flush volume was 11 litres, although it was found most pans could give satisfactory performance with 9 litres. In 1990, the largest Australian supplier (Caroma) introduced a dual flush cistern with maximum 9 litre flush, which was suitable for most existing pans as well as for all new pans.

A dual flush cistern delivers a reduced flush when the user selects that option. The first dual flush cisterns retained the 11 litres full flush, and delivered 5.5 litres on the reduced flush. AS/NZS 6400 assesses cistern performance on the basis of a weighted average of 4 reduced and 1 full flush. On this basis the weighted average flush

volume for a 11/5.5 litre cistern is 6.6 litres, a saving of 40% compared with a fixed 11 litre flush.[7]

Caroma introduced a 9/4.5 litre cistern in 1990 (AA on the present voluntary label scale). In 1993, in response to the wishes of the water authorities, the company introduced a 6/3 litres cistern, only suitable for use with purpose-designed pans. This configuration, which has a weighted flush volume of 3.6 litres, was made mandatory for new installations in Melbourne in 1993, and has since become mandatory in many other areas.

Caroma has introduced a 4.5/3 litre dual flush cistern-pan combination for sale in Singapore, in response to Singapore's minimum water efficiency standards. The technology has been used in Australia on a trial basis, and there is no reason why it should not be made available on the general market. It would rate AAAA on the present scale.

It is understood that a 4/2 litre combination, which would rate AAAAA, is also feasible except perhaps in some applications where the fall in the existing drainline is so shallow that the flush volume would not give adequate transport of solid wastes. However, full flush volumes of significantly less than 4 litres many only be feasible with non-conventional sewerage systems, such as vacuum-assisted systems.

Prices and operating costs

There is no direct relationship between price and water efficiency for toilets. At present nearly all the toilets on the Australian market fall into one of two levels of water-efficiency (AA and AAA), and at each level prices range from less than $300 to several thousand dollars. Assuming an average price of $500, water costs would account for about one third of the lifetime operating costs of a AAA toilet (installation costs excluded), and over 40% for a AA toilet (Table 3). The AAA rated toilet represents a 10 year water saving of about $125 compared with the AA rated model. If a AAAA rated toilet became available it would represent 10 year water savings of about $20 compared with AAA, whereas a AAAAA type would represent a water saving of about $85.

Table 3 Estimated 10 year operating costs - toilets

Toilet rating	Full flush litres	Part flush litres	Wtd Avg litres	Flush/day/ person	l/day/ person	kl/HH/yr	10 yr water cost
Standard (a)	11.0	11.0	11.0	6.9	75.9	77.6	$763
AA	9.0	4.5	5.4	6.9	37.3	38.1	$374
AAA	6.0	3.0	3.6	6.9	24.8	25.4	$250
AAAA	4.5	3.0	3.3	6.9	22.8	23.3	$229
AAAAA	4.0	2.0	2.4	6.9	16.6	16.9	$166

Assumptions: 2.8 persons per household; water+wastewater tariff 1.60/kl; 10 year costs are Net Present Value at 10% discount rate (a) No longer available

There would be no additional materials or manufacturing costs involved in the manufacture of dual flush toilets of higher rating than AAA, and no additional

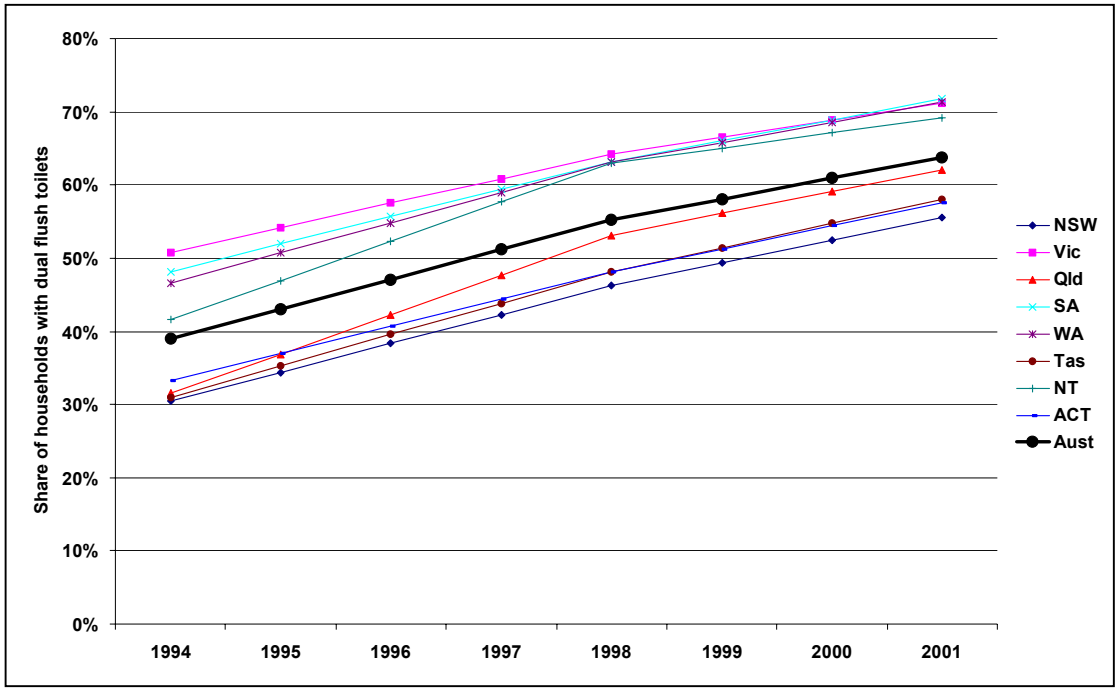
[7] The basis for the 4:1 ratio estimate is not known - some users may not bother to select the short flush even when that would be adequate, while others may accept a short flush even for solid waste.

installation costs. The initial costs of introducing AAAA and AAAAA toilets would depend on the capital costs of establishing new production lines and the additional inventory and stock control costs from carrying extra models. If the AAAA range superseded the AAA range entirely, these costs would disappear.

Market Trends

Figure 7 illustrates the steady rate of increase in the share of Australian households with dual flush toilets: from 39% in 1994 to 64% in 2001, an increase of 3.5 percentage points per annum.

Figure 7 Share of households with dual flush cisterns



Source: 1994, 1998 and 2001 from ABS Catalogue 4602.0 – other years interpolated

As with shower heads, the great majority of toilet purchases occur when dwellings are constructed and when bathrooms are renovated. The common practice during renovations is for both the pan and the cistern to be replaced: the retention of only one is relatively rare. Replacement of one item without the other may occur due to catastrophic failure, but this also is relatively rare: cistern flush mechanisms can be replaced so long as the cistern itself is intact, and pans last indefinitely unless accidentally cracked or broken.[8]

It is estimated that Australian sales of toilets are about 1 million each year, of which about 650,000 are installed in the residential sector. Table 4 indicates that about 90% of sales to households are AAA rated. Unlike shower heads, it is estimated that the

[8] In the event that an older style toilet pan needs to be replaced, the only models now available are all designed to operate with 9 or 6 litres maximum flush volumes. However, they will still operate satisfactorily with the higher flush volumes, so there will be no reduction in water use until the original cistern is replaced. In the event that an older style cistern breaks, a modern 9/4.5 litre will still work with the older-style pan, and will halve the water use (ie a weighted average flush volume of 5.4 litres, compared with a typical single-flush 11 litres).

more water-efficient type accounts for a greater share of new installations than renovations. Most new toilet installations are governed by water authority requirements for AAA ratings. During renovations householders are likely to be exposed to a wide range of models including imports, many of which have a 9/4.5 litre cistern rather than a 6/3. Even so, it is assumed that 90% of toilets installed during renovations are AAA rated.

Table 4 Estimated annual cistern sales, Residential Sector, Australia 2003

	Dwellings	Toilets / dwelling	Cisterns sold	9/4.5 litre (AA) %	6/3 litre (AAA) %	9/4.5 litre (AA) %	6/3 litre (AAA) %
New installations	150,000	1.7	255,000	5%	95%	13,000	242,000
Renovations	220,000	1.7	374,000	10%	90%	37,000	337,000
Replacements			20,000	100%	0%	20,000	0
Total			649,000	11%	89%	70,000	579,000

Source: GWA et al (2003).

Clothes washers

Technology

There are two main clothes washer configurations: top loading and front loading (also known as drum type). These correspond to two distinct types of wash technology – vertical axis machines where the wash load is moved by an impeller or agitator, and horizontal axis machines, where the entire drum revolves.[9] There are also twin-tub designs (generally an impeller top loading type with a separate spin extractor) but now only a handful of models remain on the market and sales are negligible.

Front loaders generally use less water per kilogram of wash load than top loaders. In horizontal axis machines the drum tumbles the load through the water, whereas in top loaders the load must be immersed. The apparent energy advantage of front loading machines is due almost entirely to their lower water use, since less energy is required to heat a smaller amount of water to a given temperature. If warm wash is used, a fully loaded front loader will generally use less energy than a fully loaded top loader of similar capacity (although the most efficient top loaders have lower energy use than the least efficient front loaders).

If cold wash is used, however, there is no real energy difference between top and front loaders, since the only energy use is for motors and pumps. Also, many front loaders limit the option to wash with cooler temperatures – for some machines the minimum wash temperature is a warm wash. Between 1988 and 2002, the proportion of householders indicating that they wash with cold water increased from 31% to nearly 68% (GWA et al 2003). This has de-coupled the link between energy use and water

[9] The terms "front loader" and "top loader" are used in this report to include all relevant variants in these basic designs. Some European top loading washers are in fact horizontal axis machines, with a loading hatch in the side of the drum. There are also US-made machines in which the drum axis is tilted upward for easier loading, at the expense of space-efficiency and dryer stackability. There are also new "top loading" technologies such as nutators and various types of pulsating machines.

use. Consumers who prefer cold wash could purchase a top loader knowing that there will be no energy penalty, but unaware of the extent of the water penalty.

Other issues complicate water- and energy-efficiency comparisons between top- and front-loaders, and between models of high and low energy ratings. Water and energy use are tested with a full load, but in practice many wash loads are partial.[10] Most top-loaders allow the user to adjust (and in many cases adjust automatically) by using less water. Since front-loaders already use a smaller amount of water the scope for further reduction for partial loads is limited, and if water level adjustment is present at all, it tends to be less sophisticated (eg a "half load" button). Therefore, the front loader's water and energy advantage per kilogram of wash load may be somewhat less in practice than the test indicates, but it will still be significant.

Prices and operating costs

The relative cost of water and energy in clothes washing are summarised in Table 5. Front loaders are on average about twice as water-efficient as top loaders, but the range within each type is even wider: there is a ratio about 3 to 1 in the water intensity of both top and front loader types. For top loaders, annual water costs range from $6.6 to $21.2 per kg of load capacity, whereas for front loaders the range is $4.4 to $12.5. For both top loaders and front loaders, the cost of water is higher than the cost of energy, even on hot wash, and substantially higher on cold wash. Indeed, water costs average 91% of washing costs (detergent excluded) for top loaders, and 76% for front loaders. If running costs were the only consideration, then in an informed market water should be the dominant factor in clothes washer selection.

While top loaders consume more energy and water than front loaders of equivalent capacity, they are considerably cheaper to buy. In 2001, the average top loader cost 40% less per kg load capacity then the average front loader (Figure 8), although the differential may now be reducing somewhat with the recent introduction of lower price front loader models. Also, top loaders tend to have dual water connections so any hot water they use comes from the house supply, which may be gas or solar heated. Front loaders tend to have only a cold water connection, so all their water heating is electrical, the most costly and greenhouse-intensive form of water heating.

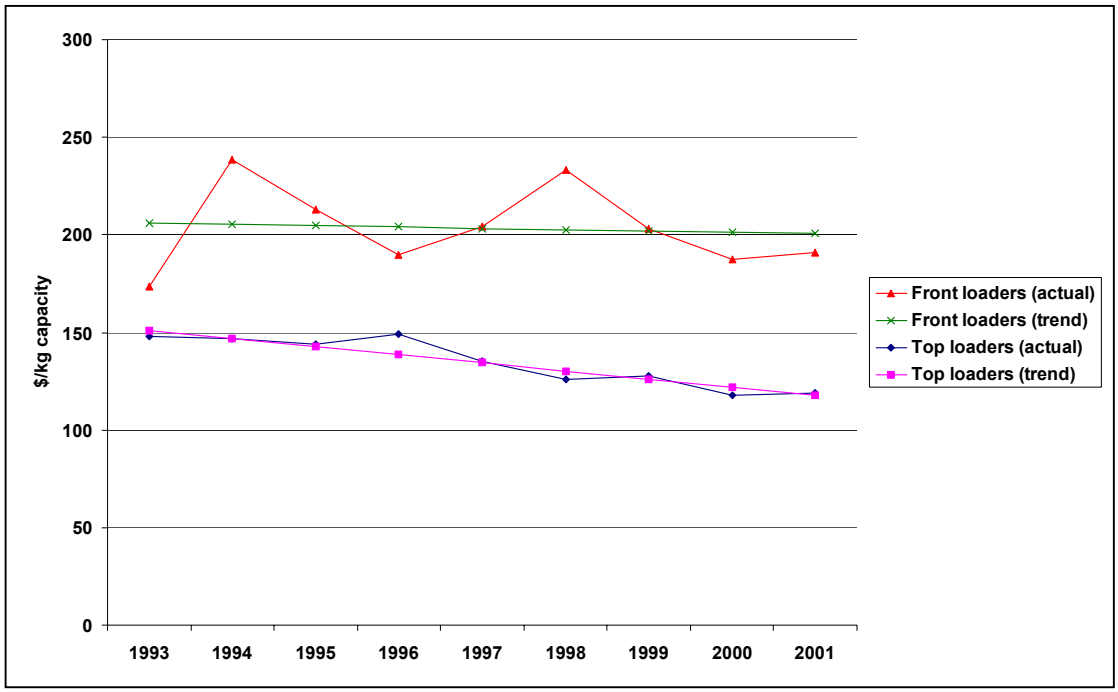
Table 5 Annual water and energy costs for washing machines

		Water		Energy – Hot wash		Energy – Cold wash		Water/total costs (a)	
		litres/kg	$/kg/yr	kWh/kg	$/kg/yr	kWh/kg	$/kg/yr	Hot wash	Cold wash
Top loaders	Minimum	11.3	$ 6.6	0.11	$ 4.6	0.02	$ 0.8	33%	82%
	Average	23.6	$ 13.8	0.27	$ 11.8	0.03	$ 1.3	54%	91%
	Maximum	36.3	$ 21.2	0.36	$ 15.7	0.07	$ 2.9	71%	94%
Front loaders	Minimum	7.6	$ 4.4	0.07	$ 3.1	0.01	$ 0.3	42%	49%
	Average	12.4	$ 7.2	0.12	$ 5.1	0.06	$ 2.5	59%	76%
	Maximum	21.5	$ 12.5	0.25	$ 10.9	0.15	$ 6.4	75%	95%

Source: Derived from data on www.energrating.gov.au; energy tariff 12.0 c/kWh; water+wastewater tariff $ 1.60/kilolitre; daily use. (a) These are taken from the combined energy and water costs for each model listed for energy labelling, not derived from the preceding columns.

[10] AEEMA and CESA have submitted data from a 1995 user survey that suggests that about 42% of wash loads are less than full, with a weighted average load of about 85% of capacity.

Figure 8 Price per load capacity by type, clothes washers



Source: Derived by author from NAEEEC (2003)

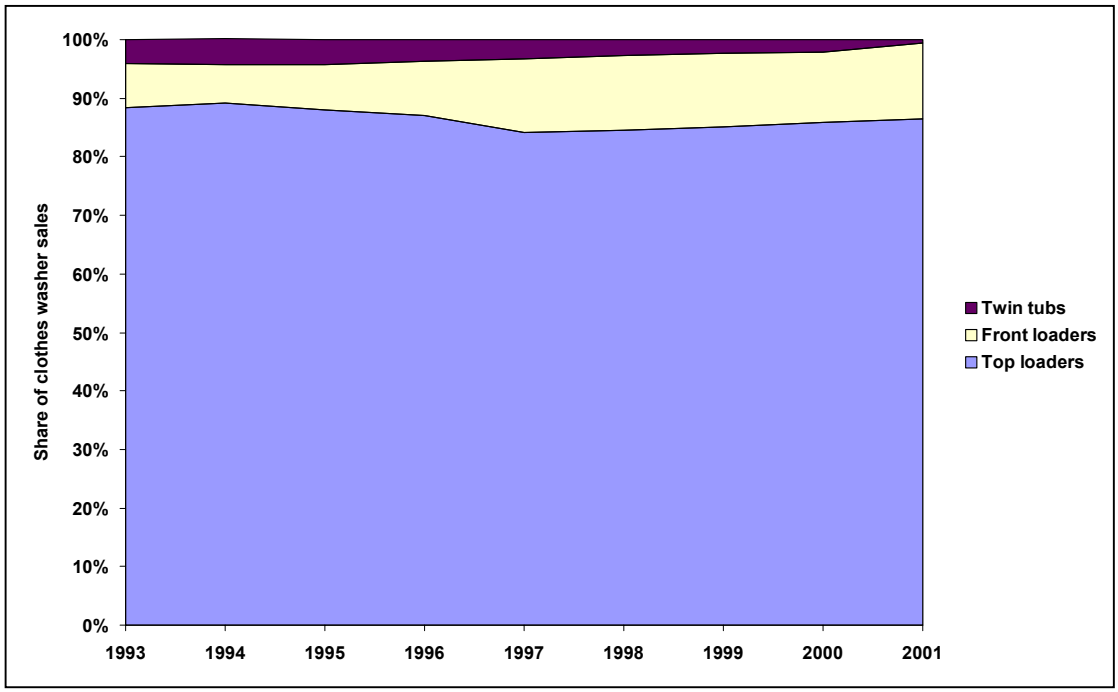
Market trends

Over 95% of Australian households possess a clothes washer. Sales are driven mainly by replacement, and to a lesser extent by the formation of new households, rather than by an increase in the ownership rate. The trend sales for 2002 were about 566,000 units.[11] Australia (like North America and Japan, and unlike Europe) has historically been a top-loader market: most people have grown up with top loaders, and are comfortable and familiar with them. Top loaders currently have about 85% of the Australian market. There was a gradual market shift to front loaders in the early 1990s, but the trend stalled in the late 1990s (Figure 9). There are some indications that the shift is gaining pace again. The front loader market is being boosted by the fact that there are now more front loader models on the market than top loader models, by the introduction of lower price models, and – in the short term at least – by water authority incentive schemes, but the rate of change is very slow.

The sales-weighted water efficiency increased for both front and top loaders between 1993 and 2001. There was a rapid reduction in water use per kg load capacity (on the standard test) for front loaders, and a less rapid reduction for top loaders: in effect, the efficiency advantage of front loaders is increasing. However, some of this apparent improvement may have been due to an increase in the average capacity of clothes washers sold.

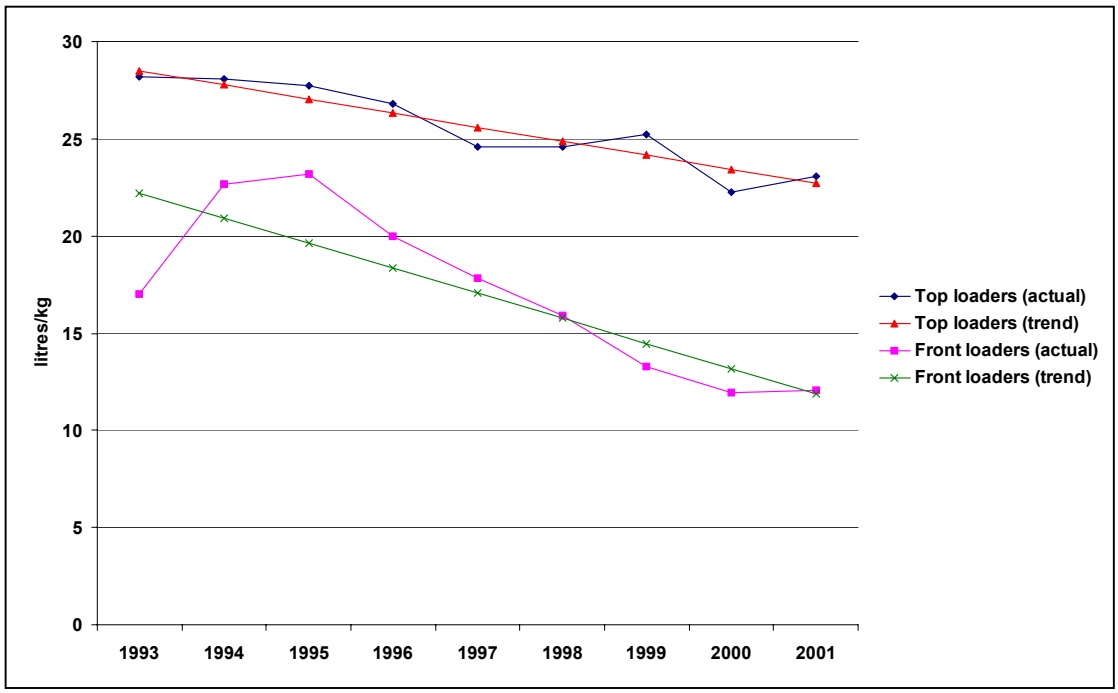
[11] Actual sales vary considerably from year to year, so trend data are more indicative.

Figure 9 Historical market share by type, clothes washers



Source: NAEEEP (2003)

Figure 10 Historical sale-weighted water efficiency, clothes washers



Source: NAEEEP (2003)

Dishwashers

Technology

All dishwashers currently on the market work on the same principle. The load of dishes is cleaned with a sequence of hot or cold water washes and rinses. Totally cold water dishwashing is not yet practical, although improvements in detergents have gradually allowed average wash temperatures and water quantities to decline. Users select the program depending on their judgement about how soiled the load is. The heavier the soiling, the higher the average wash temperatures and the longer the wash sequence within the selected program.

There is a close correlation between water use and energy use in dishwashers. The most direct technical route to greater energy-efficiency is greater water-efficiency. Therefore buyers who seek out energy-efficient dishwashers using the energy label tend to obtain one that is water-efficient as well.

Market Trends

About 35% of Australian households owned a dishwasher in 2002, and the share is rising steadily. Dishwasher sales are currently running at about 220,000 units, compared with about 566,000 units for clothes washers. Because over 95% of households already have a clothes washer, sales are restricted to replacements and new households, but with dishwashers increasing ownership is also driving sales. These are increasing at about 5.5% per annum, compared with 1.9% per annum for clothes washers. The average price of dishwashers sold new in 2001 was $990 (compared with $774 for clothes washers), with a total value of $173 M (NAEEEP 2003).

The water-efficiency of dishwashers has improved markedly since the 1980s, largely due to improvements in energy-efficiency prompted by the mandatory energy labelling program. Between 1993 and 2001, sales-weighted average water use declined by nearly 30%, from about 29 litres per cycle to 20 litres (NAEEEC 2003). The most water-efficient model on the market now uses 11 litres (0.8 litres per place setting capacity), but there is still a very wide range in water-efficiencies (Table 6)

Water costs represent on average about 70% of operating costs for dishwashers (excluding detergent cost), which is comparable to the ratio for clothes washers.

Table 6 Water consumption rates of models on the market – dishwashers

	litres per place setting (a)	kWh per place setting (a)	Water/total costs (b)
Minimum	0.8	0.04	63%
Model average	1.5	0.09	71%
Maximum	2.5	0.14	77%

Source: Derived from data on www.energrating.gov.au: standard size models only. (a) On cycle nominated by supplier for labelling test, and may be relatively light, but must still meet the cleaning performance criteria. Following revision of AS/NZS 2007 in 2003, all models will have to indicate energy and water consumption on the "normal" program. (b) These are taken from the combined energy and water costs for each model listed for energy labelling, not derived from the preceding columns.

Taps

Technology

The Australian Standard definition of taps encompasses a very wide range of products. AS/NZS 6400 defines a water tap as "a device for controlling the flow of water from a pipe by the activation of an opening and closing mechanism", and a water tap outlet as "an outlet fitting or outlet component of a tap through which water is intended to pass". Taps and outlets may be sold separately, sold as a packaged set, or combined in the one physical assembly. AS/NZS 6400 allows for the testing and rating of taps alone, tap outlets alone or taps in combination with outlets.

Typical taps discharge 15 to 18 litres/minute. Low-flow and aerating models deliver significantly lower flow rates (see Table 7), although water savings are only realised in free-flow uses, not volumetric uses. Indeed, low-flow taps are unsuitable for filling baths, because the longer filling time is less convenient and allows more cooling of the bathwater before use.

Table 7 Current water efficiency ratings for taps and flow regulators

Tap rating	For use in basin, trough Litres/minute	For use in kitchen, laundry Litres/minute
A	>6 to 7.5	>12 to 15
AA	>4.5 to 6	>9 to 12
AAA	>3 to 4.5	>7.5 to 9
AAAA	>2 to 3	>6 to 7.5
AAAAA	2 or less (a)	6 or less

Source: AS/NZS 6400:2003 (a) With automatic shutoff.

Different ratings apply to taps intended for different uses: for example a basin tap achieves a AAA rating if it has a flow rate between 3.0 and 4.5 l/min, but a kitchen or laundry tap achieves a AAA rating with a flow rate between 7.5 and 9.0 l/min. AS/NZS 6400 states that "Water taps or tap outlets shall be marked with their intended application (eg. basin tap, kitchen spout, etc.)" and "specifying the intended application of the water tap and tap outlet is necessary because the water efficiency rating of the product is awarded relative to that application".

Markets

There are several hundreds, perhaps thousands of models of taps and outlets on the Australian market, many of them technically identical but differentiated by style and finish: taps are purchased for appearance as much as for function. According to industry sources the total value of the market including imports is about $210 M per annum.

There is no information about the distribution of sales by flow rates, or indeed on the relative price of taps of different flow rates. In some cases the flow rate can be reduced by screwing on a low cost end-of spout flow regulator.

The potential savings to the householder from selecting more water-efficient taps is difficult to assess. The most used tap in the household tends to be the kitchen tap. If it is used to fill the sink twice a day at 7.5 litres per time, the total volumetric use would be 5.5 kl/yr. If in addition it is used in free-flow mode for two minutes daily, at a flow rate of 12 litres/minute, the annual free flow use would be 8.8 kl.[12] Substituting a AAAA rated tap with a flow rate of 7 l/min would save 3.65 kl/yr, with a value of about $ 5.80. The NPV of 10 years' worth of savings would be $ 36 (at 10% discount rate), so this would be about the limit of additional costs that a rational decision-maker would be prepared to pay for a tap with lower flow, all else being equal.

Flow regulators

Technology

A flow regulator is a device designed to produce a constant flow of water over a range of pressures. It is in fact identical to the device incorporated in most "low-flow" shower heads and taps, with the difference that the product is sold separately. It may be "end of the line" – eg screwed to a tap outlet – or "in-line" – eg installed in a tap supplying an outlet.

The AS/NZS 6400 water efficiency rating levels for flow regulators are identical to those for taps (Table 7). There are different levels for flow regulators intended for use with basins and ablution troughs, and for flow regulators intended for use with kitchen sinks and laundry sinks. However, the same flow regulator may fit a large number of taps or tap outlets, so the ultimate application is difficult to pre-determine.

Markets

The number and types of flow regulators sold annually as separate items or in total is not known.

[12] The combined water use of 14.3 kl is about the Perth average for kitchen sink use, and slightly higher than the Sydney average.

1.3 Water Use Outside the Household

The patterns of water use in commercial, educational and institutional buildings have much in common with the patterns of water use in the household. Many of the water using products made for household use are also installed in such buildings. Most suppliers also offer special commercial grade product ranges, designed for greater durability and higher intensity of use. Table 8 gives an estimated breakdown of water consumption in both private dwellings and in non-residential buildings (eg schools, hospitals, hotels, sports centres, offices, shops, restaurants, factory amenities blocks etc). The estimate for non-residential buildings is approximate only, since there is much less data than for the household sector.

There are two main areas of non-residential building water use which are not present in the residential sector: urinal flushing and air conditioning cooling towers, which would account for a large share of "other" water use in non-residential buildings.

Table 8 Estimated water use in households and non-residential buildings, Australia 2002

End use	Households		Non-residential		Total building-related		Household/ total	Total/household
	%	Gl	%	Gl	%	Gl		
WCs	26%	343	35%	168	28.1%	511	67%	1.49
Urinals	NA	NA	20%	96	5.3%	96	0%	NA
Showers	29%	390	15%	72	25.4%	462	84%	1.18
Taps	19%	249	5%	24	15.0%	273	91%	1.10
Appliances	27%	358	10%	48	22.3%	406	88%	1.13
Other	NA	NA	15%	72	4.0%	72	0%	NA
Indoor	100%	1340	100%	480	100.0%	1820	74%	1.36
Outdoor	33%	660	20%	120	30.0%	780	85%	1.18
Total		**2000**		**600**		**2600**	**77%**	**1.30**

Author estimates based on Figure 1 and Figure 5 and non-household sales of WCs and showerheads.

Urinal Flushing Systems

Technology

The main factors determining the water efficiency of a urinal are:

- The match between the pattern of demand and the pattern of flushing – ideally flushing should occur no more frequently than is necessary; and
- The volume of water required to clear the urinal.

The flush frequency depends on the mode of interaction between the flush control mechanism and the user. The simplest mechanism is a chain pull or push button, but in practice many users ignore this, leaving the urinal stall unflushed. The earliest way of making flushing independent of the user was to make it continuous, and this was the principle behind the "fill and flush" cistern which empties as soon as it fills. As the supply taps tend to be left on permanently, even when buildings are vacant, the fill

and flush types are highly wasteful and have now been banned by most water supply authorities. Many water authorities and building owners now have programs for the replacement of such cisterns.[13]

The urinal flush control mechanism ratings in AS/NZS 6400 are summarised in Table 9. The progression from the lowest rating (A) to the highest (AAAAA) depends on four factors:

- A progressive reduction in flush volume;
- A reduction in the number of stalls or stall-equivalents served, on the principle that the more stalls flushed at the one time, the higher the probability of unnecessary flushing;[14]
- Increasing degrees of independence of the user;
- Increasing application of intelligent sensors, to activate operation only when necessary.

Each of these principles appear self-evident and logical, although in the absence of research data it is difficult to assess which contributes more to water-efficiency in use or indeed whether they could lead to greater water consumption.[15]

Table 9 Current water efficiency ratings for urinal flush mechanisms

Rating	Litres/stall or litres/600mm	Conditions
A	2.5 or less	Conscious operation or demand-driven serving up to 3 individual stalls or equivalent
AA	2.0 or less	Conscious operation or demand-driven serving up to 2 individual stalls or equivalent
AAA	2.0 or less	Smart-demand operation serving a single stall
AAAA	2.0 or less	Smart-demand operation having an adjustable activation device with a sensitivity field of no greater than 300 mm from the front of the urinal, serving a single stall
AAAAA	1.5 or less	Smart-demand operation having programmable time delay to identify a user and an adjustable activation [device with a] sensitivity field of no greater than 300 mm from the front of the urinal, serving a single stall

Source: AS/NZS 6400:2003

Not all flush control mechanisms operate satisfactorily with all stalls, so AS/NZS 6400 requires suppliers to indicate the *combination* of stall models, flush mechanisms and sensors which can achieve a rated performance.

Markets

[13] One Queensland high school reported a reduction of 70% in urinal water consumption after replacing fill and flush cisterns with infrared sensor-activated operation (MacKinnon 1998).
[14] Each 600mm length in a continuous urinal is considered a stall-equivalent for A and AA graded mechanisms, but the higher ratings only apply to actual single stalls.
[15] On-demand flushing by sensors will not necessarily reduce the consumption of water in all cases. Many users ignore push-button activators and so leave the urinal unflushed. Also, poorly designed or installed sensors can themselves lead to unnecessary flushing.

It is estimated that about 60,000 new urinal stalls are installed in Australia each year, 80% of them continuous wall type (common in schools and occasional-use buildings such as sports stadia) and 20% wall-hung ceramic units. It is estimated that about half of the stainless steel installations have 3 stalls per flushing unit (ie water efficiency rating A, at say 2.5 litres/flush) and half are 2 stalls (ie water efficiency rating AA, at say 2 litres/flush). For ceramic installations it is estimated that half are two stalls to the flushing unit (ie AA, say 2 litres/flush) and half a single stall (ie AAA, say 2.0 litres/flush). This would give a weighted average of 2.2 litres per flush. If so, then maximising the rating of new installations to AAAAA would reduce flush volumes to 1.5 litres (a reduction of more than 30%), but the water savings could be even greater, as the greater prevalence of smart controls should reduce the incidence of unnecessary flushing. The maximum potential water savings compared with the present patterns of new installations could approach 40-50%.

Table 10 Estimated annual sales of urinals and flush mechanisms

	Stall-equivalents	Average stalls per flush mechanism	Flush mechanisms
Stainless steel continuous	48,000 (a)	2.5	19,200
Ceramic wall-hung	12,000	1.5	8,000
Total	60,000		27,200

Author estimates, based on discussions with industry sources (a) A stall-equivalent is 600mm of continuous urinal

Showering Systems

Technology

Showering systems are not a distinct technology in themselves, but assemblies of common elements. In many commercial buildings and apartment developments the designer or builder selects the elements of a showering system – the taps, shower heads and perhaps also connecting arms and flow control devices – rather than the shower heads alone.

It is not at present possible to rate the water efficiency of such systems using AS/NZS 6400, and a rating test needs to be developed.[16] Such a test would be analogous to the test for rating urinal flushing mechanisms, where the rating covers not a discrete unit but an entire assembly consisting of the urinal, the flush control device and possibly remote sensors as well.

Markets

The number of shower installations that are consciously designed as systems each year is impossible to estimate. There is however evidence that showering

[16] AS/NZS 6400 specifies that "only shower heads and shower assemblies can be rated". Components of a showering system such as a pivotal arm or the supply taps cannot be rated if they are not actually connected to the shower head, since the rated product must comply with all the performance requirements of AS/NZS 3662. A shower assembly would presumably have to meet the flow rate and pressure stability requirements in AS/NZS 6400 (ie there would have to be a flow regulator in the tap, in the shower head or somewhere between), and the shower head part of the assembly would have to meet the spray pattern requirements in AS/NZS 3662, when tested with the other components.

performance is recognised as a major contributor to water consumption in the commercial sector, leading to the analysis of water use in existing showers, usually followed by the retrofitting of flow regulators. This is one of the major markets for flow regulators in the commercial sector.

1.4 The Market for Water Using Products

Evidence of Market Failure

There would be no need for intervention in the water product market through mandatory efficiency labelling or minimum water efficiency standards if accurate information about water efficiency and water pricing were freely available to buyers, and buyers were in a position to act on that information in a way that minimises the cost to them of water-related services.

This is not the case. In the first instance, water users are likely to have a relatively low awareness of the cost of water usage. Usage charges came to the water industry fairly recently in comparison with other utilities such as electricity and gas. Access pricing, which was independent of usage, was near universal until 1982, when the Hunter Water Corporation first introduced a "two part" (access and usage) tariff (WSAA 2001).

There are indications that pricing is becoming more reflective of water use: usage charges accounted for about 61% of charges by WSAA member utilities in 2001, up from 46% in 1997 (WSAA 2001). However, the pricing of the remainder of the water cycle – wastewater disposal – is still largely access based. In 2001 only a few WSAA members charged for sewerage on a volumetric basis, calculated on the assumption that a given percentage of water supplied is used indoors and recovered as wastewater, while the balance is used outdoors. If wastewater is taken into account, then usage charges accounted for less than 40% of charges by WSAA member utilities in 2001, up from 29% in 1997 (WSAA 2001).

Even those customers who are aware of water supply costs find it difficult to take this into account when selecting products. Information about the magnitude and relative importance of different water uses in households is not widely available. During times of supply restrictions for example, water authorities often focus on optional and relatively insignificant uses (eg hosing down hard surfaces) or offer advice on behaviour modification (eg "take shorter showers") rather than take the opportunity to convey information about the relative importance of different water uses.

Where water utilities promote specific technologies and types of products – eg front loader clothes washers – there is little information on the comparative water-efficiency of different models, especially those not of the type recommended by the utilities, but where significant water savings could still be made from preferring more water-efficient models.

There is also a significant "landlord-tenant" or split incentives issue in the purchase of fixed water using products. For developers of commercial and residential property there is an incentive to minimise capital costs rather than lifetime operating costs, because water (and energy) charges will be borne by the buyer or tenant of the property. Information alone is not likely to influence this group of buyers, and water efficiency standards may be the only effective means of overcoming market failure.

In addition, many purchases of replacement products are mediated by plumbers, who may be relatively uninformed or indifferent to product labelling, or have vested interests in recommending products on the basis of convenience and familiarity, irrespective of their water efficiency.[17]

Thus there is evidence of several types of failure in the market for water-using appliances, especially in the residential sector:

- Imperfect cost-reflectiveness in water pricing (although price signals are becoming more cost-reflective, at least for water supply if not for wastewater disposal);

- Poor information on the importance of end uses and on the water efficiency of different models

- The split incentives problem.

Options to Address Market Failure

Water Efficiency Labelling

A voluntary water efficiency labelling scheme has been in existence since 1988. It is now managed by the Water Services Association of Australia (WSAA). The scheme originally covered only shower heads and dishwashers, and offered two efficiency grades (A and AA). A third rating (AAA) was introduced in 1992, and two higher ratings (AAAA and AAAAA) in 2001.

The WSAA program covers shower heads, toilets, taps, clothes washers, dishwashers, urinal flushing devices and flow regulators. The test requirements for each product type, the water efficiency levels required for each rating and the label design are all specified in Australian and New Zealand Standard AS/NZS 6400*, Water efficient products – Rating and labelling* published in February 2003.

The coverage of the existing program is limited. Because the scheme is voluntary, few suppliers have chosen to label, and those that have tend to label only their better performing products – for obvious reasons. The main incentive for labelling has been the support of the water utilities (the members of WSAA), many of whom have publicised the scheme, or offered cash rebates to their customers for the purchase of labelled appliances. Consequently, despite nominally being a comparative labelling program it has developed some of the attributes of an *endorsement* label, which assists water utilities and their customers to identify models for rebate purposes, rather than as an effective comparative label, which encourages and enables buyers to compare the water efficiency of different models.

Largely because of the low rate of labelling, consumer awareness of the existence of the voluntary label is low, and recognition is low even when prompted with a sample

[17] One of the programs under way to raise plumbers' awareness of product water efficiency is the Green Plumbers program run by the Master Plumbers and Mechanical Services Association of Australia, with funding from the Australian Greenhouse Office.

of the label (GWA et al 2003). By contrast, consumer awareness of the existence of energy labels, the display of which is mandatory, is very high. Focus group research has found that the design of the voluntary label may also be inhibiting its impact. Consumers are attuned to the mode of visual presentation and extent of technical detail embodied in the electric appliance energy label, and now also the gas appliance label and other resource labels, and do not understand the voluntary water label as clearly.

Disclosure of Product Water Efficiency

The public disclosure of the water efficiency of products can be achieved without the physical labelling of the products themselves. For commercial products such as urinals and for non-household specifiers such as apartment building designers, disclosure of information in product brochures or on websites is more effective than physical labelling.

A growing number of building approval authorities are requiring that products and appliances installed in buildings meet certain minimum levels of energy and water efficiency, or that the elements of the overall design be rated according to their resource efficiency and the design as a whole meet a certain level of environmental performance. Examples of this are the BASIX rating scheme being introduced by Planning NSW and a similar scheme being developed by the Brisbane City Council.[18]

For such programs to be effective, building designers and specifiers need to have access to the energy and water ratings of all products, or at least to a list of products which meet the required energy and water criteria. This is most efficiently achieved via a public register, which can be established in association with labelling or as a separate requirement. The current WSAA labelling program provides a public register, but its coverage is no greater than that of the program as a whole.

Registers can also be established independent of labelling. For example, there are some energy using products for which registration is mandatory, but labelling is not required. In the case of electric water heaters and electric motors registration is part of the process of demonstrating compliance with mandatory minimum energy performance standards. It would be reasonable to require registration for information disclosure as a way of addressing information failures in non-consumer markets, without imposing either minimum performance standards or physical labelling.

Water Efficiency Standards

Most water authorities require that licensed plumbers and installers only connect products that meet the requirements of the National Certification of Plumbing and Drainage Products Scheme. The authorisation procedures under this scheme are set out in AS/NZS MP52 *Manual of Authorisation Procedures for Plumbing and Drainage Products*. MP52 currently requires all products to comply with the lowest applicable rating in AS/NZS 6400. In theory, this would set the "A" rating as the minimum performance standard.

[18] See www.duap.nsw.gov.au/settingthedirection/sustainability.html

However, many products installed in fact fail to meet the A rating, since:

- there is no requirement that all water products *sold* must meet MP52, so less efficient products (eg high flow shower heads) are freely available;

- there is no control if the product is not installed by a plumber, and an increasing number of products are being designed to be user-installed. It is fairly straightforward to change over one shower head for another, and many shower heads are packaged with instructions and a roll of plumber's tape. Most clothes washer installations, and a significant share of dishwasher installations, can be carried out without a plumber – the user simply screws the hoses on to the standard fittings in the laundry or the kitchen;

- the resources for monitoring compliance by registered plumbers and installers are limited.

The only products for which there are effective water efficiency standards (WES) are toilet suites, which are almost universally plumber-installed. Although the controlling regulations and codes vary, it is mandatory to install 6/3 litre dual flush toilets in new work in most parts of Australia. Even so, the effectiveness of WES in this case is probably due to the fact that complying products dominate the market rather than to the impact of the regulations *per se*.

The case for implementing mandatory WES was reviewed in the feasibility study (GWA at al 2003). The conclusion was that WES is not warranted so long as the products that would be excluded account for the majority of the market – as is the case with showers – and until there is evidence that mandatory labelling is shown to be ineffective. Furthermore WES cannot be properly implemented until there is more information about the market – the type of information that would become available from a labelling program. The only products for which immediate WES is feasible are toilets, where all models are already at a AA rating or better.

Even if WES were implemented labelling would still be useful, since for most product types there would still be models with higher water-efficiency than the minimum, and labelling would increase buyer preference for such products.

Rebate and retrofit programs

Several water supply authorities have implemented large scale "rebate" programs, where they offer their customers free or subsidised water-saving products, notably low flow shower heads, and "retrofit" programs, where product installations and general inspections by plumbers are also subsidised. There is little information on the actual cost-effectiveness of such schemes, on "free-rider" rates or on whether the purchasing behaviours promoted persist after the incentives cease.[19]

[19] Free riders are buyers who would have taken the action anyway, but accept the incentive. Say a water authority offers $100 rebates for the purchase of front loader clothes washers, and receives an average of 35 takeups per month. Before the offer, sales were running at 50 per month, but increase to 70 with the offer. The incentive program therefore increases sales by (70-50) = 20 per month, so (35-20) = 15 of the 35 incentives paid per month are to "free riders". This means the actual cost to the

Supply authorities are free to specify the models to be supported by the retrofit program by any means they wish – eg by brand name, model number or type of product (eg front loader washing machines). Water efficiency labels provide a particularly convenient way to identify the products to be included, and offer an assurance that the stated performance of the labelled product has been established with some rigour. Utilities have come to rely on the WSAA listings to help them identify appropriate models and suppliers, and now generally only offer rebates for labelled products.[20]

These identifying and endorsement functions could be provided by almost any type of WEL system – they do not rely on the continuation of the present voluntary labelling program.

water authority per *additional* front loader sale is $ 100 x 35/20 = $175 (not counting promotional and administrative costs).

[20] In some cases water supply authorities nevertheless restrict the incentives to a subset of the products meeting a given rating, because they establish commercial agreements with specific manufacturers.

2. Objectives of the Regulation

2.1 Objective

The primary objective of the proposed regulation is to bring about reductions in the consumption of water in households and in non-residential buildings in Australia (and in New Zealand) below what it is otherwise projected to be (ie the "business as usual" case), in a cost-effective manner.

The secondary objectives of the proposed regulation are:

- to bring about reductions in the energy use associated with water use, below what it is what it is otherwise projected to be;
- to bring about reductions in the environmental impacts of water use and disposal, below what they are otherwise projected to be; and
- to bring about reductions in the environmental impacts of energy use, below what they are otherwise projected to be.

2.2 Assessment Criteria

The primary assessment criterion is the extent to which an option meets the primary objective.

The following secondary assessment criteria have been adopted:

1. Does the option address market failures, so that the average lifetime costs of obtaining water-related services in households and in non-residential buildings are reduced, when both capital and operating costs are taken into account?
2. Does the option minimise negative impacts on product quality and function?
3. Does the option minimise negative impacts on manufacturers and suppliers?
4. Is the option consistent with other national policy objectives?

3. Proposed Regulation and Alternatives

The following options for achieving the objectives were considered.

1. Status quo (termed business as usual, or BAU): this includes the likelihood that the current voluntary water efficiency labelling will be maintained at about its present level;

2. The proposed regulation, providing for the introduction of mandatory registration of the water efficiency of selected products, the mandatory water efficiency labelling of selected products and the introduction of mandatory water efficiency standards for toilets from a target date of mid 2005, and providing for the possibility of the introduction of mandatory water efficiency standards for additional products in the future;

3. The development of a voluntary agreement between industry and government on labelling;

4. The use of economic instruments such increasing the cost-reflectiveness of water pricing, or customs duties or tax rates which influence the relative prices of water-using products according to their water efficiency.

The following sections describe the options in more detail, and assess the non-mandatory options 3 and 4. The mandatory option 2 has been subject to detailed cost-benefit analysis, which is reported in the next chapter.

3.1 Status quo (BAU)

Some improvements in water efficiency are likely to take place even in the absence of any market intervention. A "BAU" water use projection has been developed for each State and Territory and New Zealand, taking into account the projected sales and trends in average water efficiency of the products covered in Chapter 1. The BAU assumptions for each product are detailed in the cost-benefit analysis in chapter 4.

The Status Quo option would, by definition, fail to meet the objective of the regulation. There would be no reduction in water use below the BAU case, and there would be no greater correction of identified market failures than at present. On the other hand, there would be no negative impact on product quality or function, or negative impacts on manufacturers and suppliers.

3.2 Mandatory Water Efficiency Labelling

Proposed Regulation

On 2 October 2003, the Environment and Heritage Ministers of the Commonwealth, State and Territory governments and of New Zealand agreed to pursue the

implementation of a national mandatory water efficiency labelling scheme covering showerheads, washing machines, dishwashers and toilets (EPHC 2003).

It is proposed that it should be made unlawful to offer these (and possibly other) products for sale unless they carry the water efficiency information prescribed in regulations, and in the format prescribed in regulations.

DEH in connection with other relevant Commonwealth agencies has begun drafting a Commonwealth Bill to give effect to the scheme. The main sources of Commonwealth legislative power for the Bill are the corporations power in s.51(xx) of the Constitution and the trade and commerce powers in s.51(i) of the Constitution.

The draft legislation was not yet available at the time of preparation of this RIS, but it is understood that it will contain the following provisions:

- The power to schedule water-using products and appliances for (a) mandatory or voluntary registration of data on their water use and efficiency, (b) mandatory or voluntary labelling of water use and efficiency on products offered for sale and/or (c) mandatory minimum water efficiency standards applicable to products offered for sale.

- The power to specify that no statements about water efficiency or performance be made in a form other than the prescribed label or other than by reference to the prescribed standard tests.

- The appointment of a Water Efficiency Labelling Regulator as a designated office-holder within the Department of Environment and Heritage: the Regulator will maintain the product register, monitor and enforce compliance and generally administer the scheme. It is envisaged that the Regulator will have a staff of 2 to 4 within DEH, and may authorise officials from other Commonwealth agencies (eg the ACCC) and State agencies (subject to the consent of the relevant State Minister) to perform functions and exercise powers.

- The establishment of a committee of representatives of the States and Territories and the Commonwealth, to advise the Regulator on the operation of the Scheme.

It is planned that the water consumption tests, the algorithms for calculating efficiency ratings and labelling requirements will be described in one or more Australian and New Zealand Standards, which will be called up in the Regulations – either in their entirety or with exclusions where necessary, to avoid requirements unrelated to water efficiency inadvertently being made mandatory.

It is proposed that the relevant standard will be a revised version of AS/NZS 6400 *Water efficient products – Rating and labelling*. The process of revising the standard to accommodate the requirements of a mandatory labelling program has commenced, and it is expected that the standard will be in close to final form by mid 2004.

Initial Scope of Regulations

It is envisaged that the 7 product types in Table 11 would initially be scheduled in the regulations, and of these five would be scheduled for mandatory registration, four for mandatory labelling and one for mandatory minimum water efficiency standards. For the other types registration and labelling would be optional, but suppliers who choose to register and label will be bound by all the requirements applying to those products for which registration and labelling are mandatory, and would face the same penalties in the event of proven non-compliance.

Table 11 Proposed initial schedule of products and application of provisions

Product	Registration	Water Efficiency Labelling	Water Efficiency Standards
Shower heads	Mandatory	Mandatory	Not at present
Toilets	Mandatory	Mandatory	Mandatory
Clothes washers	Mandatory	Mandatory	Not at present
Dishwashers	Mandatory	Mandatory	Not at present
Taps	Optional	Optional	Not at present
Flow regulators	Optional	Optional	Not at present
Urinal flush mechanisms	Mandatory	Optional	Not at present

Restriction of Application to Corporations and Interstate Trade and Commerce

Subject to constitutional restraints, the proposed Commonwealth mandatory registration and labelling requirements will apply to any person who offers a prescribed product for sale. This will include manufacturers and importers of the relevant products, as well as wholesale and retail suppliers. It is likely that most manufacturers, importers, wholesale and retail suppliers will be constitutional corporations or engaged in interstate trade and commerce.

When corresponding laws are enacted in the States and Territories they will apply generally to "persons", and would therefore bind any parties that are neither constitutional corporations nor engaging in interstate commerce, and who cannot otherwise be regulated under Commonwealth legislative power. However, the absence or incomplete coverage of such State and Territory legislation would not be a serious weakness in the proposed scheme, since the overwhelming majority of products for which labelling would be mandatory would be supplied to end users by corporations or via interstate trade.

Restriction of Application to Water Efficiency

There are already provisions in the State and Territory plumbing codes which underpin potable water safety standards and, if effectively enforced for that purpose, would establish minimum water efficiency standards for some products. As discussed in the section on Water Efficiency Standards, these provisions are not effectively enforced. This is one reason why a new regulatory regime to address market failures with regard to consumer decisions about water efficiency is warranted.

It is generally not the intention of the proposed regulation to address any aspects of product quality or performance except those that impinge on the efficiency of water use, nor to generally enforce compliance with State and Territory plumbing codes

(while of course seeking to avoid conflict with them). Therefore those parts of the Australian Standards which would require compliance with requirements not related to water efficiency will be explicitly excluded.

For example, the present Australian Standards for clothes washers and dishwashers do not invoke MP52 *Manual of authorisation procedures for plumbing and drainage products*, whereas AS/NZS 6400, which may become the reference Standard for the mandatory labelling regulations, does so. The regulation will exclude such cross-references by specifying parts of the reference Standard that do *not* apply.

Rationale for Scope of Regulation

Shower heads

Shower heads are a high priority because they account for about 29% of household indoor water use. The effect of the regulation will be to enable consumers to distinguish between shower heads that can be rated for water efficiency and those which cannot, and to identify the relative water efficiency of those which can be rated.

It is proposed that all models of shower head will have to be registered with the regulator, and all samples displayed for sale will have to carry a WEL, either attached to the unit itself or, if the unit is displayed for sale in packaging (a common mode of display for plumbing fixtures), then printed on the packaging.

For a shower to receive a water efficiency rating under AS/NZS 6400 it must satisfy all of the following criteria:

1. Its flow rate must be stable (within specified limits) over a specified pressure range: the flow rates at 150 kPA and 350 kPA must be within 1 l/min of the flow rate at 250 kPA;

2. It must give a spray pattern that meets the requirements of AS/NZS 3662 *Water Supply – Water efficient mains pressure shower head sprays*. This is intended to ensure that water-efficient showers provide satisfactory washing performance; and

3. It must have a flow rate of no more than 15 l/min at 250 kPA (the maximum flow rate for an A rating).

Models that do not meet these criteria will have to be displayed for sale with a special version of the WEL, with no "A"s or other indicators of comparative efficiency, and with text such as: "Water Warning: does not meet water efficiency standards".[21]

It is expected that most of the shower heads sold at present – the traditional AD types – will carry a warning label of this type. Indeed, the impact of WEL for shower heads relies as much on making buyers aware of the high water use of the AD types as on making them aware of the lower water use of the flow-regulated types.

[21] Statements such as these were tested in consumer research, and found to be effective and appreciated by consumers (GWA et al 2003).

The only information on the register about non-rateable shower heads would be their brand and model number, the fact that that they are not rateable and the contact details of the registering party (some may have neither brand nor model designations). An alternative would be to not require registration for non-rateable shower heads, but only mandatory disendorsement labelling. However, registration will assist compliance monitoring by maintaining a register of all suppliers of these products.

AD type showers represent a high proportion of sales at present, and may be the most appropriate option for households without mains supply and those with supply pressure problems.[22] Therefore the imposition of mandatory water efficiency standards, which would have the effect of excluding AD type showers from the market, is not feasible at present but may become so in the future.

Toilets

Toilets are a high priority for labelling because they account for about 26% of household indoor water use. All models of toilet (cistern-pan combinations and cistern and pan models if sold separately) will have to be registered with the regulator.

All units displayed for sale will have to carry a WEL, either attached to the unit itself or, if the unit is displayed for sale in packaging, then printed on the packaging. It is expected that the introduction of labelling will give suppliers the incentive to introduce still more water-efficient models.

The sole Australian manufacturer of toilets now makes only models of 6/3 litre or less for household use. This has established 6/3 litres as the preferred efficiency standard for toilets. Many of the imported models are also 6/3 litre dual flush (AAA rated), but several 9/4.5 litre models (AA rated) are also imported.

Given the requirement for 9/4.5 litre models to remain on the market for some retrofit purposes, , this could be adopted immediately as the minimum level of water efficiency.[23] The average flush volume of a 9/4.5L cistern is 5.4L, providing for the establishment of a minimum efficiency standard of 5.5L. The advantages of setting such a mandatory standard would be to remove the risk of future import of higher-flush cisterns. It would still allow the import of many cisterns that meet standards for maximum flush levels in the UK, USA and Singapore.

Clothes Washers

Clothes washers are a high priority for labelling because they account for about 26% of household indoor water use. All models will have to be registered with the water efficiency regulator, just as all models are now registered with the State regulators for energy labelling. Indeed, it should be possible to combine the registration process so that the same application form and test results can be used for both purposes.

All units displayed for sale will have to carry a WEL, in addition to the mandatory energy label. Suppliers will have the option of using a stand-alone WEL, or a

[22] 7.3% of Australian households used non-mains supply water for showering and bathing in 2001, and 10.6% reported inadequate or low pressure in their mains supply (ABS 4602.0).
[23] The average flush volume is based on the ratio of 1 full flush to 4 half flushes..

combined label in which the image of the WEL is printed on the same adhesive strip as the image of the energy label. In the latter case some of the required information (eg the model number) can be omitted from the WEL image, since it will already be present on the energy label image.

It is not proposed to impose mandatory water efficiency standards on clothes washers at present, but the option should be reconsidered in future, once the market reaction to WEL is known.[24]

Dishwashers

Dishwashers account for a relatively small share of indoor water use (a little over 1%), although this is expected to increase as dishwasher ownership rises. Nevertheless dishwashers are proposed for mandatory registration and labelling because:

- There is still significant difference in the water efficiency of models (see Table 6);
- Water cost represent the major share of operating costs (detergent excluded);
- The additional costs are low, since water consumption is already tested and model details are registered as part of the mandatory energy labelling program; and
- The presence of WEL on dishwashers will be effective in promoting the WEL program as a whole – indeed consumer research suggests that the absence of water labels on dishwashers could cause consumers to question the validity of the WEL program, since they expect water to be a major factor in dishwasher operation.

All units displayed for sale will have to carry a WEL, in addition to the mandatory energy label. Suppliers will have the option of using a stand-alone WEL, or a combined label in which the image of the WEL is printed on the same adhesive strip as the image of the energy label.

It is not proposed to impose mandatory water efficiency standards on dishwashers at present, but the option should be reconsidered in future, once the market reaction to WEL is known.

Taps

Mandatory WEL is not proposed for taps, because:

- The same tap can be used in both volumetric and free-flow modes, so buyers will need to consider more information than can be communicated on a label if they are to make an informed choice balancing water efficiency and convenience of use;

[24] If WES are imposed they will most likely need to be at a level which allows the most water-efficient top loaders to remain on the market, otherwise the result would be the exclusion of the clothes washer configuration that is currently preferred by consumers.

- There is a very large number of suppliers and models, so there would be major costs in testing and administration (to both suppliers and regulators) to ensure that all models are correctly identified and labelled;

- The AS/NZS 6400 definition of a tap is "a device for controlling the flow of water from a pipe by the activation of an opening and closing mechanism". If every such device had to be labelled, then fittings for which the ultimate end application is unknowable would have to carry *two* ratings, corresponding to each set of potential applications, or perhaps a label stating that the rating cannot be determined. Such labels would be confusing to buyers and counter-productive for the WEL program as a whole;

- Even if labelling were restricted to taps packaged with or incorporated into outlets, the applicable rating would still depend on the supplier's designation of "intended use". This may well be unenforceable in practice, and so would further weaken compliance.

Nevertheless, if a tap corresponds *exactly* and unmistakably to a product type described in AS/NZS 6400 (and is clearly marked with the intended use, as required), the supplier should have the option of registering and labelling it.

It is proposed that there should be an option of registration without physical labelling, and an option of registration with physical labelling. The former would be of value to suppliers who wished to publicise a range of low-flow taps backed by the credibility of test data on a public register, particularly for the commercial and wholesale markets, where physical labelling would have little effect. The latter would be of value to suppliers to the retail market. Suppliers exercising the option of physical labelling would take on the same obligations as for those products where WEL is mandatory, including the obligation to label in accordance with the relevant Standards and to label all samples of the model offered for sale.

Flow Regulators

Mandatory WEL is not proposed for flow regulators, because the market for these products operates in significantly different ways from the markets for end use devices such as showers or toilets.

Limiting water flow is one of the main functions of flow regulators (the other is correction of water pressure problems). Buyers are highly likely to be aware of water efficiency consideration *before* they seek out and compare models - indeed prior awareness of such considerations is likely to be the main motivator to seek out flow regulators. In the products for which mandatory labelling is proposed, awareness of water-efficiency considerations is low, and competes with many other product attributes.

Nevertheless, if a flow regulator corresponds *exactly* and unmistakably to a product type described in AS/NZS 6400 (and is clearly marked with the intended use, as required), the supplier should have the option of registering and labelling it.

It is proposed that there should be an option of registration without physical labelling, and an option of registration with physical labelling. The former would be of value to suppliers who wished to publicise a range of flow regulators backed by the credibility of test data on a public register, particularly for the commercial and wholesale markets, where physical labelling would have little effect on the product purchasers. The latter would be of value to suppliers to the retail market. Suppliers exercising the option of physical labelling would take on the same obligations as for those products where WEL is mandatory, including the obligation to label in accordance with the relevant Standards and to label all samples of the model offered for sale.

The proposed regulatory prohibition on making claims for water efficiency without reference to the prescribed standard tests would be of particular value in the flow regulator market, since it will ensure consistency and credibility of performance claims.

Urinal flushing mechanisms

Urinal flushing systems are commercial products selected and specified by architects, builders or water services engineers, who rely mainly on technical literature and other centralised decision-making aids rather than solely on visits to showrooms. The designer may take the trouble to inspect the only visually prominent component of the installation - the stall – but the water consumption of the system will depend on the combination of the stall and several other components, including cisterns or flush valves and sensors. It will also depend on:

- Configuration (ie the number of stalls connected to each cistern or valve); and

- The settings of installer-adjustable devices, eg time delays or beam spread for sensors.

Information as complex as this cannot be effectively communicated on a label, but can be communicated on a register, which can list the performance of elements in combination.

The water supply authorities have argued that mandatory registration of the components of urinal flushing systems will be essential to support the trend in commercial building codes to require water-using products and systems to meet specified levels of efficiency.

It is proposed that there should be an option of physical labelling as well, although it is not likely to be taken up very often because of the practical difficulties of specifying, on each component of the urinal flushing system that is labelled, the other components with which it needs to be combined, and the configuration and settings necessary to achieve the specified rating. Suppliers exercising the option of physical labelling would take on the same obligations as for those products where WEL is mandatory, including the obligation to label in accordance with the relevant Standards and to label all samples of the model offered for sale.

Showering systems

Showering systems are commercial products selected and specified by architects, builders or water services engineers, who rely mainly on technical literature and other centralised decision-making aids rather than solely on visits to showrooms. The designer may take the trouble to inspect the visible element of the showering installation - the shower head and the taps or mixer valve – but the water efficiency of the system depends on a combination of components. There is no Standard for showering systems at present, but the industry is pressing for one to be developed.

Unlike urinal flushing systems, where most components are designed specifically for use in such systems, showering systems are likely to consist of components useable in a wide range of applications: eg taps, mixer valves and flow regulators. Since those products would not be subject to mandatory registration in their own right, there would be no point to requiring their registration simply because they are capable of use as an element in a showering system.

A showering system may incorporate a type of shower head which, if offered for sale on its own, could not be water-efficiency rated and would have to carry a water warning label, but when combined with the other components of the showering system would contribute to the system's rated level of water efficiency. New showering systems retrofitted in existing buildings may also leave in place the pre-existing shower heads.

It is proposed that once a new Standard for showering systems is developed and adopted, there should be an option of registration without physical labelling, and an option of registration with physical labelling. The former would be of value to suppliers who wished to publicise a system backed by the credibility of test data on a public register, particularly for the commercial and wholesale markets. Although showering systems are not likely to be sold as retail products, physical labelling should be retained as an option in the regulations in the event that the new Standard develops an acceptable labelling protocol. Suppliers exercising the option of physical labelling would take on the same obligations as for those products where WEL is mandatory, including the obligation to label in accordance with the relevant Standards and to label all samples of the model offered for sale.

Given that showering systems are combinations of disparate elements which only give the rated performance in combination, it is likely that any labelling requirements would specify that labelling is only possible where the one package includes all elements of the showering system.

3.3 Voluntary Labelling Agreement

Under a voluntary regime, the suppliers and retailers of water using products would be encouraged to label their products voluntarily, ie in the absence of regulation. There has in fact been a voluntary WEL scheme in place for the last 15 years, albeit with limited effect (see section on Water Efficiency Labelling), so it is reasonable to consider whether this could form the basis of a comprehensive WEL program. The following section reviews possible precedents for such arrangements, and considers their relevance to the plumbing product and appliance industries.

Government-Industry Agreements

Manufacturers, importers and suppliers of targeted water-using products could be invited by Governments to enter into a set of formal, public undertakings to register their products, have them tested and label them according to the relevant standard. While this approach has had some success in other contexts, it has generally been supported by back-up regulations, or has succeeded mainly because it did not require participants to incur significant costs.

The National Packaging Covenant and the Greenhouse Challenge are examples of successful programs where businesses enter into agreements with Government to undertake actions aimed at achieving eco-efficiency outcomes. During the development of the National Packaging Covenant, industry parties proposing to participate indicated that fall-back regulation would be needed to ensure their competitors did not benefit from avoiding investment in the types of actions arising from Covenant commitments. For this reason, State and Territory legislation (guided by the National Environment Protection Measure on Used Packaging Materials) was developed to complement the Covenant.

This dual arrangement, with an agreement underpinned by regulation, is appropriate where participants are able to choose from a range of actions to which they may commit in the agreement. However, this is not directly applicable in the case of water efficiency labelling where the same set of actions is needed on the part of all target parties. In such a case, it is more effective to simply have regulation mandating actions: both to encourage those actions and to ensure 'free-riders" cannot gain an unfair competitive advantage over compliant businesses.

In the case of the Greenhouse Challenge, businesses can choose from a range of actions and only commit on a "no-regrets" basis: that is, they are not required to commit to actions that may detract from profits or place them at a disadvantage with competitors. This concept is not directly applicable in the case of water efficiency appliance labelling, as every manufacturer/ importer of target products will be required to invest in testing and labelling and to reveal the water-efficiency of their products, even if this disadvantages them in the market.

There is no precedent of a successful government-industry agreement for product labelling of the type envisaged, and such an agreement seems unlikely to attract a higher level of participation than the existing voluntary WSAA labelling scheme.

Industry-run Labelling

One example of non-regulated labelling, other than the current WSAA water label, is the Australian Gas Association (AGA) gas appliance rating label. The AGA labelling scheme is not truly voluntary. The AGA is historically a strong industry association encompassing both gas utilities and appliance suppliers. The utilities have been able to specify that only products approved by the AGA can be connected to the gas supply.[25] The AGA approvals process has been able to enforce the registration of

[25] This quasi-regulatory function has now transferred to State regulators in some jurisdictions.

energy labels for all gas appliances in the relevant categories, although it has been less successful in enforcing the actual labelling of products in showrooms (Ellis 2002).

The water industry does not have a single industry association analogous to the AGA. WSAA represents the large urban water utilities, but not the manufacturers or importers of water-using products. Coverage is divided between The Australian Industry Group (AIG), the Australian Tapware & Plumbing Manufacturers Association (AUSTAP), Queensland Brass Manufacturers Associations, and – for clothes washers and dishwashers – the Australian Electrical and Electronics Manufacturers Association (AEEMA) and the Consumer Electronics Suppliers Association (CESA). There are also many smaller suppliers unaffiliated to any of these associations. This fragmentation increases the difficulty of making and maintaining an agreement on labelling between Governments and industry.

Voluntary labelling requires that suppliers have an incentive to label. The main motivation for the introduction of gas appliance labelling was the development by one gas appliance supplier of a more efficient technology, and the supplier's wish to have a gas utility-endorsed label to distinguish it.

The background to the introduction of the original water rating labels in 1988 was analogous – it was largely to differentiate low flow showerheads from traditional AD showerheads, and front loader from top loader clothes washers. The main function of the rating levels and label designs was to draw attention to these types, and differentiation within technology types was a secondary purpose.

The incentive for suppliers to use the water label has been driven by utility promotion of the label as a means to identify water-efficient products, in brochures and booklets and ultimately through cash rebates. The label has been the easiest way for both the utilities and the customers to identify the selected models. Product suppliers apply for the voluntary label in order not to lose sales to their competitors in those markets and during those periods when the utilities are offering rebates.

The most direct way for water authorities (or Government) to promote voluntary labelling is via the incentives they offer to suppliers. It may be feasible to impose conditions on incentive schemes so that only those products are eligible for rebates whose suppliers have agreed to affix water labels to their entire product range.

However, even if this approach were successful, it would:

- make labelling dependent on the continued operation of financial incentive schemes, which appear to have very low cost-effectiveness in their own right;[26]

- have no effect on suppliers of products which are all of low water efficiency, since they would not expect to benefit from the incentives in any case; and

[26] White and Fane (2001) considered over water efficiency program 40 options, addressing all consumption sectors (residential, manufacturing etc) end uses (toilets, showers, garden watering etc) and measures including minimum water efficiency standards (WES), pricing, education and advisory services, rebates, incentives and free retrofitting. Rebates were found to be among the least cost-effective as well as the least effective options.

- could not prevent the proliferation of confusing and contradictory labelling schemes by non-participants.

Furthermore, the dynamics of voluntary labelling mean that suppliers and utilities dominate the relevant standards and technical criteria, and their joint commercial interests would quite likely outweigh public or consumer interests in the event of a conflict.

Conclusion

To sum up, voluntary water efficiency labelling is not considered a realistic alternative to the proposed regulation. The approach is not likely to be any more effective than the existing voluntary labelling scheme in addressing information failure in the markets for water using products.

3.4 Economic Instruments

The Pricing of Water Services

The pricing of water services is a controversial area. There is a general view that water and wastewater prices do not reflect the full costs of these services. For example, the 2002 Senate Committee inquiry concluded that:

> At an average of $1 per kilolitre, the price of water in Australia, compared with other countries and with other product is very low and as such is not providing any incentive to households for water conservation. It has been possible to keep water prices low because neither the costs of taking water from the environment nor of protecting the catchments from which it is collected are required to be included in the current 'full cost recovery' pricing regimes (ECITARC 2002).

There is also controversy about how pricing should reflect, and preferably defer or obviate, the need for investment in augmenting freshwater supply and wastewater disposal capacity. Such augmentation tends to be highly capital-intensive (eg new storage dams) and/or involve much higher operating costs (eg desalination).

In some areas the potential sites for new infrastructure are under such pressure from competing uses (including for conservation) that governments have committed the water authorities to avoiding major infrastructure expansions indefinitely. In such cases the pricing of water services should reflect what is in effect the rationing of a finite resource.

The application of more cost-reflective pricing is not likely to be easy. As the Senate Committee notes "Increasing water prices would be politically contentious and many consumers would argue that because water is a basic human need, it should be free". In some cases Governments have placed restrictions on the rate of water price increases in the charters of publicly-owned water authorities.

If water prices increase, it would lead to greater incentive for water users to consider water-efficiency in product purchases. However, the incentive is already high, since water service costs already account for over 90% of the lifetime costs of showers, over 70% for clothes washers and dishwashers and 35-40% for toilets. Increasing water service prices may strengthen buyer incentive somewhat, but would not enable buyers to act on that incentive without product labelling. Increasing the price of water services would not on its own overcome the information failures in the market.

Measures Affecting Product Prices

Economic instruments could in theory be used to influence the relative prices of water-using products according to their water-efficiency.

There are several precedents for the use of instruments towards environmental objectives. For example, the Commonwealth uses differential excise rates to ensure that the price of unleaded automotive gasoline is below that of leaded, and to encourage refineries to produce diesel fuel with lower sulphur content.

However, the sale of water-using products are not at present subject to excise, only to the general Goods and Services Tax regime.

It may in theory be possible to use the customs duty regime to impose a differential rate of duty on imported products according to their water efficiency. However, the practical difficulties include the following:

- A large proportion of the products for which mandatory WEL is proposed - including the majority of toilets, clothes washers and dishwashers – are manufactured in Australia or New Zealand, and are not therefore subject to customs duty;

- The level of information available to Customs is not at present fine enough to distinguish products of different water efficiency – eg common statistical terms such as “plumbing fittings” or “tapware” could cover a wide range of fitting types (eg taps, shower heads, valves) and efficiencies.

Perhaps the one product type for which this approach may be feasible is AD shower heads, which according to the industry are now all imported. A sufficiently high level of customs duty could close the price gap between the cheapest AD showers and the cheapest low-flow showers. However, the main form of market failure identified is not the relative price of showers but lack of information about their high water use and operating costs, and the existence of lower operating cost alternatives. Economic instruments alone would not address this.

Conclusions

While there is general agreement that the current pricing of water services is not fully cost-reflective;

- There is little agreement on the ways to increase cost-reflectiveness;

- There is active resistance to measures which increase the price of water services; and

- Increasing cost-reflectiveness alone would not overcome the information failures in water product markets.

As the main problem is information failure, rather than the relative costs of water using products (which are affected by many factors other than water-efficiency), the use of economic instruments bearing on the relative price of products according to their water efficiency would not be effective, even if the considerable legislative impediments to their implementation could be overcome.

To sum up, the use of economic instruments is not considered a realistic alternative to the proposed regulation.

4. Costs, Benefits and Other Impacts

The major quantifiable economic benefits of water efficiency labelling are the value of the water saved (both freshwater supply and wastewater disposal) and the value of the energy saved through the purchase and installation of products that are more water efficient than would be the case without labelling. The major economic costs are the increase in the cost of products and the program administration costs. This chapter summarises the cost-benefit modelling carried out to estimate these benefits and costs.

A reduction in water and energy consumption would also produce additional environmental benefits, beyond those reflected in the pricing of water services and water infrastructure. The projected reductions in greenhouse gas emissions from lower water and energy use are estimated, but not given monetary value. Additional environmental benefits include a reduction in abstraction of water from natural waterways and hence an increase in water availability for environmental flows. It is not within the scope of this RIS to attempt to quantify or value the additional environmental benefits from a reduction in household water demand.

4.1 Benefits and Costs of Mandatory WEL

Modelling Approach

The projected costs and benefits of WEL need to be evaluated from two points of view – the impacts on the economy and the impacts on end users. The program should be cost-effective on the basis of economic (resource) costs, and ideally it should be cost-effective on both criteria. If it were cost-effective for the economy but not for significant groups of water users, there would be a serious and perhaps unacceptable distortion in the distribution of benefits.

Economic Costs

The cost to the economy of promoting and manufacturing more water-efficient products is the resources diverted from other activities, valued at the marginal cost of those resources. As such, only the extra *costs* involved in the manufacturing and distribution processes — such as extra testing, materials, handling and storage costs — should be counted, and the benefit should be the marginal cost of water supply and wastewater disposal, not the retail price. Price increases not related to costs, such as retail markups and taxes, are merely transfers from consumers to intermediaries, and should not be counted.

Therefore the resource analysis differs from the price analysis in the following respects:

1. Water production costs are used in the economic analysis whereas prices are used in the end user analysis;

2. Product production costs, net of intermediary markups, are used in the economic analysis, whereas product prices are used in the end user analysis;

3. All capital costs of tooling are accounted in the year they are likely to occur (ie the year preceding the implementation of WEL;

4. Taxes are excluded.

End User Perspective

The other important way to assess the costs and benefits of demand management programs is from the perspective of end users. Water users as a group will save water and energy costs if they act on the information made available to them by WEL, and water users as a group will ultimately bear the costs of the program, even if those costs are initially incurred by other parties.

The costs of testing products and registering the results with the Regulator are borne in the first instance by the manufacturers or importers. The manufacturers and importers also bear the costs of physically fixing the labels. Wholesaler and retailers bear the costs of staff training, stock management and inventory control required to implement and manage WEL at the points of sale. It is expected that all of these costs will be passed on to buyers via a small increase in the purchase price of the products subject to WEL.

If product suppliers choose to absorb some or all of the costs it will reduce profits accordingly, but given that the costs will be a relatively small proportion of product price, and will be distributed widely because of the mandatory nature of the program (ie no supplier can avoid participation) it is likely that they will be passed on to customers rapidly if not immediately.

Apart from the costs borne by product suppliers, some of which will be paid to the administrators, there may also be some unrecovered administrative costs to government, ie to taxpayers. Given that the group of water users impacted by WEL is so large and diverse, it may be reasonably taken as a proxy for the community as a whole, ie for all taxpayers. Therefore costs to government are also treated as if incurred by the end users of water.

Water and wastewater costs and prices structures

Almost every water supplier in Australia has a different cost and price structure for both freshwater supply and wastewater disposal services.[27] Three cost and price indicators which are publicly available on a consistent basis are:

- Service provider operating costs per kilolitre;
- Variable charges to end users per kilolitre; and
- Total charges to end users per kilolitre.

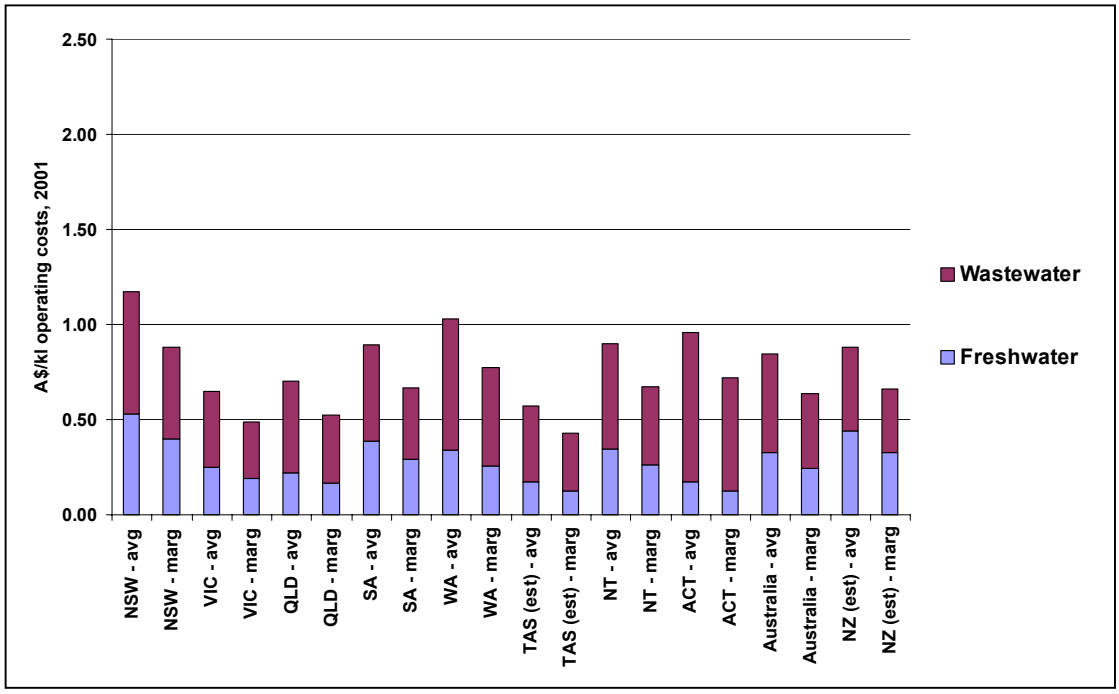
[27] The information in the following section has been derived from *The Australian Urban Water Industry* (WSAA 2001) which covers the performance of most Australian water authorities up to 2000-01. The updated version, covering performance to 2002-03, is currently being prepared.

According to WSAA, the operating costs of water supply and wastewater systems comprise the following elements:

- Wages (labour)
- Materials
- Plant
- Power
- Chemicals
- External bulk treatment and transfer costs
- Contracts and other.

Figure 11 illustrates the weighted average of these values for each jurisdiction, derived from WSAA (2001). The Australian average operating cost in 2001 was about $0.33 per kilolitre for supply and $0.52 per kilolitre for wastewater, ie a total of $0.85 per kilolitre of water used indoors. The *marginal* operating cost will be somewhat lower. Doubling the volume of water supplied or removed may effectively double energy and chemicals cost, for example, but is not likely to double labour or materials costs. In the absence of detailed operating information for each utility (much of which would be confidential) it has been assumed that the marginal operating costs at present are 75% of the average operating costs (an assumption that can be varied in sensitivity analyses). The average and assumed marginal operating costs for each jurisdiction including NZ are illustrated in Figure 11.[28]

Figure 11 Water supply and wastewater disposal operating costs, 2001



Source: Average costs derived by author from WSAA (2001); marginal costs author estimates.

[28] NZ officials advised the marginal operating costs per kl for freshwater plus wastewater disposal are A$ 0.88 in Auckland and A$ 0.45 in Chistchurch. An average of A$ 0.66 has been used for NZ.

The prices which end users face are of course significantly higher than utility operating costs, since they must also recover capital charges, depreciation, taxes and profit. Almost every water authority has a different method of charging. Most suppliers have a fixed annual or quarterly charge per customer for access to freshwater supply. In some cases the charge varies according to the connection capacity (ie pipe diameter) and/or category of customer (ie residential or other).

Most suppliers in Australia have a usage charge ($/kilolitre) for water consumed. Some apply the charge to all water consumed, and some only to water consumed above a specified volume (ie "excess" water). In some cases the $/kilolitre rate increases according to volume of consumption. A few suppliers still have a combined access and supply charge based on property value, which entitles the user to a "free" water allowance. This form of pricing is inconsistent with 1995 Competition Principles Agreement of the Council of Australian Governments, and is being phased out in Australia. In NZ only a third of household customers are subject to volume charging and this is not expected to increase.[29]

There is also considerable diversity in approaches to pricing for sewerage (wastewater) services. All suppliers have an access charge for sewer connection, based either on an annual or quarterly fee per customer or on the rateable value of property. Some authorities also charge by volume of wastewater discharge, determined not by metering but by a formula based on the water supplied. The basic assumption in all such formulae is that most of the water supplied is used indoors, and hence fully discharged to the sewer, but some is used in gardens and either soaks in or runs off to stormwater, and so does not place a load on the sewerage system or on the treatment facilities.

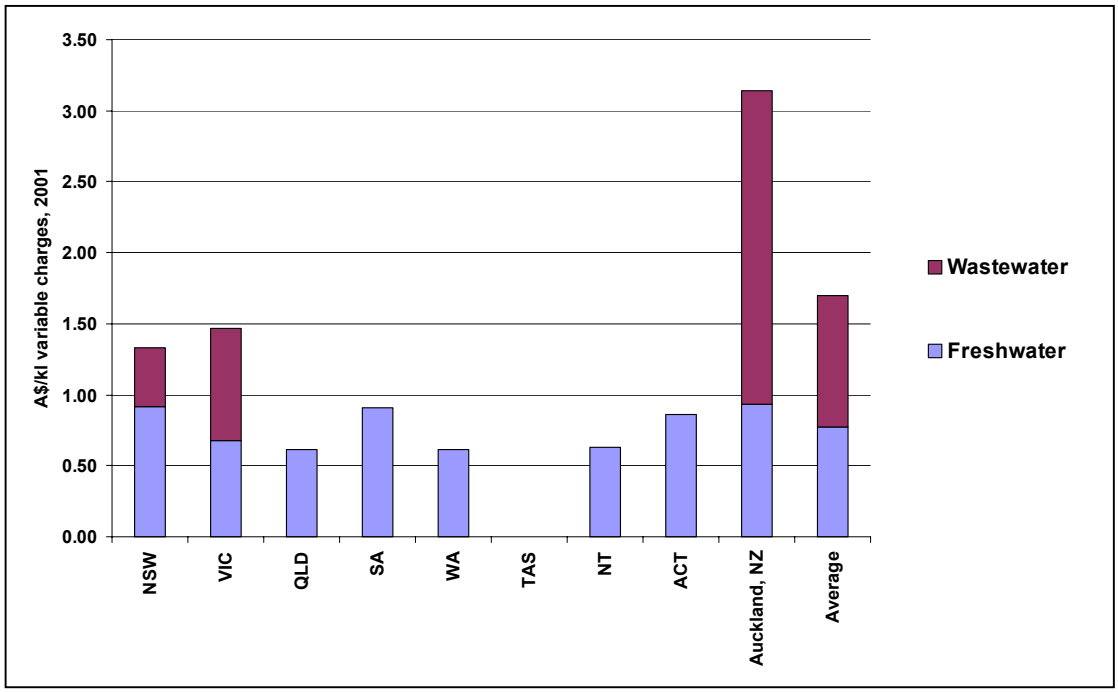
The terms of the formulae used and values applied for each term vary widely. Some suppliers assume a constant percentage of discharge to waste for all customers, while others distinguish between residential and business users, and some even have tables of percentages based on the business category of the user. (If the discharge is trade waste rather than merely wastewater this also affects the pricing).

An analysis of WSAA data indicates that wastewater collections amount to about 60% of freshwater supplied, with the difference corresponding to garden use. For the indoor water uses that are the subject of the present RIS, the discharge rate would be 100%.

Figure 12 and Figure 13 illustrate, respectively, the average variable charges and the average total charges (ie variable plus fixed components) per kilolitre in each jurisdiction in 2001 (WSAA 2001 has no data for Tasmania). The average variable charge is not the same as the marginal variable charge, ie the monetary value to a user of saving a litre of freshwater and a corresponding litre of wastewater. Only in a few cases will there be a reduction in both water charges and wastewater charges, and even then the reduction in the wastewater charge will be partial only, since the charging formula will only give say 50 to 60% credit for the actual litre of wastewater saved.

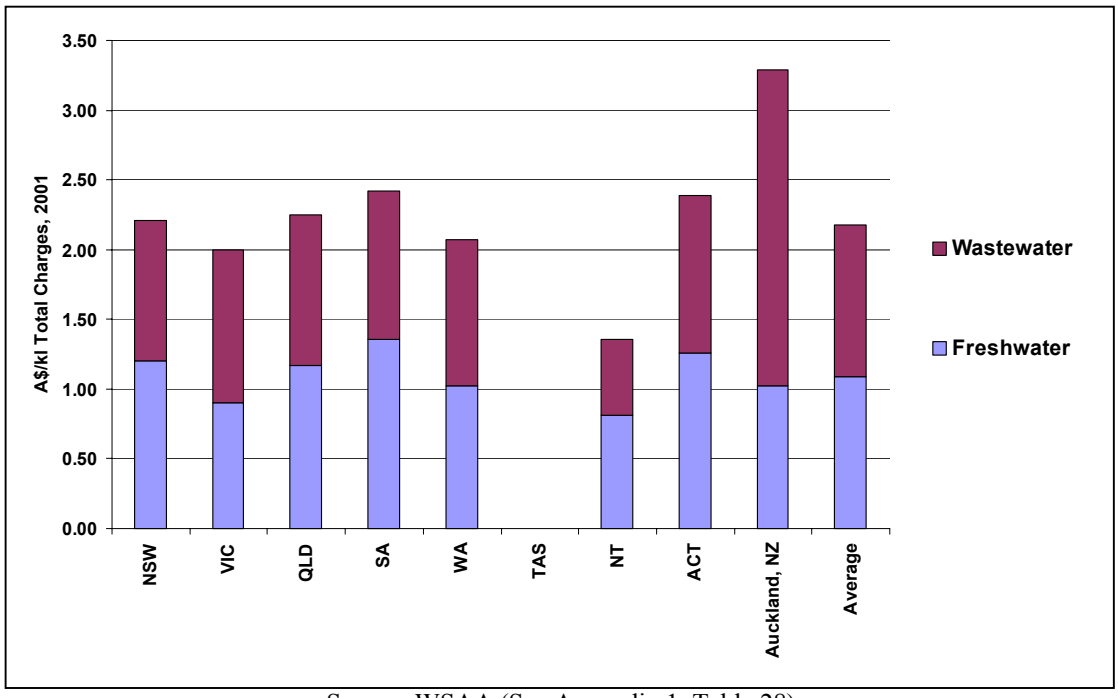
[29] NZ Ministry for the Environment, personal communication, 5 February 2004.

Figure 12 Average variable charges for water and wastewater, 2001



Source: WSAA (see Appendix 1, Table 28)

Figure 13 Average variable and fixed charges for water and wastewater, 2001



Source: WSAA (See Appendix 1, Table 28)

In order to carry out the cost-benefit modelling, an idealised price schema has been adopted in which:

- the marginal value to users of saving a litre of freshwater corresponds to the marginal freshwater usage charge;

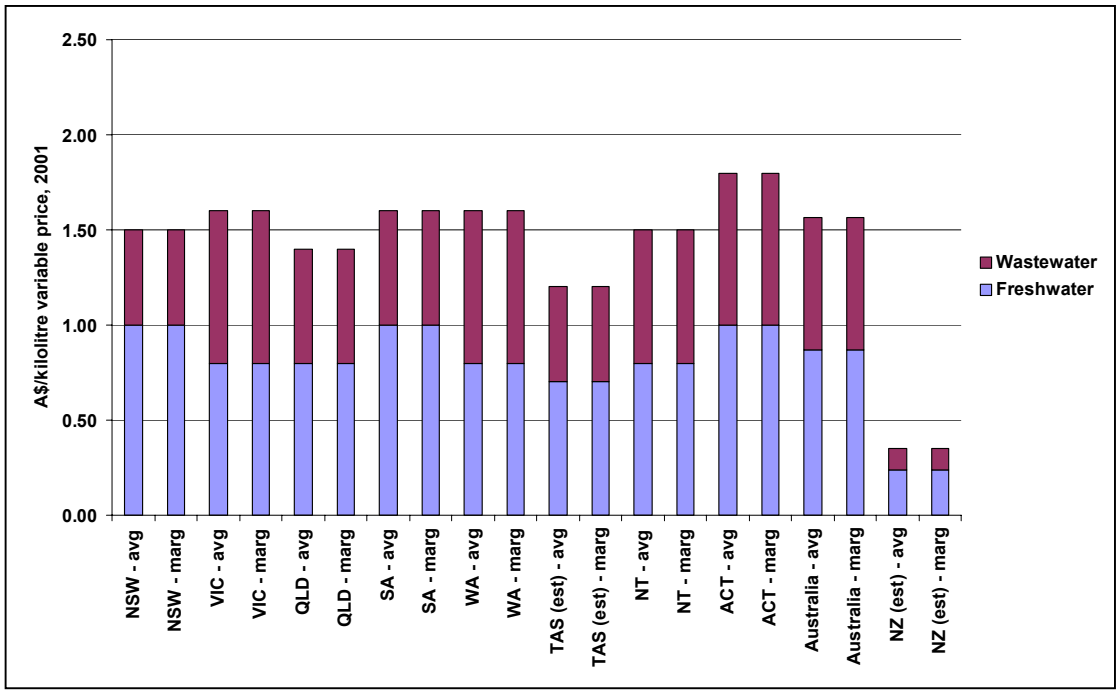
- there is a notional marginal wastewater usage charge, even for those States and supply authorities which do not at present have one (except in NZ);[30]

- the wastewater usage charge is able to capture the full saving in indoor water discharges, rather than discount for notional outdoor water use;

- the marginal variable charge equals the average variable charge.[31]

Figure 14 illustrates the notional prices in 2001 as they would have been had this idealised price structure been in place. It is assumed that trends towards greater cost-reflectiveness in water pricing will move actual price structures toward the idealised structure over the projection period, so users can gain the full benefit of their reductions in water use.

Figure 14 Idealised variable charges for water and wastewater, 2001



Projecting costs and prices

Water services

The costs and prices discussed above relate to present levels of demand and existing infrastructure. Water suppliers are facing growing demand and the need to invest in additional infrastructure, which are likely to have higher operating costs than the

[30] On the advice of NZ officials, it has been assumed that only a third of NZ households are subject to marginal usage charges for freshwater and only a tenth to marginal usage charges for wastewater and that these ratios do not increase.

[31] This differs from the assumption that the marginal variable cost equals 75% of the average variable cost, because most Australian water tariff regimes have a constant or indeed rising marginal element.

present average. Figure 2 indicates that urban water deliveries increased at a trend rate of 3.3% per annum between 1996 and 2001, driven mainly by a 3.4% per annum trend rate of growth in residential water use.

The WEL feasibility study (GWA et al 2003) estimated that WEL could reduce residential water use by about 5.2% below BAU by 2016. At the current rate of growth this is about 18 months of growth in residential water use. Because the impacts of WEL build up progressively, water authorities are in a position to plan for the impacts by avoiding or reducing high cost investments, rather than find themselves in the position of having existing investments stranded.

WSAA has supplied some information about the likely timing of supply augmentation for the five mainland State capital cities, and the operating costs for the additional supply (WSAA personal communication, 20/08/03).[32] These cannot be individually tabulated for reasons of confidentiality, but the main points are:

- Water consumption in two capital cities is already beyond the "safe yield" level, and either additional supply or effective demand management are present (not future) necessities;

- The other capitals will be beyond safe yield between 2012 and 2020;

- The incremental cost of additional water (including capital costs and operating costs, which will be higher than at present) will be between $1.20 and $2.50 per kilolitre (supply only), compared with marginal operating supply costs of about $0.20-0.40 at present. The costs of desalination would be at the high end.

- Wastewater costs will also rise, perhaps doubling from the present $0.60 to about $1.20 per kilolitre.

The upward drivers on wastewater disposal costs include the need to treat increased volumes and rising community and regulator expectations regarding standards of treatment and recycling. The current balance between primary, secondary and tertiary modes of treatment is indicated in Table 12. According to WSAA (2001), the cost per kl of secondary treatment is roughly three times that of primary treatment, and for tertiary treatment it is six times. If primary treatment were upgraded to secondary, then the cost increase from this change alone would be about 17%. If all wastewater were given tertiary treatment, the average cost per kilolitre would nearly double.

Table 12 Indicative cost factors for wastewater treatment, 2001

	Primary	Secondary	Tertiary	Total
Weighted average	25%	56%	19%	100%
Cost factor	1	3	6	3.1

Source: Derived from WSAA (2001): Percentages represent mode of treatment in 2001

On the basis of the information received, two projection scenarios have been developed for future marginal resource costs per kilolitre (Figure 15, Figure 16) and

[32] The assistance of WSAA is gratefully acknowledged.

two for marginal prices per kilolitre (Figure 17, Figure 18). Each projection embodies a relatively low rate of increase between 2003 and 2011, then a more rapid rise between 2011 and 2021, to coincide with the period when augmentation will be required if demand growth continues at the current rate, then a reversion to a low rate of growth. Within each scenario there are separate change profiles for water supply and wastewater. Table 13 summarises the change rate assumptions for each period, and the resulting impact on costs or prices in 2021. All projections are real prices (ie excluding inflation).

Table 13 Details of cost and price projection scenarios, water services

Scenario	Service	2003-06	2006-11	2011-16	2016-21	2021-36	Ratio: 2021 to 2003
Resource cost: medium increase	Supply	1.0%	2.0%	6.0%	5.0%	0.5%	1.9
	Wastewater	0.5%	2.0%	4.0%	2.0%	0.5%	1.5
	Combined						**1.65**
Resource cost: higher increase	Supply	2.0%	3.0%	10.0%	9.0%	1.0%	3.0
	Wastewater	1.0%	2.0%	7.0%	5.0%	1.0%	2.0
	Combined						**2.40**
Retail price: medium increase	Supply	1.0%	1.0%	3.0%	3.0%	0.5%	1.5
	Wastewater	0.5%	1.0%	2.0%	1.0%	0.5%	1.2
	Combined						**1.35**
Retail price: higher increase	Supply	1.0%	2.0%	6.0%	5.0%	0.5%	1.9
	Wastewater	0.5%	2.0%	4.0%	2.0%	0.5%	1.5
	Combined						**1.65**

Author estimates

Under the medium increase assumptions, marginal resource costs for water supply and wastewater combined in 2021 would be 1.65 times as great as in 2003 (ie 65% higher). Under the high increase assumptions, marginal resource costs for water supply and wastewater combined in 2021 would be 2.4 times as great as in 2003 (ie 140% higher). This may be an under-estimate, given that treatment costs alone could increase six-fold (see above).

The rate of increase in retail prices is projected to be lower, since the increment in operating costs would represent a smaller proportion of retail price. Under the medium increase assumptions, marginal prices costs for water supply and wastewater combined in 2021 would be 1.35 times as great as in 2003 (ie 35% higher). Under the high increase assumptions, marginal resource costs for water supply and wastewater combined in 2021 would be 1.65 times as great as in 2003 (ie 65% higher).

Figure 15 Projected marginal resource costs of combined water services, Medium Increase

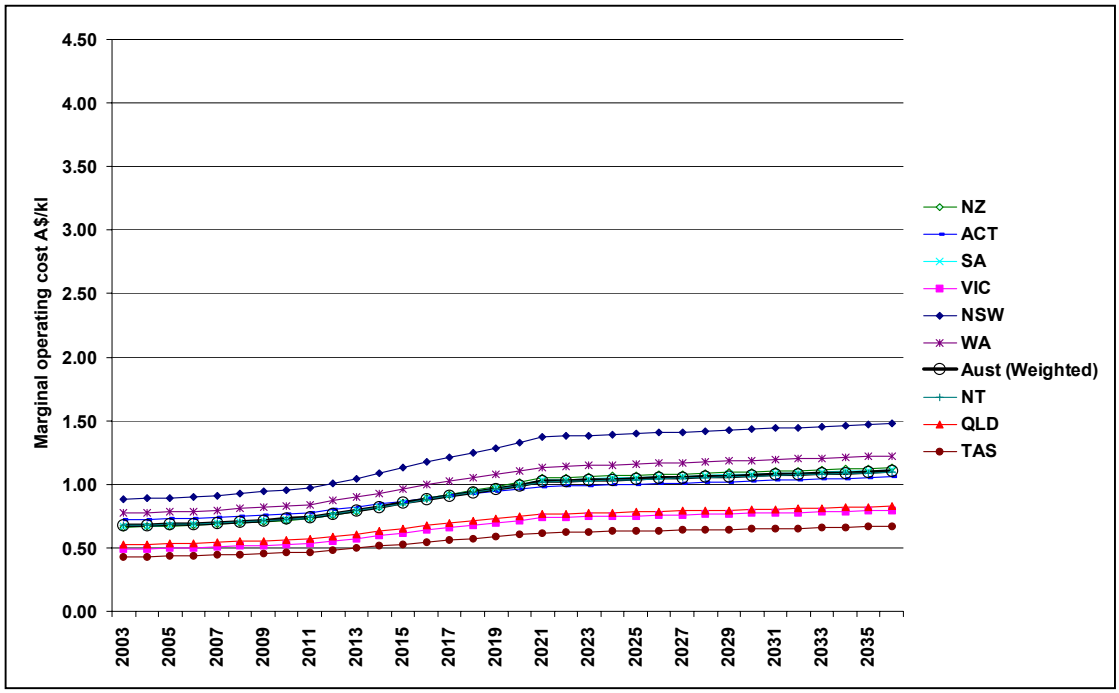


Figure 16 Projected marginal resource costs of combined water services, High Increase

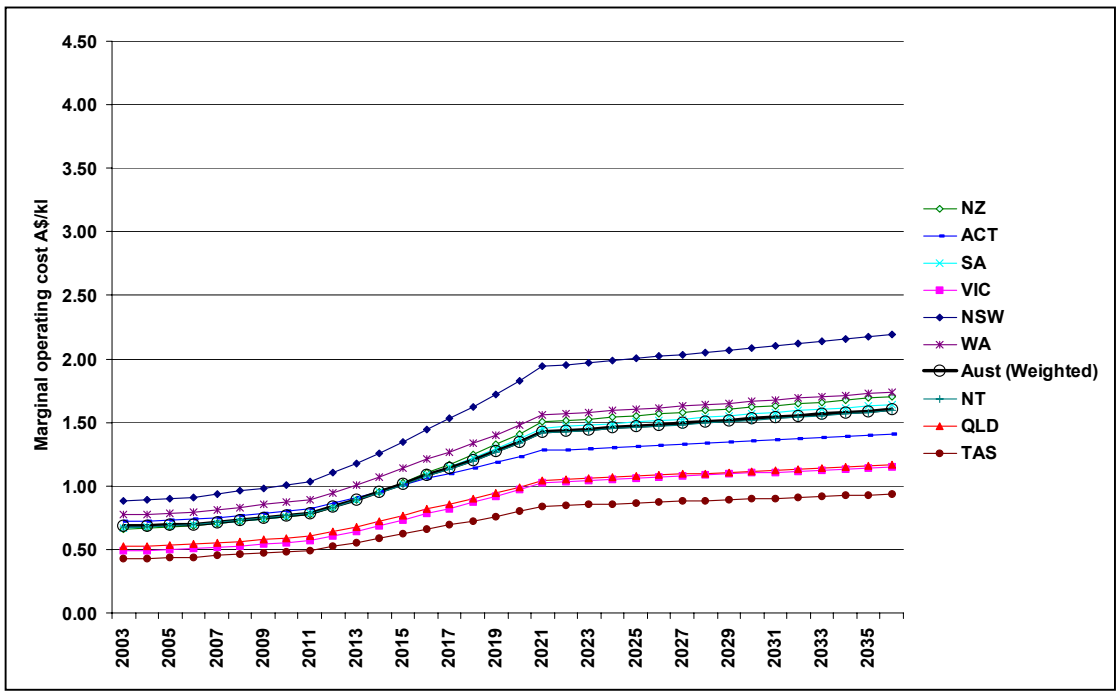


Figure 17 Projected marginal retail price of combined water services, Medium Increase

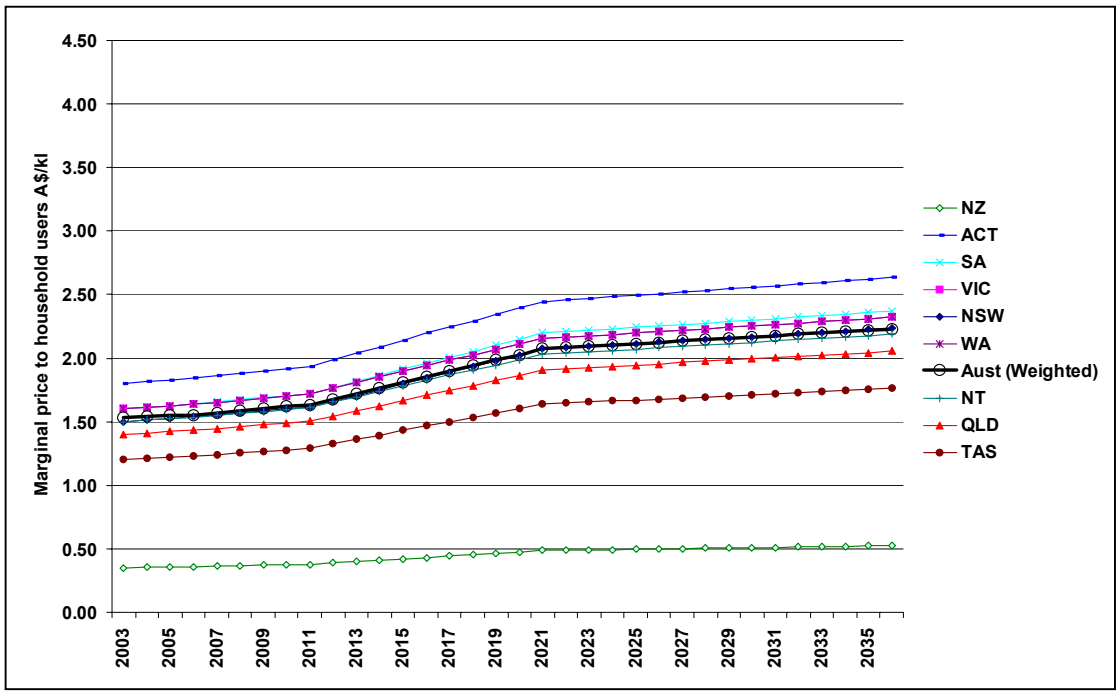
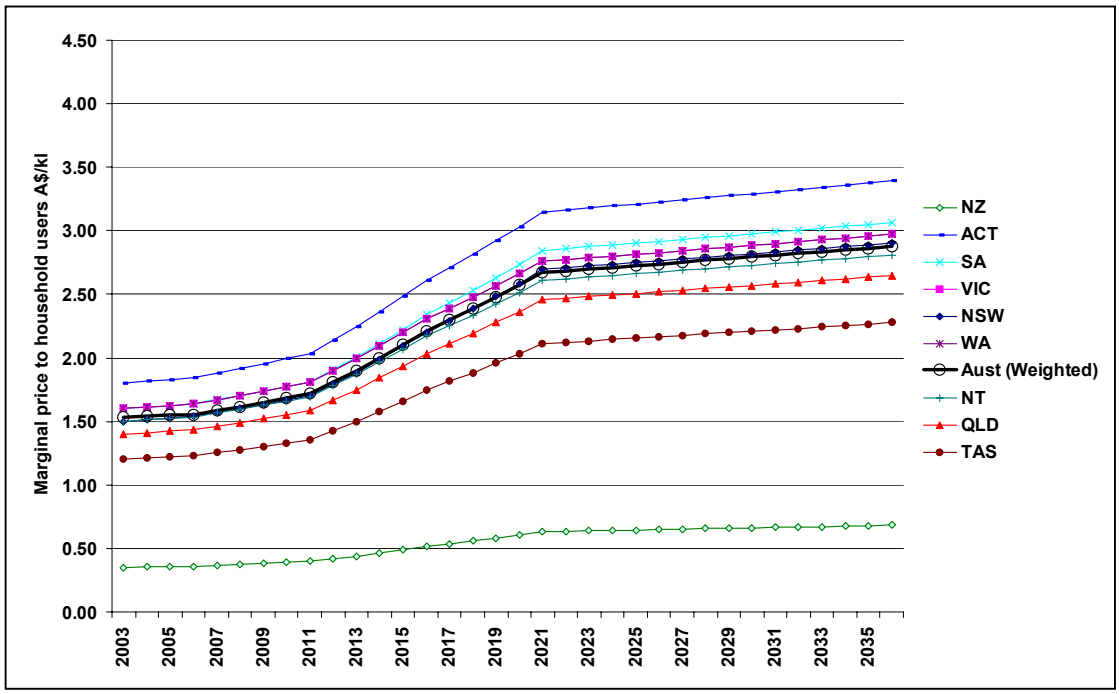


Figure 18 Projected marginal retail price of combined water services, High Increase



Energy

The 2003 marginal energy prices used to calculate value to end users of water heating energy avoided are summarised in Table 14. The retail prices are the published tariffs

of the largest retailer in each State. The marginal electricity production costs are derived from a set of projections of marginal costs at regional reference nodes in the National Electricity Market (SA, Victoria, Tasmania, NSW, Snowy, Southeast Queensland, Central Queensland and Far North Queensland) developed in 2000 by the AGO for use in the evaluation of Greenhouse Gas Abatement Program (GGAP) proposals (AGO, personal communication).

The marginal costs of energy *delivered* to users has been calculated by scaling up the cost at reference nodes by the average distribution loss factor for the State distribution systems (ranging from 5% to 7%) reported by the Electricity Supply Association of Australia.

Table 14 Marginal energy prices, 2003

	Retail price		Resource costs	
	Electricity c/kWh(a)	Natural Gas c/MJ	Electricity c/kWh(b)	Natural Gas c/MJ (i)
NSW	11.35	1.42	3.69	0.57
Victoria	14.00	1.00	3.90	0.40
Queensland	11.41	1.41	3.63(c)	0.56
SA	19.50	1.17	4.21	0.47
WA	13.94	1.26	4.25 (d)	0.50
Tasmania	9.00	1.40	4.24	0.56
NT	14.02	1.17	3.73 (e)	0.47
ACT	10.34	1.37	3.69 (f)	0.55
New Zealand	12.00(g)	1.40	3.80 (h	0.56

Source: (a) Electricity utility published tariffs (b) Derived by author from AGO projections of prices at National Electricity Market supply nodes (personal communication) (c) Three Queensland supply nodes adjusted to a single Queensland value on the basis of population as follows: 80% Southeast Queensland, 8% Central Queensland, 12% Far North Queensland. (d) Not provided by AGO: set to SA. (e) Not provided by AGO: set to Far North Queensland. (f) Set to NSW. (g) Advised by NZ officials. (h) Author estimate, based on average Australian ratio of resource costs to retail price: (i) Author estimate that ratio of resource costs to retail price is 0.40.

Two projection scenarios have been developed for energy prices (apart from the no change scenario). Table 15 summarises the change rate assumptions for each period, and the resulting impact on costs or prices in 2021. All projections are real prices (ie excluding inflation). Under the medium increase assumptions, marginal prices and costs for energy in 2021 would be 1.08 times as great as in 2003 (ie 8% higher). Under the high increase assumptions, marginal prices and costs would be 18% higher.

Table 15 Details of cost and price projection scenarios, energy

Scenario	2003-06	2006-11	2011-16	2016-21	2021-36	Ratio: 2021 to 2003
Medium increase	0.0%	0.5%	0.5%	0.5%	0.5%	**1.08**
High increase	0.5%	1.0%	1.0%	1.0%	1.0%	**1.18**

These are much lower than the projected increases than for water services (Table 13) on the assumption that, unlike water services, there will be no major changes in supply technology over the period, and that the pattern of capital investment will be progressive rather than concentrated in the period 2011-2021. The electricity price projections embody the assumption that there will be a reduction in the coal share of

generation, partly in favour of a small increase in the share of renewable generation but mostly due to an increase in the share of gas generation.

Figure 19 Projected marginal prices and resource costs of electricity, Medium Increase

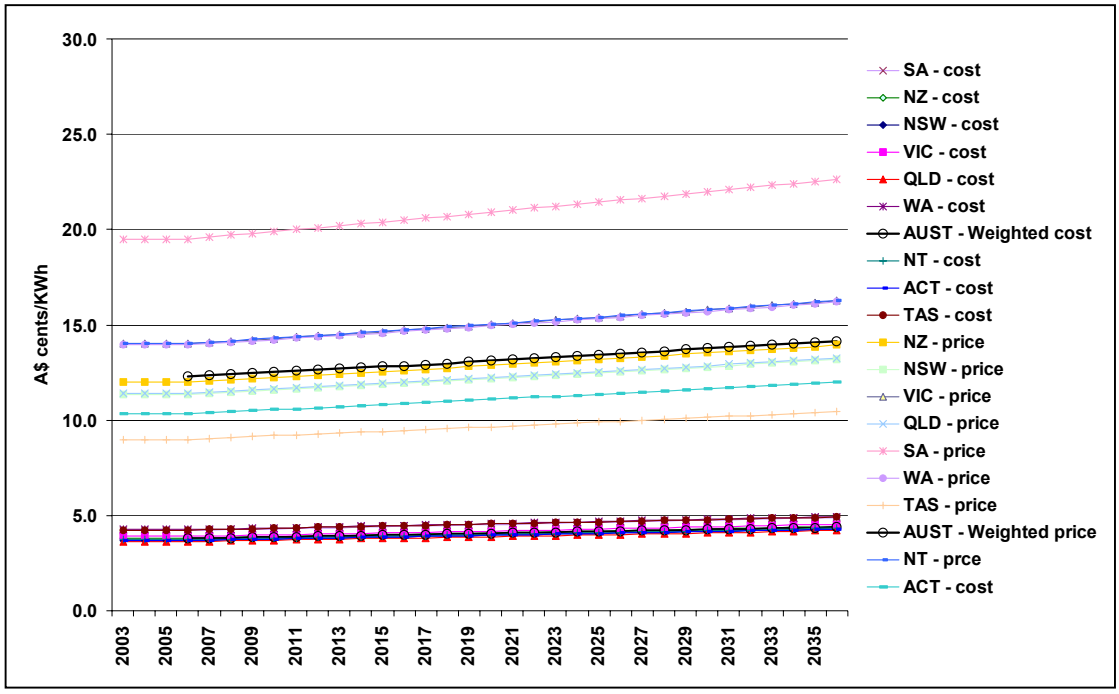
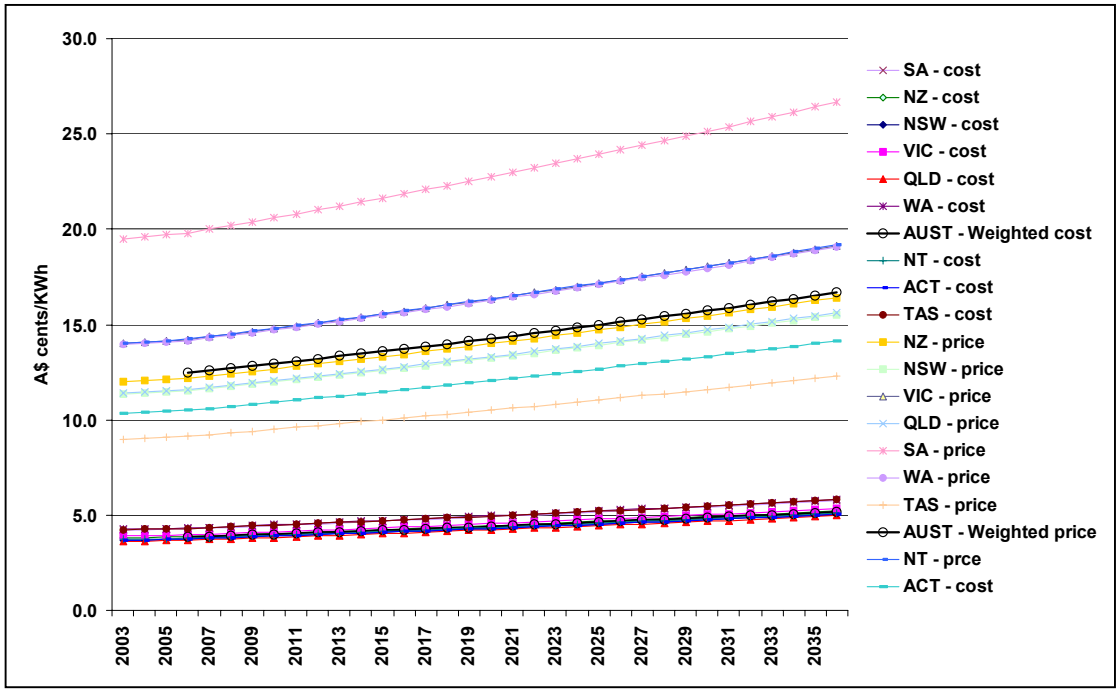


Figure 20 Projected marginal prices and resource costs of electricity, High Increase



Analysis of WEL Impacts

Projection Method

The projected impacts of WEL have been modelled separately for each State and Territory and for New Zealand, ie 9 jurisdictions in all. Results are presented for each jurisdiction alone, for Australia as a whole and Australia and New Zealand combined.

A projection period of 2003-2021 has been selected, partly because 2021 is the limit of the population and household number projections published by the Australian Bureau of Statistics (ABS) and Statistics New Zealand (SNZ). The increasing uncertainty as the modelling period extends, and the declining impact on present NPV due to time discounting, also mean there is little point in extending the analysis further in time.

The following method is applied for each jurisdiction;

1. Start with ABS and SNZ projection of population household numbers (household numbers are used as proxies for occupied dwelling numbers);

2. Project dwelling construction rates and renovation rates (necessary to determine the rate of change in the stock of toilets and showers, and to provide a cross-check with product market size);

3. Project average number of toilets and showers installed per new and per renovated dwelling;

4. Project ownership per household of clothes washers and dishwashers;

5. Estimate *present* water usage per device or per household for the main end uses (toilets, showers, clothes washers, dishwashers and taps) based on current indoor water use breakdowns, efficiency levels (eg the distribution of A,AA,AAA etc) and product types (eg top and front loading washing machines);

6. Estimate *present* electricity and gas used to heat water for the above devices, based on the present distribution of water heater types, cold water temperatures and assumptions about rates of cold water clothes washing;

7. For each product, model two scenarios, for the period beginning 2003 up to 2021:

    - "business as usual" (BAU), which assumes the continuation of any existing trends towards more efficient water use (eg the replacement of older single flush toilets by 6/3 dual flush) and changes in the fuel mix for water heating; and

    - "with-labelling", which assumes a more rapid shift towards water-efficient products in response to labelling. The projected rate of shift is based on experience with the market impacts of energy labelling (GW 2001).

8. For each of the two scenarios, calculate the following for each product type (per household and for the entire jurisdiction):

    - Total freshwater consumption and total wastewater discharge (same value);

    - Total electricity and gas consumption for water heating.

9. Calculate the impact of WEL as the difference, in each year, between the BAU and the with-labelling values for freshwater consumption, wastewater discharge, electricity consumption and gas consumption.

10. Estimate the value of the water and energy savings by multiplying the projected reductions in each year by the projected *marginal* costs of freshwater supply, wastewater discharge, electricity supply and gas supply, under each of the water service and energy price/cost change scenarios detailed in the preceding section Projecting costs and prices:

    - the medium increase scenario;

    - the high increase scenario; and

    - a constant price scenario (to test the overall sensitivity of cost-effectiveness to price change assumptions).

11. Estimate the greenhouse gas reductions from the heating energy saved and the pumping and treatment energy saved.

The analysis is carried out with full detail for toilets, showers, clothes washers and dishwashers. A simplified approach is used for taps (based on the ratio of free-flow water use via taps to the ratio of shower water use) and for urinals (based on estimates of the ratio of urinal water use to the ratio of toilet water use in non-residential buildings).

The savings from WEL in the non-residential building sector are estimated by scaling up the residential sector savings estimates by the scaling factors in Table 8 (ie the water savings from non-residential toilets are estimated as 49% of those for the residential sector, and the water savings and energy savings for showers are estimated as 18% of those for the residential sector).

The analysis described above quantifies the benefits of mandatory WEL. The costs comprise three major elements:

1. Testing, labelling and administrative costs to suppliers: testing and administration cost estimates are based on the number of discrete models that will need to be tested and registered, and labelling costs are based on the number of products sold annually;

2. Administrative costs to government for program development, implementation and administration (including compliance monitoring): this is estimated as an annual budget;

3. The costs associated with the increases in the average water-efficiency of products.

The net present value (NPV) of the projected stream of costs and benefits for products installed over the period 2003 to 2021 is calculated using discount rates of 0%, 5% and 10%. The total lifetime operating costs of products is taken into account, so the operating costs of products installed in the last year of projection period (2021) will be affected by projected water and energy prices up to 2036.

Finally, the NPV of projected benefits from mandatory WEL is compared with the NPV of the projected costs, to give net benefits (or net costs) and benefit/cost ratios.

Two sets of analyses have been carried out:

1. From the resource cost perspective: this uses projected marginal costs of water services and energy, and projected marginal resource costs of products. Product resource costs are derived from product retail prices (which are known) using a simple assumption that producer profits, wholesale markups and taxes amount to double the resource costs. This is supported by studies of appliance prices undertaken for RISs for minimum energy performance standards (eg GWA 2003).

2. From the end user perspective: this uses projected marginal retailer prices of water services and energy, and projected marginal retail price products.

The first set of analyses indicates the likely cost-effectiveness of the program from a national resource perspective, and the latter the cost-effectiveness from the viewpoint of end users of the services supplied by the products in question.

The modelling method produced 18 sets of outputs in all, as indicated in Table 23.

The modelling input assumptions regarding water service costs and prices, energy service costs and prices and program administration costs are covered in this chapter. All other input assumptions including product water efficiency trends, product costs and prices and the greenhouse impacts of energy user are detailed in Appendix 2.

Appliance Costs

The general assumption is that more water-efficient products are, on average, more costly to manufacture than less water-efficient products. This correlation tends to be strongest for relatively simple low-cost products such as showers, where the water-efficient performance depends on the addition of components such as flow control devices. For more complex products such as clothes washers and dishwashers the correlation is much weaker, especially at the beginning of the improvement process, when many low-cost options are available.[33]

[33] The weakness of the correlation between costs, prices and energy-efficiency for complex products such as refrigerators has been extensively documented (eg GWA 2001).

In some cases the price relativities between products do not reflect underlying costs. The resource costs of manufacturing a front a loader clothes washer are comparable to those for a top loader of similar quality. The fact that the average front loader is currently much more expensive than the average top loader is partly due to the fact that sales volumes per model are lower and hence the fixed distribution costs per unit sold are higher, and all front loaders are imported, so shipping and import transaction costs are higher. These conditions could change over time in response to a water-labelling-driven change in market preference, so closing the price gap between top and front loaders. However, the costs of the WEL program are calculated on the conservative assumption that labelling alone will not raise the front loader share of the clothes washer market to more than about 30% (from its present level of about 15%) and current price differentials will remain.

The price differential between toilet and cistern combinations of different water-efficiency levels reflects production volumes, inventory costs and market conditions rather than underlying resource costs, which are essentially the same for all types. As more water-efficient models are introduced in response to labelling they are likely to carry a small price premium, but this premium would diminish and disappear (or even reverse) as production is switched over to the newer models. Ultimately, the older models are likely to disappear from the market, and the price of the new, more water-efficient models are likely to be the same as the models they replace.

The appliance price assumptions used in the modelling are summarised in Table 16. For clothes washers, there are two separate price increase drivers in operation: a greater preference for top loaders (leading to a higher weighted average base price) and a preference for models of higher water-efficiency (the extra $15 price premium).

Table 16 Price assumptions for levels of water-efficiency

Product	Water-efficiency grade	Estimated average price for modelling	Estimated price premiums for more water-efficient models
Showers	All Directional	$20	
	AAA	$30	$10 compared with AD
	AAAAA	$45	$15 compared with AAA
Toilets	AA	$500	
	AAA	$520	$20 compared with AA
	AAAA	Varies	$20 compared with AAA in 2005, falling to $0 in 2010
	AAAAA	Varies	$40 compared with AAA in 2005, falling to $30 in 2010
Clothes washers - top loader	All	Base price $728 in 2003, declining	$0 in 2005 rising to $15 in 2010
Clothes washers - front loader	All	Base price $1196 in 2003, declining	$0 in 2005 rising to $15 in 2010
Dishwashers	All	Base price $990 in 2003, constant	$0 in 2005 rising to $15 in 2010

Author estimates

Program Costs and Cost Recovery

There are three major sets of costs imposed on product suppliers: the costs of tests to determine the water-efficiency of the product, the costs of registering the product with

the regulator and the costs of labelling – both physically affixing the labels and managing labelling in the retail environment.

The estimates of these costs are summarised in Table 17. There are no additional testing costs for clothes washers and dishwashers, since water consumption has to be measured in any case as part of the energy labelling test, which is already mandatory. Similarly, the labelling cost for clothes washers and dishwashers are estimated to be half that for other products, since production lines are already set up to fix energy labels on every unit, and it is likely that many suppliers will choose to add the water label image to the same blank as is used for the energy label (the blank would have to be larger). Also, appliance retailers are familiar with energy labelling and little additional training on water labelling will be required.

It has been assumed that for urinals, where registration would be mandatory but labelling optional, no supplier chooses to label. For taps, where both registration and labelling would be optional, it is assumed that there would be a low rate of takeup.

Table 17 Estimated annual product testing and registration costs of WEL

		Showers	Toilets	CW	DW	Taps, FCDs	Urinals	Total
Labelling	$/unit	0.20	0.20	0.10	0.10	0.20	0.00	
Testing (additional)	$/model	1500	1500	0	0	1500	1500	
Registration	$/model	2500	2500	2500	2500	2500	2500	
Initial test load	Models	200	100	300	200	35	150	985
Annual test load	Models	30	15	45	30	12	23	155
Initial test cost	$M	0.30	0.15	0.00	0.00	0.05	0.23	0.728
Initial registration cost	$M	0.50	0.25	0.75	0.50	0.09	0.38	2.463
Annual test load	$M/yr	0.05	0.02	0.00	0.00	0.02	0.03	0.119
Annual registrations	$M/yr	0.08	0.04	0.11	0.08	0.03	0.06	0.386

Author estimates, based on energy labelling program costs

The Department of the Environment and Heritage advises that a registration cost of $2500 per model for five years will be necessary to cover the costs of the Water Efficiency Regulator.[34] Australian Government policy is to put in place full cost recovery arrangements wherever possible. [35] There would be a peak in activity in the year of introduction of the program, as all existing models would need to be tested and registered, and the rate of tests and registrations would then fall to the rate of introduction of new models. DEH proposes that registrations would be renewable every 5 years, so the program budget also follows 5 year cycles.

Table 18 summarises the program costs and revenues over the first 5 year cycle. Program costs are estimated at $900,000 per year. Staff costs are estimated to be $550,000 per annum (Commonwealth only). Other costs are estimated at $350,000 per annum. Costs of litigation have not been included – experience with energy labelling suggests that compliance disputes tend to be resolved between the regulator and supplier in question. Unspent moneys from registrations in the first year would

[34] Models with identical water efficiency characteristics – eg models with identical shapes that differ only by colour - would be classed as belonging to the one family and will be covered by the one registration.

[35] *Commonwealth Cost Recovery Guidelines for Regulatory Agencies* (not dated)

be invested for use in subsequent years, and it is projected that there will be a moderate cash surplus, as a buffer against unforseen eventualities.

Given the nature of the program, some of the costs will be allocated to policy studies and program development and evaluation, which are not properly recoverable in registration charges. It is estimated that 10% of total program costs will be "non-recoverable", and these will be borne half by the Commonwealth and half by the States and Territories. Government contributions are estimated at $450,000 over 5 years compared with a program budget of $4,500,000 indicating a 90% rate of overall cost recovery. From the Commonwealth's viewpoint, 95% of costs would be recovered.

Table 18 Estimated annual administration costs and revenues of WEL, Australia

	$					2005/6-2009/10
	2005/06	2006/07	2007/08	2008/09	2009/10	
Publicity and promotion	70,000	70,000	70,000	70,000	70,000	350,000
Development of technical standards	85,000	85,000	85,000	85,000	85,000	425,000
Regulatory, compliance and enforcement	100,000	100,000	100,000	100,000	100,000	500,000
Database and website and administration	95,000	95,000	95,000	95,000	95,000	475,000
Staffing and overheads	550,000	550,000	550,000	550,000	550,000	2,750,000
Total costs (a)	900,000	900,000	900,000	900,000	900,000	4,500,000
Registration income (b)	2,463,000	386,000	386,000	386,000	386,000	4,008,-00
Commonwealth contribution (c)	45,000	45,000	45,000	45,000	45,000	225,000
States' contribution (c)	45,000	45,000	45,000	45,000	45,000	225,000
Interest on unspent income (d)	0	85,000	68,000	49,000	30,000	232,000
Total revenues	2,553,000	561,000	544,000	525,000	506,000	4,690,000
Net income	1,653,000	-339,000	-356,000	-375,000	-394,000	+190,000

(a) All cost elements estimated by DEH (b) From Table 17. (c) 50% of unrecoverable costs
(d) Invested at Commonwealth bond rate of 5.15%

The impact of registration charges, additional tests (if not already required for energy labelling) and labelling costs as a percentage of average 2004 sales price for the products affected is summarised in Table 19. The total of such costs as a percentage of average product sales price is very low for toilets, clothes washers and dishwashers, but is significant for shower heads. However, consumers who use the shower head label to select a more water-efficient product than otherwise stand to make the largest monetary savings.

Table 19 Estimated impact of program costs on appliance prices

	Projected sales 2005/6-9/10	Registration charges $/unit sold	Additional test costs $/unit sold	Labelling costs $/unit sold	Average price 2004 $/unit sold	Additional costs as % of price
Showerheads	3,493,000	0.23	0.14	0.20	23.1	2.5%
Toilets	3,963,000	0.10	0.06	0.20	518.6	0.1%
Clothes washers	3,367,000	0.36	0	0.10	789.1	0.1%
Dishwashers	1,483,000	0.54	0	0.10	990.0	0.1%

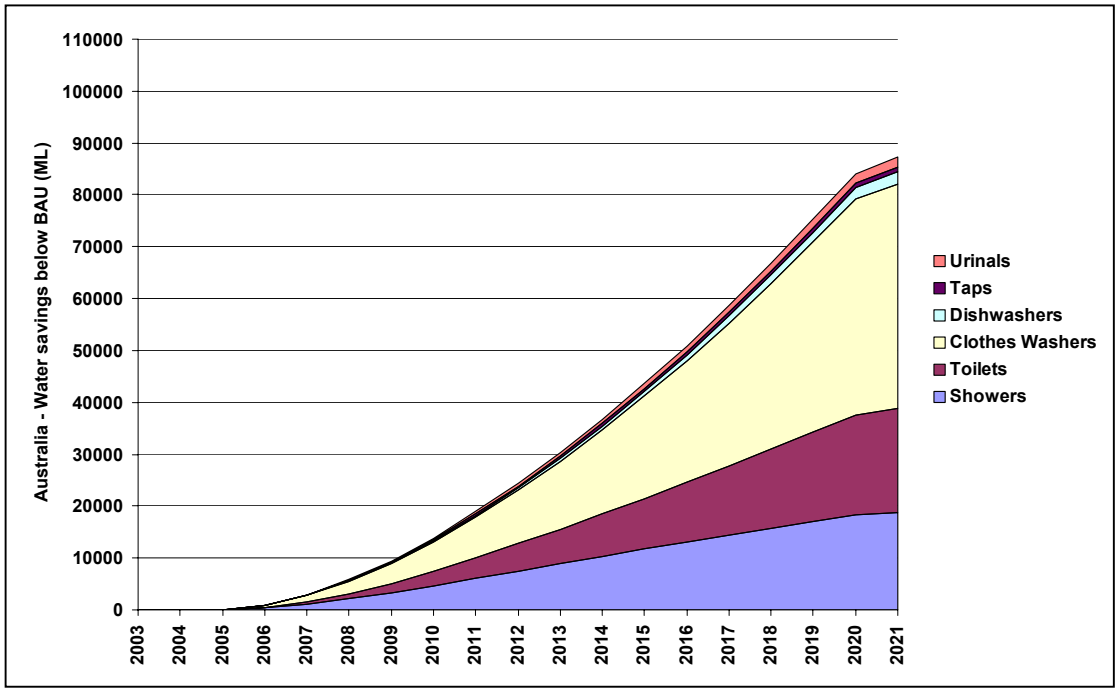
Overview of National Benefits and Costs

Projected reductions in water use

The projected impact of the water efficiency labelling program on water consumption is illustrated in Figure 21. It is estimated that total Australian water consumption will be about 18,900 ML per annum below BAU by 2011, and about 87,200 ML below BAU by 2021, the end of the projection period. The corresponding reductions for New Zealand are projected to be 3,500 ML and 15,800 ML per annum respectively.

The reduction in total household water use is projected to reach about 5% by 2021, with the impacts ranging from about 9% for clothes washers to less than 0.3% for taps (Figure 22). The low impact for taps is based on the assumption that tap labelling will be less effective than for other products, and even where a more water-efficient tap is installed the savings will be low because only free-flow uses will be reduced and volumetric uses will be unaffected. Figure 23 illustrates the impacts on daily household water use per capita.

Figure 21 Projected water savings by product, Australia – All sectors



It is projected that water savings over the period 2003 to 2021 will total about 610,000 ML. Nearly half of this would come from clothes washers, about 25% from showers and 22% from toilets (Figure 25). Over 86% of the water savings would occur in the residential sector, and rest in non-residential buildings. Showers account for about 57% of the electricity savings (4,380 GWh over the period) and nearly 64% of the gas savings (14.3 PJ). This is because most showering water is heated, whereas there is a growing tendency to cold washing for clothes. (The electricity savings associated

with toilets and urinals are for pumping only, not heating).

Figure 22 Projected % water savings below BAU – Residential Sector

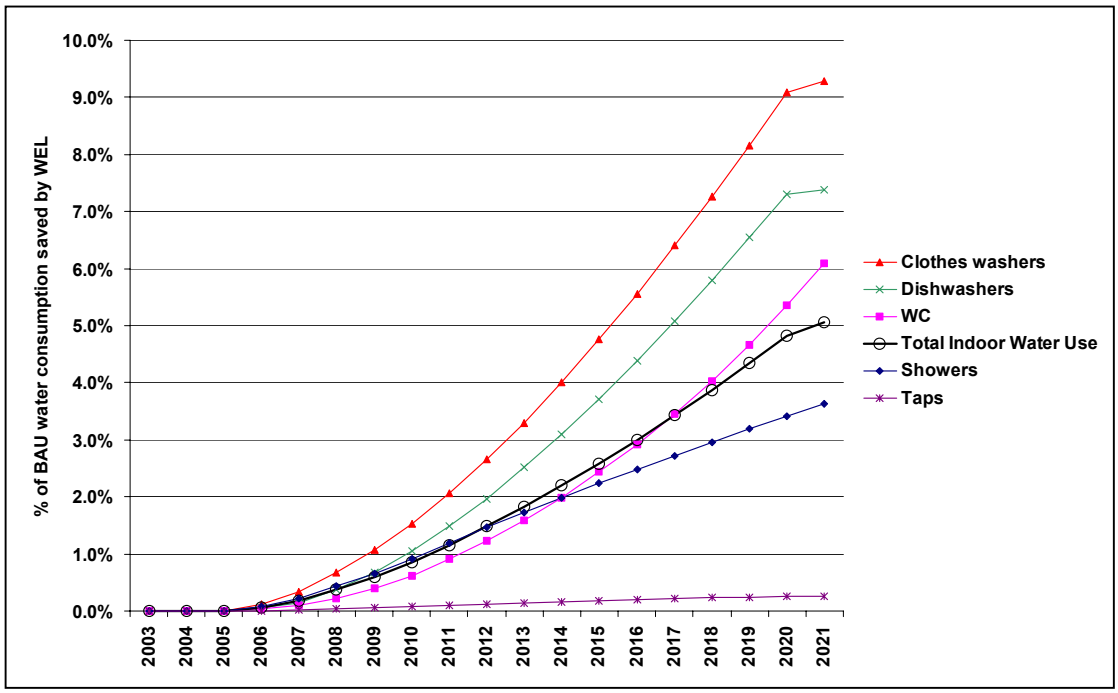


Figure 23 Projected impact on daily household water use per capita, Australia

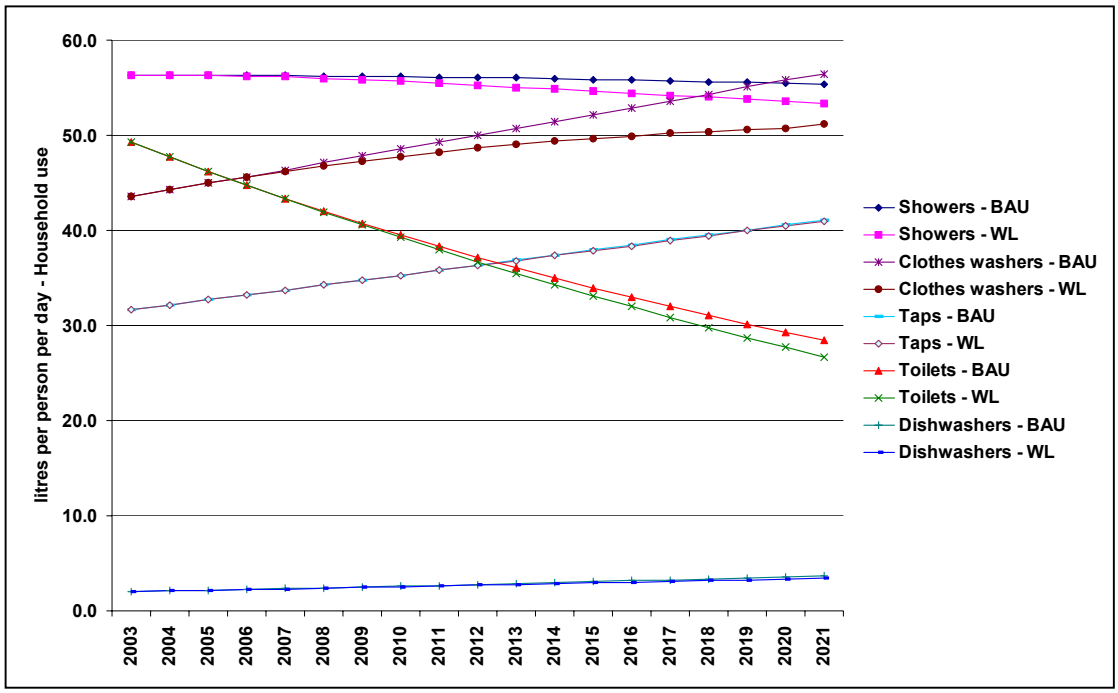
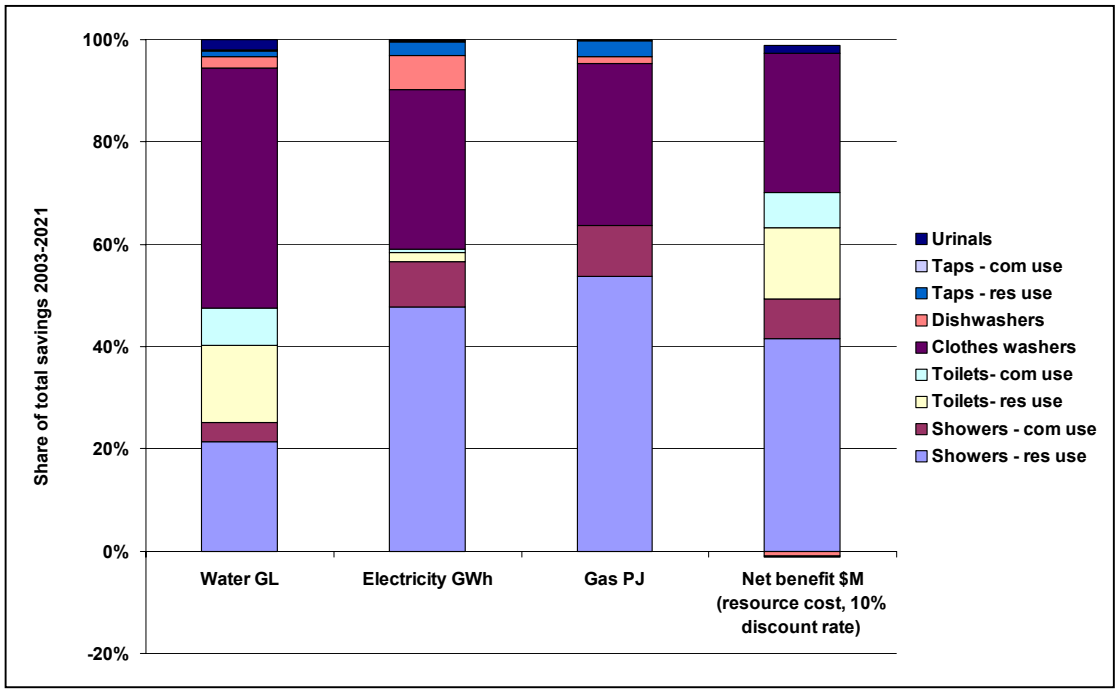


Figure 24 Breakdown of projected savings by product and sector



Projected reductions in greenhouse emissions

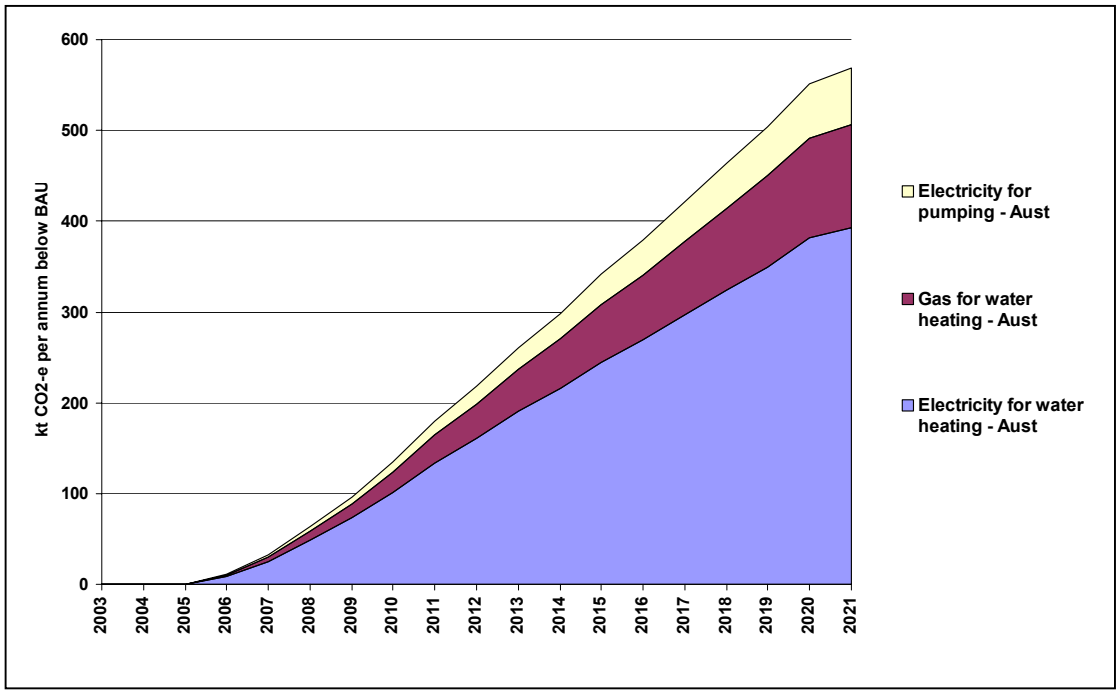
WEL is projected to reduce greenhouse gas emissions from electricity and gas use by reducing the amount of hot water used in showers, taps, clothes washers and dishwashers. This is calculated from the share of water heaters that are electric, solar-electric and gas (see Appendix 1 Model Inputs). WEL will also reduce the electricity required for pumping freshwater and wastewater, calculated using the factors in Table 20. The total reduction in emissions for Australia is projected to reach about 135 kt CO_2-e per annum in 2010, 570 kt CO_2-e per annum in 2021 (Figure 25). The corresponding values for New Zealand are 20 and 95 kt CO_2-e respectively.

Table 20 Pumping energy used by region, 2001

	kWh/kl supply	kWh/kl wastewater	Total kWh/kl
NSW	0.31	0.35	0.65
Vic	0.16	0.71	0.88
Qld	0.33	0.61	0.95
SA	1.16	0.43	1.58
WA	0.28	0.44	0.72
Tas	0.53	0.77	1.30
NT	0.27	0.19	0.47
ACT	0.07	0.60	0.67
NZ	0.05	0.77	0.82

Derived by Author from WSAA (2001)

Figure 25 Projected greenhouse gas reductions, Australia



Costs and Benefits

Two "reference" scenarios have been selected in order to simplify the presentation of the benefit/cost estimates: one represents the resource costs perspective (Table 21) and the other the retail price perspective (Table 22). Both assume medium increases in marginal water service costs and prices, and a discount rate of 10%. The main findings are:

- From the resource cost perspective, the projected benefit for Australia from mandatory water efficiency labelling is about $M 386 and the projected cost is about $M 119. This indicates a net benefit of about $M 267, at a benefit/cost ratio of 3.2;

- The program would be cost-effective for every product covered, except for dishwashers, for which cost-effectiveness is slightly below 1;

- About 89% of the costs of the program would be the additional resource costs of increasing product water-efficiency. Testing, registration and labelling costs would account for about 9%, and other administration costs for about 2%;

- The value of savings in water services account for nearly 72% of the benefit, electricity cost savings for about 19% and gas cost savings for about 9%;

- Showers, toilets and clothes washers together account for nearly all of the net economic benefit (Figure 24).

From the retail price perspective, the projected benefit for water services users as a group is about $M 900 (NPV at 2003, 10% discount rate), and the projected cost is

about $M 225. This indicates a net benefit of about $M 674 at a benefit/cost ratio of 4.0. This compares favourably with the estimated benefit/cost ratio of 2.4 (at 10% discount rate, retail price perspective) for the mandatory energy labelling and minimum energy performance standards program (NAEEEC 2003a). From this perspective WEL is cost-effective for all products including dishwashers. The inclusion of dishwashers would greatly reinforce the impact on consumers of the program as a whole.

Table 23 indicates that the program appears to be cost-effective even under the most severe combination of conditions modelled: *no* increase in the real resource costs of water services or energy, and a discount rate of 10%. The combined benefit/cost ratio for the program as a whole is still 2.5.

It is projected that, over the period 2003-2021, about 2.5% more will be spent on the purchase of water-using products for the residential sector compared with the BAU case: about 10.1% more on showers, 0.5% more on toilets, 4.4% more on clothes washers, 1.3% more on dishwashers and 7.6% more on taps (assuming that suppliers opt to participate and that tap labelling is moderately effective).

Table 21 Summary of Costs and Benefits, Australia: Resource Cost Perspective, Medium Water and Energy Cost Increases, 10% Discount Rate

	Costs ($M)				Benefits ($M)				Net Benefit	B/C Ratios
	Product Costs	Label-ling	Test & Reg	Total	Water savings	Elect savings	Gas savings	Total savings		
Showers	$6.9	$1.1	$1.4	$9.5	$67.5	$44.3	$22.4	$134.1	$124.6	14.1
Toilets	$8.8	$1.6	$0.7	$11.2	$63.7	$0.0	$0.0	$63.7	$52.5	5.7
Clothes wash	$70.6	$0.5	$1.3	$72.4	$130.4	$21.6	$11.2	$163.2	$90.8	2.3
Dishwashers	$13.7	$0.2	$0.9	$14.8	$6.4	$5.0	$0.5	$11.9	-$2.9	0.8
Taps	$4.8	$1.6	$0.4	$6.8	$3.5	$2.3	$1.1	$6.9	$0.1	1.0
Urinals	$1.2	$0.0	$1.2	$2.4	$6.0	$0.0	$0.0	$6.0	$3.6	2.5
Product total	$106.1	$5.0	$6.0	$117.2	$277.5	$73.2	$35.2	$385.9	$266.7	
Administration				$ 2.0(a)						
Grand total	$106.1	$5.0	$6.0	$119.2	$277.5	$73.2	$35.2	$385.9	$266.7	**3.2**

Source: Appendix 2; All values are $M NPV in 2003 (a) Costs not recoverable via registration charges

Table 22 Summary of Costs and Benefits, Australia: Retail Price Perspective, Medium Water and Energy Cost Increases, 10% Discount Rate

	Costs ($M)				Benefits ($M)				Net Benefit	B/C Ratios
	Product Costs	Label-ling	Test & Reg	Total	Water savings	Elect savings	Gas savings	Total savings		
Showers	$13.9	$1.1	$1.4	$16.5	$140.4	$143.0	$55.9	$339.3	$322.9	20.6
Toilets	$17.7	$1.6	$0.7	$20.0	$131.7	$0.0	$0.0	$131.7	$111.7	6.6
Clothes wash	$141.1	$0.5	$1.3	$143.0	$269.5	$70.0	$27.9	$367.5	$224.5	2.6
Dishwashers	$27.4	$0.2	$0.9	$28.6	$13.5	$16.5	$1.3	$31.2	$2.7	1.1
Taps	$9.6	$1.6	$0.4	$11.6	$7.2	$7.3	$2.9	$17.4	$5.8	1.5
Urinals	$2.4	$0.0	$1.2	$3.6	$12.4	$0.0	$0.0	$12.4	$8.8	3.4
Product total	$212.2	$5.0	$6.0	$223.3	$574.7	$236.9	$88.0	$899.5	$674.2	
Administration				$2.0(a)						
Grand total	$212.2	$5.0	$6.0	$225.3	$574.7	$236.9	$88.0	$899.5	$674.2	**4.0**

Source: Appendix 2; All values are $M NPV in 2003(a) Costs not recoverable via registration charges

The testing, registration and administration costs of WEL are largely fixed, in that they would be incurred whether or not product buyers actually use the labels to change their purchase behaviour. The product costs, however, are variable in that they closely correlate with buyer behaviour. If buyers make less use of the label (eg because it is poorly designed) then average product costs will not increase as much. The very high ratio of variable to fixed costs means that the program benefit/cost ratios are relatively insensitive to program impact, although of course the projected reduction in water and energy would be lower if program impact were lower.

Table 23 Summary of Benefit/Cost Ratios

Perspective	Cost/Price Growth	Discount rates		
		0%	5%	10%
Resource Cost	No change	5.3	3.5	2.5
	Medium increase	7.3	4.7	**3.2**
	High increase	9.6	6.0	4.1
Retail Price	No change	7.0	4.6	3.3
	Medium increase	8.8	5.7	**4.0**
	High increase	10.6	6.8	4.7

Source: Appendix 2: shaded cells correspond to "reference" scenarios in Table 21 and Table 22

Impacts by Jurisdiction

Water Reductions

The projected impacts on water use in each State and Territory and in New Zealand are roughly in proportion to household numbers and population, with some differences according to the starting stock of water-efficient products dishwashers and market preferences for front loader clothes washers (which range from 12.6% in Queensland to 16.6% in Victoria and WA). The estimated impacts in 2011 and 2021 are summarised in Table 24 and Table 25 respectively, and illustrated in Figure 26. The contribution of different products to water savings varies slightly by jurisdiction: eg clothes washers account for about 38% of annual water savings in Queensland in 2011, but for 50% of annual water savings in Tasmania.

Table 24 Projected reductions in water consumption, 2011

Juris-diction	Showers	Toilets	Clothes Washers	Dish-washers	Taps	Urinals	Total	Share of total
NSW	1972	1292	2635	94	101	121	6217	32.9%
Vic	1367	899	1912	78	70	84	4410	23.3%
Qld	1426	915	1566	67	73	86	4134	21.9%
SA	347	229	509	18	18	22	1142	6.0%
WA	729	469	817	34	37	44	2129	11.3%
Tas	92	62	170	6	5	6	339	1.8%
NT	80	51	90	2	4	5	230	1.2%
ACT	90	58	133	6	5	5	297	1.6%
Australia	6102	3974	7831	305	313	373	18899	100.0%
NZ	1064	688	1542	46	55	65	3459	15.5%
ANZ	7166	4662	9374	351	368	438	22358	
	32.1%	20.9%	41.9%	1.6%	1.6%	2.0%	100.0%	

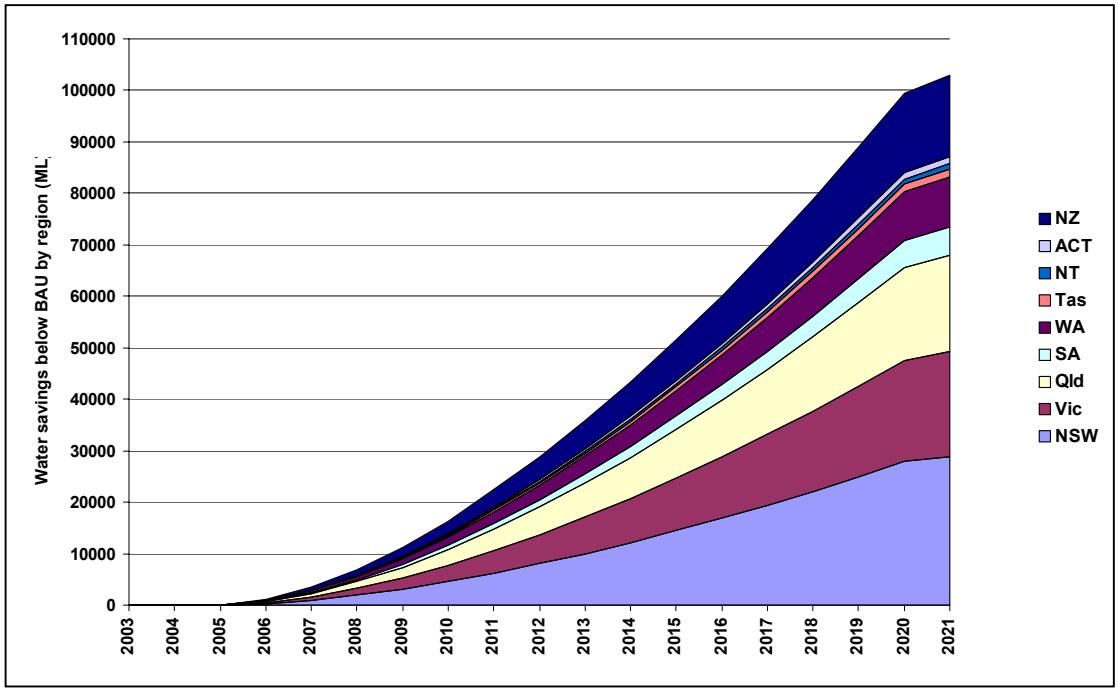
Source: Appendix 2

Table 25 Projected reductions in water consumption, 2021

Juris-diction	Showers	Toilets	Clothes Washers	Dish-washers	Taps	Urinals	Total	Share of total
NSW	6109	6533	14615	705	314	614	28890	33.1%
Vic	4146	4489	10434	580	213	422	20284	23.3%
Qld	4514	4565	8595	500	232	429	18836	21.6%
SA	1033	1144	2899	136	53	107	5374	6.2%
WA	2273	2312	4711	250	117	217	9881	11.3%
Tas	250	294	865	45	13	28	1495	1.7%
NT	261	257	508	11	13	24	1075	1.2%
ACT	277	292	738	45	14	27	1394	1.6%
Australia	18866	19886	43364	2273	969	1869	87227	100.0%
NZ	3300	3398	8252	341	169	319	15779	15.3%
ANZ	22166	23284	51616	2615	1138	2188	103006	
	21.5%	22.6%	50.1%	2.5%	1.1%	2.1%	100.0%	

Source: Appendix 2

Figure 26 Projected reductions in water consumption by jurisdiction, 2003-2021



Benefits and Costs

Benefits and costs can also be estimated on a jurisdictional basis. The sales of each product in each jurisdiction are separately modelled, so any increases in average product cost or price can be allocated to the jurisdiction. Unit labelling costs can also be allocated on the basis of sales. The water and energy savings are modelled on a jurisdictional basis. Model testing and registration costs and administration costs are

independent of product sales volumes, and have been allocated to jurisdictions on the basis of population.

Table 26 and Table 27 summarise the costs and benefits for each jurisdiction over the period 2003-2021, on the basis of resource costs and retail price respectively. On a resource cost basis the benefit/cost ratios range from a high of 4.0 for NSW to a low of 2.5 for Tasmania, compared with an average of 3.2 for Australia. On a retail price basis the benefit/cost ratios range from a high of 4.6 for the NT to a low of 3.2 for Tasmania, compared with an average 4.2 for Australia. For New Zealand, the benefit/cost ratio is lower on a price basis (2.8) than on a resource cost basis (4.2), because only a third of householders are exposed to volume-based pricing that would enable them to derive a monetary benefit from more water-efficient appliances. In effect, WEL is more cost-effective for the NZ economy as a whole than for individual householders, although householders would also be better off with WEL.

Savings in water services account for the majority of benefits in all jurisdictions, although the value of energy savings ranges from 28% in the ACT to 44% in Tasmania.

Table 26 Estimated costs and benefits by jurisdiction, resource costs perspective

	Costs	Water Benefits	Energy Benefits	Total Benefits	Net Benefits	B/C ratio
NSW	$40.0	$122.4	$38.3	$160.7	$120.7	4.0
Vic	$30.0	$46.6	$21.9	$68.5	$38.5	2.3
Qld	$24.0	$45.5	$25.6	$71.1	$47.1	3.0
SA	$7.2	$17.1	$6.5	$23.7	$16.4	3.3
WA	$14.2	$35.2	$10.6	$45.8	$31.6	3.2
Tas	$2.3	$2.9	$3.0	$5.9	$3.6	2.5
NT	$1.1	$3.4	$0.8	$4.2	$3.1	3.7
ACT	$2.2	$4.3	$1.7	$6.0	$3.9	2.8
Aust	$121.1	$277.5	$108.4	$385.9	$264.8	**3.2**
NZ	$17.9	$51.1	$23.6	$74.7	$56.8	4.2
ANZ	$139.0	$328.5	$132.0	$460.6	$321.5	3.3

Corresponds to Table 21; Medium cost increase. All values $M NPV at 2003, 10% discount rate

Table 27 Estimated costs and benefits by jurisdiction, retail price perspective

	Costs	Water Benefits	Energy Benefits	Total Benefits	Net Benefits	B/C ratio
NSW	$76.1	$189.6	$111.2	$300.8	$224.7	4.0
Vic	$57.2	$139.5	$66.3	$205.8	$148.6	3.6
Qld	$45.5	$114.7	$78.5	$193.2	$147.7	4.2
SA	$13.6	$37.3	$24.5	$61.8	$48.2	4.5
WA	$27.1	$68.0	$30.7	$98.7	$71.5	3.6
Tas	$4.4	$7.8	$6.3	$14.1	$9.7	3.2
NT	$2.1	$7.0	$2.9	$9.8	$7.7	4.6
ACT	$4.2	$10.8	$4.5	$15.3	$11.1	3.7
Aust	$230.3	$574.7	$324.9	$899.5	$669.2	**4.0**
NZ	$33.8	$24.3	$69.2	$93.5	$59.7	2.8
ANZ	$264.1	$599.0	$394.1	$993.1	$729.0	3.8

Correspond to Table 22; Medium cost increase. All values $M NPV at 2003, 10% discount rate

4.2 Industry, Competition and Trade Issues

Supplier and Market Issues

Shower heads

There are many suppliers of shower heads on the Australian market. Only a small proportion of products sold are manufactured (wholly or partly) in Australia, by Con-Serv and Dorf-Clark (Dorf, Caroma, Irwell brands). Nearly all the locally-made shower heads are flow regulated and rate AAA or AA. It is not economical to manufacture non-flow-regulated (AD) style shower heads since these can be imported cheaply from high-volume factories around Asia.

The other specialist shower head brands - Delrana, Dunnings, Ecoshower, Flexispray, Gracott, Interbath and Teledyne – all offer a range of flow regulated shower heads, as do the better known European tapware brands (eg Grohe, Hansa). These are imported from a range of countries, including USA, Germany, Israel, Italy, China and Taiwan. Some suppliers – including the local manufacturers - source models from a number of countries, and may also supply some models packaged as house brands for the major plumbing supply stores.

Some of the major suppliers also offer branded AD showers, generally imported from China or Taiwan. However, a large share of the AD shower market (perhaps the majority) is unbranded or house branded.

Shower heads are sold through a wide range of outlets, both wholesale and retail. The main plumbing supply chains are Tradelink, Reeces, Plumbing Plus and Plumbtech. The store ownership and central buying arrangements all vary. Shower heads and taps are also sold through hardware based chains such as Bunnings, and through appliance and furniture based chains such as Harvey Norman. In addition, there are many specialist bathroom and kitchen design stores that may be part of smaller chains or entirely independent, and many local hardware shops offer at least a few AD type showers and some basic tapware. Other important areas for display are display homes and the showrooms of project builders, who often keep a limited selection of products on hand to illustrate the range of bathroom packages and options they offer.

The range on offer and the mode of display varies widely. Some outlets display showers out of their packaging, on display boards or stands or in full-scale mockups of shower alcoves or entire bathrooms. The shower heads and fittings are fixed to vertical surfaces as if installed, often alongside or above the matching tapware. This mode of display occupies considerable showroom space and requires careful preparation, so is generally restricted to higher value products in retail plumbing and specialist bathroom showrooms.

Customers select the product from the fixed display, and often do not see the actual unit or its packaging until it is delivered, or perhaps only after the plumber installs it. For labelling to be capable of influencing a purchase decision based on open display the labels would have to be either fixed to the shower heads by adhesive, attached to

the unit by a swing tag or attached to the display board next to the shower head. This may be less onerous than for other products since, unlike electrical appliance showrooms, the suppliers often prepare and maintain the displays themselves.

Another common mode of display is "Pick and Pay" – the shower heads are displayed in transparent packages on open shelving, and the customer selects one from the rack and takes it to the pay station. There may be a single unpackaged sample fixed to the end of each rack, but it will generally be in close proximity to the packaged units. Again, the most prominent position for the label would be either fixed to the sample or fixed next to it, but as every customer will take a packaged unit, placing the label information on the packaging would still make it capable of influencing the purchase.

The cheapest shower heads are often displayed in open cartons or bins, without any form of individual packaging, pricing or branding at all. The label information is only likely to come to the attention of the buyer if there is an adhesive label on every unit. Swing tags are not likely to remain attached, and single labels on or next to the carton or bin may not be highly visible in juxtaposition with piles of product. This low-value end of the market is where "disincentive" modes of the label will be concentrated, and there will be considerable temptation for retailers to remove or obscure labels. Clearly, the most effective mode of attachment will be by adhesive.

It has been assumed that there is no reduction in the performance of flow regulated showers compared with that of AD showers, so deterioration of performance does not constitute a barrier to the effectiveness of labelling. This is borne out in recent follow-up surveys for water authority rebate schemes, which have found that a greater share of participants reported an increase in satisfaction with their AAA shower than reported a reduction in satisfaction.

Toilets

The dominant supplier of cisterns and pans on the Australian market, Caroma, a division of GWA International, makes a wide range of sanitary ware (cisterns, toilet pans, urinals, basins, bidets, sinks etc) under the Caroma and Fowler brands, and also supplies house-branded products to the major plumbing supply chains. The company manufactures ceramic sanitary ware in Sydney and in Melbourne, and plastic cisterns and cistern mechanisms in Adelaide. It imports some models from its own factory in Malaysia and exports about 10% of its production to countries including China, Singapore, USA and Canada.

It is estimated that Caroma supplies between 75% and 85% of all toilets sold in Australia. Its main competition is low to medium value imports from China (eg Imperial brand) and high to medium value imports from Europe (eg Duravit, Villeroy & Boch) and the USA (Kohler, Jakob Delafon). Most Caroma and Fowler models, and a few imported models, are registered for labelling under the existing voluntary program.

The introduction of dual flush cisterns has been very successful in reducing water consumption. The share of Australian households with dual flush toilets increased from 39% in 1994 to 64% in 2001. Even if there is no further intervention in the market, it is projected that the AAA share of toilets in use will continue to increase.

However, the AA share is also projected to increase slightly: several 9/4.5 litre models from China have come on to the market in the last few years, and as these are highly cost-competitive it is expected that they will gain some market share.

As Caroma fixes water efficiency labels to its products as a matter of course (the label also appears on the carton), the great majority of both cisterns and toilets already carry water labels, and the overwhelming proportion of those labels are AAA. There is potential for mandatory labelling to influence the market in the following ways:

- It would allow buyers to identify the less efficient AA models, especially among the higher end models which now rarely carry labels;

- It would provide an incentive for the introduction of products more efficient than AAA: ie the 4.5/3 litre models currently sold in Singapore would rate AAAA under AS/NZS 6400, and models rated AAAAA are being trialed.

Labelling is clearly feasible since it is already widespread on a voluntary basis. Labelling may well lead to the introduction of more water efficient 4.5/3 litre dual flush toilets, which are already supplied in other markets, but if so it would be subject to meeting the performance requirements in the Australian Standards, so there is no risk of deterioration of product performance in response to labelling.

Mandatory minimum water efficiency standards (WES) are feasible for toilets, since – unlike the other products within the scope of this RIS – there are at present no products on the Australian market with water consumption higher than the minimum rating level in AS/NZS 6400. In the event that WES is adopted for toilets, there would be a case for rescaling the label ratings, since no model that uses more water than the current AA rating could be sold. One option would be to designate the present AAA rating as AA, and the present AA rating as A.[36]

Clothes Washers

The only two manufacturers of clothes washers in Australia and New Zealand are Electrolux and Fisher & Paykel. Electrolux manufactures top loaders in Australia (sold under the Simpson, Hoover and Kelvinator brands) and also sells (under the Electrolux, Hoover and Simpson Brands) several front loader models imported from Electrolux plant in Italy, Korea, Slovenia and Turkey. Fisher & Paykel only manufactures top loaders, at factories in Australia and New Zealand, and sells all its models under the Fisher & Paykel brand.

At present all front loaders are imported, mainly from Europe, China or Korea. Some of the imports are low price, but many carry a cost premium due to higher overall build quality, more sophisticated controls, wider range of features and brand prestige. Also, average sales per front loader model are only one sixth that of top loaders, so their pricing is at a disadvantage in terms of scale economies: the average sales price of a front loader washer is 50% higher than that of a top loader at present. This could

[36] If so, it may be necessary to set the upper bound of A as 6 litres (rather than the present 5.5 litres) to permit the sale of single-flush cisterns for hospital use.

possibly be eliminated or reversed if labelling succeeds in increasing the market share of front loaders.

The modelling indicates that preference for more water-efficient models within the same type contributes nearly three quarters of the water savings, and the greater preference for front loaders about one quarter. This means that the water label has to work effectively as a comparative label, not just as an endorsement label for front loaders, if the full water saving potential of clothes washer labelling is to be realised.

Water labelling of clothes washers is clearly feasible since it already exists on a voluntary basis, alongside the mandatory energy label. Clothes washers have large flat surfaces, so the placement of two mandatory labels of roughly equal size on the product should not be difficult. Suppliers should be given the option of printing the two images on the same label (side by side or one above the other), but in this case there should be an ordering protocol – perhaps with the water label dominant (in the left or upper position) because water now represents the greater part of typical clothes washer operating costs.

One issue related to the clothes washer tests in AS/NZS 2040 and the rating algorithms in AS/NZS 6400 would need to be resolved before the introduction of mandatory WEL. There is at present no rinse performance test, and some suppliers are said to be over-stating water efficiency at the expense of rinse performance. This temptation would be greatly increased if labelling were made mandatory in the absence of a rinse performance test. Standards Australia is currently working on such a test, with funding support from the Department of the Environment and Heritage, and it is likely to be in place by mid 2004.

Dishwashers

The majority of dishwashers sold in Australia are manufactured by Electrolux (Dishlex, Kelvinator, Westinghouse and Simpson brands) or in New Zealand by Fisher & Paykel. There are several imported brands on the market, mainly from European countries but also from Korea and, more recently, China.

A recent change in the energy labelling standard for dishwashers could change both the energy and water ratings of some models. Before the recent publication of *Performance of household electrical appliances – Dishwashers: Part 2: Energy labelling requirements* (AS/NZS 2007.2:2003) the energy and water efficiency of dishwashers was tested on whatever program the supplier nominated. The new standard specifies that the washing and drying performance requirements must be met on the program which the manufacturer recommends for a normally soiled load.[37]

The energy test method itself (AS/NZS 2007.1:2003) has also been substantially revised. All current model dishwashers remaining on the Australian market after 1 April 2004 will need to be tested to the new test standard.

[37] While the actual program nominated for energy labelling will change on some models, in other cases suppliers may reprogram models to redesignate the program previously nominated as "normal".

AS/NZS 6400 specifies that the same program is to be used for water efficiency labelling purposes as for energy labelling, so any retesting of dishwashers for energy rating purposes would automatically lead to the revision of many of the water efficiency ratings issued. The lead time for the introduction of mandatory WEL should be sufficient to cover the time required for this retesting.

Water labelling of dishwashers is clearly feasible since it already exists on a voluntary basis, alongside the mandatory energy label. Dishwashers have large flat surfaces, so the placement of two mandatory labels of roughly equal size on the product should not be difficult.[38] Suppliers should be given the option of printing the two images on the same label (side by side or one above the other), but in this case there should be an ordering protocol – perhaps with the water label dominant (in the left or upper position) because energy labelling is already well established, and the profile of water efficiency needs to be raised.

Energy labelling has been more effective for dishwashers than for any other labelled product (GWA 1999). Suppliers and buyers have tended to attach more importance to higher energy label star ratings for dishwashers than would be warranted solely on the basis of the monetary value of each additional star rating. This is partly because dishwasher buying households tend to have higher incomes and higher levels of education, but also because dishwashers are still seen as a luxury more than a necessity, and purchasing a more energy-efficient model ameliorates the residual guilt of the purchase. It is likely that buyers would have a similar reaction to indications of water-efficiency.

Urinal flush mechanisms

The two main suppliers of urinal flush mechanisms are Zip Industries and Caroma. The performance of a urinal flush system depends on the combination of up to three elements – the stall, the flush valve or cistern and, in some cases, the remote sensor which activates the flush. Mandatory registration will make information about the performance of all available combinations accessible to building designers. Suppliers may also choose to label the packaging of components that are sold together.

Taps

If a tap corresponds *exactly* to a product type described in AS/NZS 6400 (and is clearly marked with the intended use, as required), the supplier should have the option of labelling it, on the condition that it would then take on the regulatory obligations.

The 77 models registered with WSAA for voluntary labelling represent only a small fraction of what is on the market. The manufacturers with models registered are Enware (made in NSW) Galvin (made in WA), Hansa (Germany) and Samwon (Korea). Other tapware brands on the Australian market include Caroma, Centique, Dorf, Donson, Flexispray, Fowler, Greens, Heirloom, Irwell, RAM, Raymor and Starion.

[38] The 2003 edition of AS/NZS 2007 recognises that some premium models with stainless surfaces can be marked by the adhesion of a label and the standard will allow a double-sided swing tag or a single sided non-rotating swing tag. Similar arrangements could be made for water labels.

Some suppliers offer locally made as well as imported products, while others offer imports only. Some suppliers supply house-branded products to the plumbing products chains, and some of the chains import products directly themselves.

Flow Regulators

The number and types of flow regulators sold annually as separate items or as part of flow controlled showers and taps is not known. The suppliers include Aqualoc, JEM and Neoperl, which also supplies most of the flow regulators used in low-flow showers manufactured in Australia. Most of the flow regulator sold in Australia are imported.

Mandatory WEL will raise buyer awareness of the water efficiency of plumbing products and should increase the market for flow regulators, as part of water-efficient shower and tap assemblies and in their own right. This should reinforce the incentive for suppliers to register and label their products.

Impacts on Industry Participants

Manufacturers and Importers

Mandatory WEL will apply equally to products manufactured locally (ie in Australia and New Zealand) and to imported products. All firms will initially need to follow the same steps leading up to implementation:

- Take note of the regulations and standards (when finalised) applying to the products they supply, and the intended commencement date;

- Ensure that all models or model families are tested for water consumption on the standard test (it is likely that the regulations will permit initial tests to be carried out in suppliers' own laboratories, but compliance check tests initiated by the regulator will be carried out by accredited independent laboratories);

- Register the product and its performance characteristics with the program regulator in advance of the commencement date;

- Devise a system for ensuring that the labels are displayed as required at the points of sale on and after the commencement date: this may involve fixing a label to every product in the factory, changing packaging designs to incorporate the label image, or setting up a procedure to ensure that product displays incorporate the correct labels.

Manufacturers and importers of clothes washers and dishwashers tend to be larger firms, are already familiar with these processes through the energy labelling program, and are well placed to implement water labelling at minimal additional cost. Similarly, toilet suppliers are large firms with a high rate of participation in the current voluntary WEL program, and should be able to adjust to WEL at minimal cost.

Pure importers will need the full year to respond, since the new standards tests and labelling requirements will need to be communicated to their overseas suppliers. Both manufacturers and importers have indicated that a year's notice between finalisation of the regulations and commencement of labelling should be adequate.

Importers will need to ensure that products are labelled correctly, either at the point of origin or after import. For rated showers (ie those having a flow rate of less than 15 l/min and meeting the flow stability and other performance requirements) it will be necessary to ensure that the label matches the product, and the best way to ensure this would be to label the products in the factory, or adopt a form of clear display packaging which makes separate labelling necessary only for those few units that are taken out of the package.[39] Non-rateable showers, which currently account for the majority of sales, will only have to carry the disendorsement message label. As it will not be necessary to differentiate between models, adding the labels in the warehouse or even in the retail store can done at relatively low cost.

The costs associated with initial compliance are likely to be moderate, and unlikely to cause any participants to withdraw from the market.

As WEL increases its influence on consumer preference, the relative advantage of manufacturers and importers will depend on the water-efficiency of their product ranges. Manufacturer and importers that only offer products of low water-efficiency will obviously be disadvantaged, and may need to cut prices and margins to retain market share. However, most manufacturers and importers have access to a range of products with different levels of water efficiency, and can switch their production or source different models from their overseas suppliers to meet changing demand. All of the local manufacturers already offer products at the higher end of water efficiency, so should be well placed to respond to the marketing opportunities offered by the introduction of WEL.[40]

The demand for more water-efficient models is likely to drive up the average retail price of the labelled products, so supplier revenues should increase by far more than the costs of testing, registration and labelling.

Retailers

The revenues of wholesales and retailers should increase to some degree as the average retail price of the labelled products rises.

Retailers will also incur some costs, from:

- Training staff to understand and explain the water label;

[39] One cost-effective way for retailers to deal with such situations would be cut out the label image from the package and fix it to the display model as a swing tag.

[40] All ANZ-manufactured shower heads have high water-efficiency ratings. All ANZ-manufactured toilet suites have the highest rating. ANZ-manufactured top-loader clothes washers all have medium to high ratings. There are no ANZ-made front loaders at present. ANZ-manufactured dishwashers all have medium to high ratings.

- Ensuring that all products displayed carry a label (the absence of a label will be a readily verifiable breach of the proposed regulation); and

- In some cases, actually affixing the labels in the store.

Retailers will probably wish to negotiate arrangements with their suppliers whereby the retailer's workload and room for error is minimised.

Again, those retailers which carry at least some water-efficient models will be advantaged, while those that specialise in low-cost products with low water efficiency will be disadvantaged. In general however retailers have more flexibility than manufacturers or importers to alter their model ranges at short notice, so they should be less impacted by shifts in consumer preference, provided these are not so abrupt as to leave them with hard-to-sell stock. As the awareness of water labels is likely to build up gradually rather than abruptly, retailers should have ample time to sell their old stocks and to order in more water-efficient models. This lead time can be increased through the awareness programs that will need to be implemented for the retail sector as soon as the regulations are finalised.

Impacts on supplier competition

The implementation of mandatory WEL is not likely to lead to either significant increase or decrease in the number of manufacturers, importers, wholesalers or retailers regularly supplying the market for water-using fittings and appliances. The major impact will be on firms who occasionally import low-cost and/or less efficient plumbing fittings. Such firms may not be aware of the compliance obligations, since their participation in the market is irregular, and if aware, may be tempted to risk non-compliance rather than go to the cost of testing, registration and labelling.

The overall market share of unaware, deliberately non-complying and exempt firms is likely to be negligible. Any market advantage from avoiding labelling costs is likely to be more than outweighed by increasing consumer wariness of unlabelled products, and by the fact that such firms will forgo the price premium that more water-efficient products will be able to command.

While the requirements apply equally to imported and locally manufactured products, it is likely that some overseas manufacturers will not bear the costs of registering, testing and labelling their products to service a market as small and disparate as Australia. Therefore, importers of products will most likely face the cost of registering, testing and labelling products. These "fixed" costs will impact more heavily on small volume imports, possibly discouraging their supply to Australia. Hence the proposal is more accurately described as 'potentially anti-competitive' than 'competition-neutral'. But the benefits of potentially restricting competition would more than offset the costs.

Alternatively, there is also a possibility that specialist suppliers of more water-efficient product could be drawn into the market because mandatory WEL will increase greater buyer sensitivity to water efficiency differences. Also, very few importers of plumbing fittings have only a single model. Most supply a range of

products of different levels of water efficiency, and the proposal will tend to make them revise their product ranges rather than withdraw from the market.

As the purpose of WEL is to overcome information failure in the market, competition between products should be enhanced, since water-efficiency will become a stronger factor in product differentiation.

On balance, the effect of the proposed mandatory WEL program on supplier competition is likely to be so small as to be effectively competition-neutral.

Plumbers and builders

The impact of WEL on plumbers and builders is likely to be gradual. These groups will still be free to select or recommend products irrespective of water efficiency, as many do now, and will be able to remove the water efficiency labels before the end users see it. Indeed, plumbers or builders who install non-rateable showers that by law will have to carry the disendorsement label at time of sale will almost certainly wish to remove the label before handing over the building or the installation to the user, in order to avoid having to justify their selection of low-efficiency fittings.

On the other hand, plumbers or builders who install highly-rated products may wish to leave the label on, and even call the end user's attention to it.

Over time, as more householders are exposed to the water label, they will inevitably take greater interest in the water-efficiency of products recommended by or installed by plumbers and builders. This will assist those plumbers and builders who take an interest in, or seek competitive advantage from, advising clients on water- and energy-efficient products. There are already a number of programs under way to raise plumbers' awareness of product water efficiency, including the Green Plumbers program run by the Master Plumbers and Mechanical Services Association of Australia, with funding from the Australian Greenhouse Office. Such programs provide an ideal vehicles for making plumbers aware of the details of the proposed regulations.

Building Specifiers and Regulators

The register of products will be of considerable value to building specifiers and regulators. As market demand and public policy pressures for greater resource-efficiency in buildings increases, specifiers are being called on to ensure that designs incorporate products of acceptable water-efficiency, and to certify this to building approval authorities. The existence of an approved list of the water-efficiency of all products will enable parties to meet these requirements at minimal cost.

Water Services Authorities

WSAA is a major stakeholder in the existing voluntary WEL program, and is a strong supporter of the introduction of a mandatory WEL program. Many of the water services authorities that are WSAA members face rapidly increasing demand for water services on the one hand, and major impediments to augmentation of supply and wastewater capacity on the other. Some water authorities are subject to formal

government-endorsed water conservation targets. WSAA has expressed its commitment to programs which are likely to significantly increase the efficiency of water use, even if there are short term revenue loss implications for its members.

The feasibility study (GWA et al 2003) found that the actual and potential effectiveness of the existing voluntary scheme in improving sales-weighted water-efficiency of products is limited, partly because it does not include low-efficiency products, but also because of deficiencies on the rating algorithms and the label design itself. On the other hand, the fact that it is linked to government and water authority rebate programs *increases* its effectiveness, since this provides a commercial incentive for suppliers to participate.

Whether or not the current voluntary labelling program continues to be effective up to the time the regulated scheme is introduced is largely in the hands of the government agencies and water authorities that support the voluntary scheme. Buyers will not be aware of the impending introduction of a new scheme or a new label until it is actually introduced, and until then will have no reason to change their response to the voluntary labels or to the incentive schemes linked to them. The water authorities will have as much notice as product suppliers to plan for the termination of incentive schemes using the current label and the introduction of new schemes based on a new label. In fact, a new label will provide an opportunity to increase public interest in and hence cost-effectiveness of incentive schemes.

The introduction of mandatory WEL will be in the interest of WSAA members in two key ways. It would be in their commercial interests in that they would no longer need to pay incentives for suppliers to participate on a voluntary basis. If they still wished to offer incentives for customers to select more efficient appliances, they could do this no less effectively under a mandatory program, whatever methods of rating and labelling were adopted.

Secondly, a nationally mandated WEL program – with the option of nationally mandated WES - is likely to be far more effective in containing growth in water consumption than the existing voluntary WEL program and state-based regulations on plumbing work.

Compliance Issues

WEL Compliance

The obligations on parties supplying products subject to the regulation are:

1. To ensure that all models of products subject to mandatory registration are registered;

2. To ensure that the information provided to the regulator in support of registration is correct;

3. To ensure that all models of products subject to mandatory labelling are labelled;

4. Where the option of labelling is taken up, to first register the models in question with the regulator;

5. To ensure labelled models carry the correct label (ie the one corresponding to that model), that the information on the label corresponds with the information on the register, and the label meets the requirements (eg size, colour, shape, graphic elements, position on the product etc) of the regulation, which will call up these details from AS/NZS 6400;

6. Not to use any label purporting to indicate the water consumption or efficiency of any product subject to mandatory or optional labelling, other than the approved water-efficiency label. (Suppliers may provide additional general information, eg how the water efficiency performance of the product may be enhanced if installed or used in a certain way or in combination with other specified products, but cannot make statements about the quantity of water that would be saved, unless this has been substantiated by tests undertaken to appropriate Australian and New Zealand Standards);

7. To change registrations when product characteristics are significantly altered, cancel registrations when products are withdrawn from the market, or re-register products if they remain on the market after the 5 year registration period.

The most obvious form of non-compliance would be the absence of a label from a product of a type for which mandatory labelling is required. This can be determined by any person inspecting the product. Such breaches are likely to be detected in retail showrooms in the first instance, but retailers able to substantiate that the product had been supplied to them unlabelled may have a legitimate defence (unless they had themselves imported the products directly, or had been provided with the labels but had not applied them).

The detection of other forms of non-compliance will require at least the matching of the model numbers on the label with those on the product and, ultimately, the commissioning of technical tests to verify the accuracy of statements made by the supplier about the product. It has been assumed for the purposes of the cost-benefit analysis that the regulator will spend about $100,000 per year on check testing, sufficient for between 75 and 100 product tests. Since there will probably be between 1500 and 2000 models on the register at any given time this implies one test for every 20 products, but in fact the effort is likely to focus on products which are brought to the regulator's attention by consumer groups or by competing suppliers.

Because of variability in the production processes, it is possible that a test on a random sample will return a higher or lower level of water efficiency than the value claimed at registration. AS/NZS 6400 will include procedures for testing one or more additional samples, and for averaging or otherwise combining the results of tests, to determine the point at which verified performance deviates from stated performance.

The Regulator will set out the procedures to be followed once it is established that a breach has indeed occurred. Suppliers may generally be given the opportunity to explain the discrepancy and if necessary rectify it by registering and issuing an amended label, withdrawing all incorrect labels, etc. The obligation to rectify would

apply even if the labelling were optional in the first place – a breach could not be expiated solely by removing labels or by withdrawing that product from the market.[41]

Interaction with State Plumbing Regulations

The plumbing regulators have argued that the proposed WEL regulations should ensure that no products may be sold that do not meet the requirements of AS/NZS MP52 *Manual of Authorisation Procedures for Plumbing and Drainage Products*. These specify, among other things, that licenced plumbers should not install products that cannot obtain a rating of A or higher under the current rating system in AS/NZS 6400, and that product must also comply with a range of other standards regarding performance and materials.

The proposed regulation is intended primarily to correct market failures that lead to higher costs of water services and lower efficiency of water use than otherwise. The regulation it is not intended to reinforce existing State plumbing regulations – the costs and benefits of such a course of action are outside the scope of this RIS. The enforcement of MP52 would in effect impose immediate water efficiency standards on products for which a case for WES remains to be established, and in the case of shower heads would prevent the sale of models which currently account for over 60% of the market (see Table 2). It is necessary to leave such products on the market in order to meet the needs of households with low pressure supply.

Nevertheless, even though the proposed regulation would not invoke or enforce state plumbing regulations:

- The proposed regulation does not conflict with state plumbing regulations;
- The public registration of products for the purposes of the proposed WEL scheme will greatly assist State regulators to enforce their regulations; and
- The market share of products not meeting MP52 is likely to fall, so the proposed WEL scheme will serve the objectives of the plumbing regulations.

Under the proposed regulation, shower heads which are unrateable on the water efficiency test could still be sold, but only with a mandatory disendorsement label. If a shower head would have a water efficiency rating of A or better but fails some other aspect of performance invoked in the water efficiency test, then it could still be sold, but only with the mandatory disendorsement label.

For toilets, there is enough information about the market to be confident that the adoption of WES would impose no costs on the community, is consistent with standards developments among Australia's trading partners, and would eliminate the risk, however slight, of future deterioration in the water-efficiency of toilets offered for sale. However, the recommended WES level is not A, as in the plumbing

[41] A breach of labelling requirements in the case of optional labelling should not be capable of expiation solely by withdrawing the product from the market in the event that the supplier wishes to avoid the expense of relabelling, given that the supplier may have gained a significant market advantage from the incorrect label. A fine may be appropriate in such cases.

regulations, but a slightly more stringent level corresponding to 5.5 litres weighted average flush (as defined in AS/NZS 6400).[42]

For dishwashers and clothes washers, it is envisaged that the water-rating scale would accommodate all models, however low their water–efficiency. In mid 2003, only three clothes washer models (less than 1% of the models on the market) and no dishwasher models had a water consumption too high to meet the A rating. This could change once the rinse performance test is introduced for clothes washers and dishwashers are retested to the newly revised standard. For the time being, there is no case for adoption of WES at any water-efficiency level, so the bottom end of the rating scale should be open.

There are already additional consumer safeguards applying to clothes washer and dishwasher performance in that products which cannot meet minimum washing and drying performance standards cannot meet mandatory State energy labelling requirements and cannot therefore be sold. It is **not** intended that failure to meet any additional performance requirements that may be invoked by cross-reference to MP52 should exclude a clothes washer or dishwasher from the market under the proposed WEL regulations.

In the case of products for which WEL registration and labelling are optional, products could not qualify for such registration and labelling unless they meet all requirements of AS/NZS 6400, including those invoked by cross-reference to MP52.

Trade Issues

GATT issues

One of the requirements of the RIS is to demonstrate that the proposed test standards are compatible with the relevant international or internationally accepted standards and are consistent with Australia's international obligations under the General Agreement on Tariffs and Trade (GATT) *Technical Barriers to Trade* (GTBT) Agreement. The relevant parts of the GTBT *TECHNICAL REGULATIONS AND STANDARDS Article 2: Preparation, Adoption and Application of Technical Regulations by Central Government Bodies* are addressed below.

The regulations would apply equally to imports and locally manufactured products, and so do not discriminate against imports.

It is a particular concern of the GTBT that where technical regulations are required and relevant international standards exist or their completion is imminent, member countries should use them, or the relevant parts of them, as a basis for their technical regulations. There are no accepted international test standards for product water

[42] The current A rating specifies a weighted flush volume (1 full and 4 reduced flushes) of not more than 6.5 litres and lot less than 5.5 litres. It is proposed to reduce the maximum weighted average flush to 5.5 litres. This would allow the existing 9/4.5 units (with a weighted average flush volume of 5.4 litres) to stay on the market, but would exclude single flush toilets of 9 and 6 litres which could conceivably be imported without the proposed WES. It would allow the import of most units complying with US, UK and Singapore regulations.

consumption, so the proposed use of AS/NZS 6400 as the basis for testing does not create a conflict.

The GTBT urges GATT members to give positive consideration to accepting as equivalent the regulations of other members, even if these regulations differ from their own, provided they are satisfied that these regulations adequately fulfil the objectives of their own regulations. In this respect, toilet suites meeting the minimum water efficiency standards of the USA and Singapore – which are at least as stringent as those proposed in the regulation - would be acceptable for sale in Australia, provided they met all other statutory requirements.

The results of water consumption tests conducted in other countries would be acceptable in the first instance, provided that AS/NZS 6400 were used as the basis of testing and the laboratory did not have a history of unreliable results (this principle is used in the mandatory energy labelling program). Check tests could also be carried out in other countries, but only in laboratories accredited by a testing authority recognised by the National Association of Testing Authorities (NATA).

In summary, the proposed regulations are not inconsistent with the GATT *Technical Barriers to Trade* Agreement.

TTMRA

The Trans-Tasman Mutual Recognition Agreement (TTMRA) states that any product that can be lawfully manufactured in or imported into either Australia or New Zealand may be lawfully sold in the other jurisdiction. If the two countries have different labelling requirements for a given product, the less stringent requirement (which may be no label at all) becomes the defacto level for both countries unless the one with the more stringent requirement obtains an exemption under TTMRA.

New Zealand has indicated, through its membership of the EPHC, its intention to also implement the mandatory WEL program. The present RIS indicates that mandatory WEL is likely to be cost-effective for New Zealand as well as for Australia (even though the proportion of householders exposed to volume-based water charges is much lower in New Zealand). [43] It is assumed that the technical basis of the two programs will be harmonised through use of the joint standard AS/NZS 6400.

In the event that New Zealand does not implement the program at the same time as Australia, there will be scope for products imported from New Zealand to be sold unlabelled in Australia, unless the Australian Government obtains an exemption from the provisions of the TTMRA Act until such time as mandatory WEL takes effect in New Zealand. However, the risk of this occurring is minor even without a TTMRA exemption, because for the categories of products that would be subject to mandatory WEL, firms exporting from New Zealand to Australia would have every commercial incentive to label.

[43] This would not necessarily make New Zealand householders less inclined to purchase more water-efficient products. The consumer research for the design of the water label, which included some focus groups in New Zealand, found that responsiveness to the water label was not closely connected to awareness of water prices.

Even if New Zealand-made clothes washers and dishwashers, which have a significant share of the Australian market, could be lawfully sold without labels, the manufacturer (Fisher and Paykel) is likely to participate voluntarily, as it participates in the current voluntary labelling program and its products have relatively high water efficiency ratings.

There are no exports from New Zealand to Australia of the types of toilets that would be covered by the WEL regulations (there are some exports of specialised self-cleaning public toilet assemblies and earth closet kits, which are not covered).

To sum up, while harmonisation of WEL requirements and implementation timetables between Australia and New Zealand would be desirable, lack of harmonisation would not seriously threaten the integrity or effectiveness of the program in Australia.

International Standards

The only known water efficiency labelling program in operation at present, other than the WSAA label, is run by the Dublin Region Water Conservation Project in Ireland: this is a voluntary label covering clothes washers and dishwashers.[44] The US Environment Protection Agency has also recently expressed an interest in WEL (according to information from DITR).

Some countries have mandatory minimum water efficiency standards for water fittings, although these are less common than minimum energy performance standards. The US Energy Policy and Conservation Act, as amended (EPCA), requires the Department of Energy (DOE) to administer an energy and water conservation program for certain appliances and plumbing products, including shower heads, water closets and urinals. The maximum water use for toilets is 1.6 US gallons (6.0 litres) per flush (10 CFR Part 430, Federal Register, 18 March 1998). The EPCA also mandates a maximum flow rate of 2.5 US gallons (9.5 litres) per minute for showers, at a pressure of 80 psi (552 kPA).

The UK Water Regulations Advisory Scheme, which took effect on 1 July 1999, states that "no flushing device installed for use with a WC pan shall give a single flush exceeding 6 litres" (*Water Regulations Guide*, First Edition 1999).

Singapore has required cisterns of no more than 4.5 litres per flush to be installed in all new public housing apartments since 1992. With effect from April 1997, installation of low flush toilets was made mandatory for all new premises including all residential, hotels, commercial buildings and industrial establishments. Caroma has developed a 4.5/3 litres dual flush model specifically for the Singapore market.

The adoption of the proposed mandatory WEL does not appear to conflict with water labelling requirements elsewhere. Similarly, the proposed WES for toilets do not conflict with, and are no more stringent than, such standards as exist overseas.

[44] see www.codema.ie

5. Consultations and Review

5.1 Consultations

Chronology of Previous Reports and Consultations

The investigation of mandatory WEL was initiated by the Department of the Environment and Heritage in late 2002. The contract for a Feasibility Study was awarded to a consortium led by George Wilkenfeld and Associates, authors of the present RIS.

In January 2003 the consultants issued a public discussion paper canvassing the main issues, for use as a basis for consultations with stakeholders (GWA 2003a). Between January and April 2003 the consultants held individual meetings, telephone discussions or meetings with the representatives of the following groups and companies (the participating individuals are listed in GWA et al 2003):

- Water industry regulators from several States, who were consulted directly or via the National Plumbing Regulators' Forum;

- The Water Services Association of Australia (WSAA), which represents the major urban water utilities. Its 24 member organisation collectively supply water services to 13 million people. Several meetings were held with individual officers, subgroups and subcommittees of WSAA, including with the managers of the existing voluntary labelling program;

- The Australian Tapware & Plumbing Manufacturers Association (AUSTAP), which represents the local manufacturers of tapware, some of whom also make shower heads;[45]

- The Australian Electrical and Electronics Manufacturers Association (AEEMA), which represents the Australian and New Zealand manufacturers of household appliances, including clothes washers and dishwashers (ie Electrolux and Fisher & Paykel);

- The Consumer Electronics Suppliers Association (CESA), which represents importers of household appliances, including clothes washers and dishwashers. Members include Maytag, Robert Bosch, Philips, Hitachi, Sanyo, Samsung, NEC and Sharp;

- The Master Plumbers' and Mechanical Services Association of Australia (MPMSAA);

[45] AUSTAP's member companies are ABB Metering Pty Ltd, Award Bathrooms, CB Ideal Tapware, Consolidated Extrusions, Crane Group Limited, Dorf Clark Industries Limited, Enware Australia Pty Ltd, Galvin Engineering Pty Ltd, Greens Industries, Kembla Plumbing Fittings, Ramtaps Pty Ltd, Reliance Worldwide and Ryemetal Pty Ltd.

- The water supply authorities consulted were ACTEW Water, Brisbane Water, City West Water (Melbourne), Melbourne Water, SA Water, Sydney Water and WA Water Corporation. Several others were approached but were not able to arrange meetings;

- Several manufacturers and importers of shower heads, taps, toilets, urinals, flow control valves, clothes washers and dishwashers; and

- Two major plumbing product retailer chains.

A Feasibility Study Draft Report was released at a one-day public forum in Melbourne on 11 April 2003. The forum was advertised in the national press, and all parties who had been consulted were invited directly. There were 40 participants (in addition to the consultants and DEH staff). These are listed in the Feasibility Study Final Report.

All forum attendees on 11 April were given a copy of the Feasibility Study Draft Report, which was also published on the websites of DEH and of the consultants. Written comments and responses to the Draft Report were invited, and 11 responses were received by May 27. The submissions are summarised and addressed in the Feasibility Study Final Report, which was completed and published on the DEH website in June 2003.

Further consultations since the completion of the Feasibility Study in June 2003 have included:

- Two further meetings with WSAA;

- Two further meetings with representatives of AEEMA and CESA;

- A further meeting with AUSTAP;

- A further meeting with the Plumbing Industry Commission;

- Three further meetings with individual manufacturers;

- Participation in seven days of meeting of Standards Australia committee WS-032, which manages AS/NZS 6400[46], to discuss the technical basis of the proposed regulation and begin drafting a revised AS/NZS 6400;

- Participation in a new Standards committee to discuss the possible future inclusion of hot water systems in the WEL program once a "water wastage" test is agreed;

[46] The following organisations are represented on WS-032: AUSTAP, Australian Industry Group, Building Code of Australia, CESA, CSIRO, Department of Land and Water Conservation (NSW), Environmental Protection Agency (Qld), Institute for Sustainable Futures, Master Plumbers Association, NATA, Natural Resources and Environment (Vic) , NZ Water and Wastes Association, Master Plumbers, Gasfitters and Drainlayers NZ, Queensland Brass Manufacturers Association, Sustainable Energy Development Authority (NSW), Victorian Water Industry Association and WSAA. The Department of Environment and Heritage (Australia) has recently joined WS-032.

- Participation in a workshop convened by WSAA on the possible development of a "Smart WaterMark" endorsement label for garden irrigation systems;

- Participation in a meeting of manufacturing, retail and plumbing industry stakeholders in South Australia, convened by the SA Government.

Points raised in Consultations

Most parties consulted actively supported the introduction of a mandatory WEL program and none opposed it.

Many of the water authorities and the plumbing industry regulators also advocated the immediate introduction of:

- Mandatory water efficiency standards; and

- Mandatory performance standards to enforce compliance with MP52, ie aspects of plumbing fitting safety and performance not directly related to water consumption.

The manufacturers of appliances (clothes washers and dishwashers), while supporting mandatory WEL, are opposed to WES for the time being and particularly opposed to the use of WEL or WES as a way of ensuring compliance with MP52.

The water authorities and plumbing industry regulators initially advocated the inclusion of all products currently covered in AS/NZS 6400 in a mandatory WEL scheme, but accepted the exclusion of taps, flow control devices and urinal flushing systems on the grounds of practicality, enforceability and cost-effectiveness. Manufacturers and importers (including those supplying dishwashers) support the proposed scope of the program as summarised in Table 11, including the concept of optional labelling for some products.

There is broad agreement that the water consumption tests should be based on those in AS/NZS 6400, but with some improvements and modifications. There was some disagreement between the water industry and plumbing regulators on the one hand, and the appliance industry on the other, about the allocation of responsibility within Standards Australia for the water efficiency algorithms and labels for appliances, but this has since been resolved.

There were also divergent views on the most effective format for the water label itself. The water industry wanted many of the elements of the existing label retained, whereas the manufacturers of toilets, clothes washers and dishwashers supported a redesigned label along the lines proposed in the Feasibility Study. Further consumer research since the feasibility study has now convinced nearly all stakeholders of the value of introducing a new label design. The appliance manufacturers want the water label to be integrated with the energy label as much as possible, but accept the case for a separate label image that is consistent across plumbing fittings as well as appliances.

Several respondents emphasised the importance of allocating resources to monitoring and enforcing compliance, whatever regulatory framework might be adopted.

Proposed public consultations on the RIS

The Department of the Environment and Heritage proposes the following publicity and consultation process for this RIS:

- Posting the RIS on the DEH internet site;
- Advertising in national press the availability of RIS;
- Advising known interested parties (ie all those who have been involved in meetings and consultations) of the availability of the RIS;
- Receiving written comments for a period of 4 weeks after the release of the RIS.
- Responding to comments received on the RIS.

Additional public consultation is planned once the proposed regulations are finalised.

5.3 Public Comments on the RIS

[To be completed after public consultations]

5.3 Review

The initial scheduling of products for mandatory registration, mandatory labelling and mandatory minimum water efficiency standards is covered in the present RIS. Regular reviews of the scheme's operation will be necessary in order to:

- Review impacts on consumers: are buyers aware of the labels and product listings, interpreting them correctly and using the information as part of the purchase decision as intended?
- Review compliance levels: the incidence of non-labelling, the incidence of incorrect labelling etc;
- Review the impacts on suppliers: are there unforseen difficulties or burdens, trade implications etc?
- Monitor trends in product water-efficiency;
- Consider the case for changing the labelling requirements for products, eg from optional to mandatory labelling (or vice versa);
- Consider the case for minimum performance standards for the products scheduled;

- Consider the case for including additional products in the program (eg evaporative air conditioners, cooling towers, water heaters etc);

- Consider the adequacy of tests and algorithms, and manage re-scaling if required to maintain the commercial incentive for suppliers to keep increasing water-efficiency;

- Review the design and effectiveness of publicity, the public register and the other communication aspects of the program;

- Review the overall operation and cost-effectiveness of the program.

The nominal Water Efficiency Regulator will be *ex-officio* the Secretary of the Department of the Environment and Heritage, who will head an advisory committee comprising State, Territory and New Zealand officials, analogous to the National Appliance and Equipment Energy Efficiency Committee which manages the energy labelling and minimum standards programs.

There will also be advisory committees comprising the other stakeholders.

The Department of the Environment and Heritage intends that there will be annual reviews of the operation of the program, with public workshops and opportunities for stakeholder involvement, on the lines of the annual NAEEEC Forum.

Decisions regarding the administration and review of the WEL program will be initiated in the first instance by the Regulator. Major changes such as changes to the scheduling of products will be subject to determination by the Minister, with the usual provisions for review and disallowance by Parliament.

The proposed review processes should give stakeholders adequate opportunity to monitor, comment on and participate in the management and evolution of the WEL scheme.

6. Evaluation and Recommendations

6.1 Assessment

The desired policy objective of the proposed regulation is to bring about reductions in the consumption of water in households and in non-residential buildings in Australia (and in New Zealand) below what it is otherwise projected to be (ie the "business as usual" case), in a manner that is in the community's best interests.

The secondary objectives are to bring about reductions in the energy use associated with water use and the environmental impacts associated with both water and energy use, below the BAU case.

The following options for achieving the objectives were considered in this RIS.

1. Status quo (termed business as usual, or BAU): this includes the likelihood that the current voluntary water efficiency labelling will be maintained at about its present level;

2. The proposed regulation, providing for the introduction of mandatory registration of the water efficiency of selected products, the mandatory water efficiency labelling of selected products and the introduction of mandatory water efficiency standards for toilets from a target date of mid 2005, and providing for the possibility of the introduction of mandatory water efficiency standards for additional products in the future (see product summary, Table 11);

3. The development of a voluntary agreement between industry and government on labelling;

4. The use of economic instruments such as increasing the cost-reflectiveness of water pricing, or customs duties or tax rates which influence the relative prices of water-using products according to their water efficiency.

The following section reviews each option against the criteria in section 2.2 Assessment Criteria.

Reduce water consumption below business as usual

The proposed regulation is the only one of the options likely to be effective in reducing water consumption below BAU. Voluntary labelling already exists, and changing the nature of the agreements supporting it is not likely to increase its effectiveness.

Economic instruments could be complementary to, but not substitutes for, the proposed regulation. Increasing the cost-reflectiveness of water pricing would have some impact on water demand, but end users would still require product information to respond effectively.

The proposed regulation is the only one of the options for which impacts, costs and benefits can be quantified. The benefit/cost analysis indicates that the proposal is likely to be cost-effective under a wide range of assumptions, and so meets the community interest test.

Reduce other environmental impacts below business as usual

The consumption of energy (for water heating and pumping) and the emissions of energy-related greenhouse gases would be reduced in proportion to the reduction in freshwater demand, and these impacts have been quantified in the analysis. It is assumed that the production of wastewater would be reduced in direct proportion to the reduction in freshwater demand, although this relationship would be modified if greywater recycling (eg use of wastewater on gardens) became widespread. Therefore the environmental impacts of wastewater disposal, whatever the level of treatment, would also be reduced.

The costs or environmental impacts of the proposal outside urban water supply systems have not been assessed, but any reduction in urban water demand should increase the availability of fresh water for other purposes, whether for agriculture or environmental flows in natural waterways.

Address market failures

The proposal addresses information failure in the market for household water services. It does this much more effectively than voluntary labelling, since poor performers will also have to be labelled. It does not directly address the split incentives problem (except for toilets) since plumbers and builders will still be free to select less water-efficient products and remove the label before the end user sees it, but the proportion of purchase decisions in which customers take a direct interest should increase, so putting pressure on intermediaries to select water-efficient products.

The split incentives problem should not be exaggerated, since the majority of products that carry mandatory WEL labels will be purchased by users rather than intermediaries. Nearly all clothes washers and most dishwashers are user-purchased. Even for showers and WCs, at least half would be purchased by users, since about two thirds of showers are purchased at the time of renovation or are deliberately changed by the user (see Table 2), and about 60% for WCs (Table 3).

Given the proportion of user purchases, *effective* information labelling would be capable of influencing the majority of purchases of water products, and mandatory labelling would be far more effective than voluntary labelling.

There are two reasons for this – coverage and rating spread. At present coverage is low and rating spread is narrow. For example, only 18% of clothes washer models are labelled, and the proportion of clothes washers displayed in showrooms actually carrying a label is probably well below 10%. The apparent rating spread is narrow, because suppliers only choose to label their 4A and 5A models. Consumers are not

aware that there is in fact a range on the market from 1A to 5A, and that higher rated models are not necessarily more expensive than lower rated models.[47]

Making labelling mandatory rather than voluntary will overcome both problems – it will ensure that close to 100% of displayed clothes washers will carry a WEL, and at the same time show buyers the full rating spread, from 1A to 5A. This will probably increase customer propensity to take the information into account by an order of magnitude.

The situation is similar for dishwashers and shower heads. Toilets are slightly different in that most units displayed are already labelled, but the suppliers are likely to use opportunity of the proposed new WEL to launch a range of more water-efficient models.

The proposal does not address deficiencies in the pricing of water services. These can only be addressed by economic instruments, but there would still be a need for reliable information on the relative water efficiency of products, so buyers can act on the pricing signals.

Minimise negative impact on product quality

The BAU option and the voluntary labelling option should have no impact on product quality either way, since they will have no impact on "business as usual" behaviour of suppliers or product buyers.

The proposal should significantly change the pattern of market demand for products of various types and levels of water-efficiency, and will create an incentive for some suppliers to increase apparent water efficiency at the expense of other aspects of product performance. The safeguards in the energy efficiency tests should adequately protect consumers against any risk of deterioration in clothes washer and dishwasher performance. Indeed, the additional safeguards being developed to support mandatory WEL – eg the clothes washer rinse performance test – could increase product quality compared with the BAU case.

Minimise negative impacts on suppliers

The BAU option and the voluntary labelling option would have no impact on suppliers, since they will have no impact on "business as usual" behaviour of suppliers or product buyers.

The proposed regulation will have some impact on all participants in the water services sector: product manufacturers, importers and retailers, plumbers and builders and water service suppliers. There will be initial compliance-related costs, and further impacts as consumers change their product preferences and purchasing behaviour. The initial costs to suppliers should be modest, and greatly exceeded by the additional revenues from the sale of more water-efficient products than otherwise.

[47] There is no clear correlation between efficiency and price for products where there is a continuous efficiency range – eg top loader clothes washers or dishwashers – although there tends to be a correlation for products where there are discrete efficiency levels – eg non flow regulated vs flow-regulated showers, or top loader vs front loader clothes washers.

The impact on supplier and product competition is expected to be modest. The suppliers of more water-efficient products (this includes most Australian and New Zealand manufacturers) will have a competitive advantage, and suppliers with less efficient product will have a competitive disadvantage, but suppliers should have both flexibility and time to change their product range as consumer preference changes.

Consistency with other policy constraints and objectives

The proposed regulation is consistent with international trade rules, since it will apply equally to imported and locally manufactured products, and does not use test standards that are at variance with internationally accepted test standards (largely because there none in this area).

The regulation is consistent with State plumbing regulations, assists their objectives and facilitates their enforcement, although it does not seek to enforce them directly.

With regard to the Trans Tasman Mutual Recognition Agreement, harmonisation of WEL requirements and implementation timetables between Australia and New Zealand would be desirable, but lack of harmonisation would not seriously threaten the integrity or effectiveness of the program in Australia.

Conclusion

The proposal to implement a mandatary water efficiency labelling program is likely to meet the objectives of the regulation, with net economic benefit to the community. None of the other options considered in this RIS is likely to meet the objectives of the regulation.

6.2 Recommendations

It is recommended that:

1. The proposed regulatory framework to support a mandatory water efficiency labelling (WEL) program and a mandatory water efficiency standards (WES) program should be implemented;

2. The regulatory framework should incorporate powers to schedule products for which registration would be mandatory, products for which WEL would be mandatory, products for which registration would be optional, products for which WEL would be optional and products for which WES would be mandatory;

3. The target implementation date for the regulations should be mid 2005, to give adequate notice and lead time from the finalisation of the regulatory framework, tests, algorithms and label designs;

4. Shower heads should be scheduled for mandatory registration and mandatory labelling, with effect from the date of implementation of the regulations;

5. Clothes washers should be scheduled for mandatory registration and mandatory labelling, with effect from the date of implementation of the regulations;

6. Dishwashers should be scheduled for mandatory registration and mandatory labelling, with effect from the date of implementation of the regulations;

7. Toilets should be scheduled for mandatory registration, mandatory labelling, and mandatory water efficiency standards (expressed as a maximum weighted average flush volume of 5.5 litres) with effect from the date of implementation of the regulations;

8. Urinal flushing systems (ie combinations of stalls, flush mechanisms and sensors) should be scheduled for mandatory registration and optional labelling, with effect from the date of implementation of the regulations;

9. Taps (or selected subgroups of household taps) should be scheduled for optional registration and optional labelling, with effect from the date of implementation of the regulations, subject to satisfactory product definitions being included in the relevant test standard;

10. Flow control devices (or selected subgroups of flow control devices) should be scheduled for optional registration and optional labelling, with effect from the date of implementation of the regulations, subject to satisfactory product definitions being included in the relevant test standard;

11. Showering systems (ie combinations of shower heads, taps and/or flow control devices) should be scheduled for optional registration and optional labelling at such time as a satisfactory Standard incorporating product definitions, water efficiency tests and performance standards is finalised;

12. The technical basis of the program (apart from showering systems) should be Australian and New Zealand Standard AS/NZS 6400 *Water efficient products – Rating and labelling* as currently being revised, subject to the revision meeting the needs of the regulation;

13. The Standard should retain the present links between the water consumption tests and the energy consumption tests for clothes washers and dishwashers (noting the recent and proposed revisions of those tests);

14. The Standard/s should retain the present links between the water efficiency rating tests and other essential product performance requirements (eg shower performance, clothes washer and dishwasher cleaning, drying and rinse performance), but products should not be excluded from the market solely as a result of failure to meet performance criteria that are not related to water consumption or efficiency;

15. For the scheduled products, the regulations should prohibit any form of water efficiency labelling other than the regulated form;

16. Suppliers of taps, flow regulators, urinal flushing systems and (once the Standard is developed) showering systems should be encouraged to take up the option of participating in the program, and/or to include water efficiency data and ratings in their product catalogues and websites;

17. If suppliers choose to take up the option of participating in the program, they should be subject to the same compliance obligations as products for which WEL is mandatory;

18. There should be a large-scale promotional program to establish and support the mandatory WEL program when it is implemented;

19. The case for mandatory WES for showers, clothes washers, dishwashers and urinal flushing systems should be reviewed once the WEL program has been established and its effectiveness has been evaluated;

20. The case for mandatory rather than optional labelling for taps and flow control devices should be reviewed once the WEL program has been established and its effectiveness has been evaluated;

21. WSAA and the water authorities should be encouraged to maintain the voluntary water efficiency labelling program until the mandatory program takes effect.

*****

References

ABS 4602.0 (series) *Environmental Issues: People's Views and Practices* Australian Bureau of Statistics, June 1994, March 1999, March 2001, March 2002

ABS 4620.0 *Water Accounts for Australia 1993-94 to 1996-97* Australian Bureau of Statistics

AS/NZS 6400:2003 Australian and New Zealand Standard *Water efficient products – Rating and labelling*

AWRC (1993) *Guidelines for the provision of water efficient appliances and plumbing* Issued by the Water Technology Committee of the Australian Water Resources Council, April 1993

COAG (1997) *Council of Australian Governments: Principles and Guidelines for National Standard Setting and Regulatory Action by Ministerial Councils and Standard-Setting Bodies.* Endorsed by COAG April 1995, Amended by COAG November 1997.

ECITARC (2002) *The value of Water: Inquiry into Australia's management of urban water* Report of the Senate Environment, Communications, Information Technology and the Arts Reference Committee, Parliament of the Commonwealth of Australia, December 2002

Ellis (2002) *Energy Labelling and Minimum Energy Performance Standards for Domestic Gas Appliances,* Mark Ellis and Associates, Energy Efficient Strategies and George Wilkenfeld and Associates, for Sustainable Energy Authority of Victoria, June 2002.

EES & GWA (1993) *Issues in the labelling of household appliances for water efficiency*, for Manager Demand Management, Melbourne Water, by Energy Efficient Strategies and George Wilkenfeld and Associates, June 1993

EES et al (1999) *Australian Residential Building Sector Greenhouse Gas Emissions 1990 – 2010* Energy Efficient Strategies with Energy Partners, George Wilkenfeld and Associates, Graham Treloar and Mark Ellis, July 1999.

EPHC (2003) *Communiqué: Water heads national action agenda for environmental protection,* Environment Protection and Heritage Council, 2 October 2003.

GW (2001) *Projecting the impacts of energy programs: How good were the estimates?* George Wilkenfeld. CLASP Asia Regional Symposium, Bangkok 29-31 May 2001.

GWA et al (1991) *Review of Residential Appliance Energy Labelling*, George Wilkenfeld and Associates, with Test Research and Artcraft Research. Prepared for the State Electricity Commission of Victoria, September 1991 (2 vols)

GWA et al (1993) *Benefits and Costs of Implementing Minimum Energy Performance Standards for Household Electrical Appliances in Australia*. George Wilkenfeld and Associates, with Lawrence Berkeley Laboratory. Prepared for the State Electricity Commission of Victoria, July 1993.

GWA et al (2003a) *A mandatory water efficiency labelling scheme for Australia (Draft Report)* George Wilkenfeld and Associates with Artcraft Research, Energy Efficient Strategies and Tomorrow Today, for Environment Australia, April 2003

GWA et al (2003) *A mandatory water efficiency labelling scheme for Australia (Final Report)* George Wilkenfeld and Associates with Artcraft Research, Energy Efficient Strategies and Tomorrow Today, for Environment Australia, June 2003

GWA (1999) *Regulatory Impact Statement: Energy Labelling and Minimum Energy Performance Standards for Household Electrical Appliances in Australia.* George Wilkenfeld and Associates with assistance from Energy Efficient Strategies, for Australian Greenhouse Office, February 1999.

GWA (2001) Draft for Public Comment: *Regulatory Impact Statement: Revised minimum energy performance standards for household refrigerators and freezers,* George Wilkenfeld and Associates with Energy Efficient Strategies, for Australian Greenhouse Office, October 2001.

GWA (2003) *Revised Regulatory Impact Statement: Revised Minimum Energy Performance Standards and Alternative Strategies for Small Electric Storage Water Heaters* George Wilkenfeld and Associates for Australian Greenhouse Office, August 2003

GWA (2003a) *Mandatory Water Efficiency Labelling: The Issues* A Discussion Paper Prepared for Environment Australia by George Wilkenfeld and Associates Pty Ltd February 2003

Mackinnon S. (1998) *The Waterwise School* Wet Paper, Ashmore 1998

NAEEEC (2001) *The Scope for Application of Minimum Energy Performance Standards to Additional Household Appliances.* National Appliance and Equipment Energy Efficiency Committee, December 2001

NAEEEC (2003) *Greening whitegoods: A third report into the energy efficiency trends of major household appliances in Australia from 1993 to 2001.* National Appliance and Equipment Energy Efficiency Committee, February 2003

NAEEEC (2003a) *Projected Impacts 2000-2020*, National Appliance and Equipment Energy Efficiency Committee, January 2003.

ORR (1998) *A Guide to Regulations* (Second Edition), Office of Regulation Review, December 1998

Roy Morgan (1993) Water Rating Scheme Survey conducted for Pricing and Management Division, Melbourne Water Corporation by Roy Morgan Research Centre Pty Ltd

Sarac, K, Day, D.A and White, S. (2002) *What are we saving anyway? The results of three water demand management programs in NSW.* Institute for Sustainable Futures, Sydney, April 2002

White, S. and Fane, S.A (2001) *Designing cost effective water demand management programs in Australia.* Institute for Sustainable Futures, Sydney, October 2001

White. S (2001) *Demand Management and Integrated Resource Planning in Australia*, Institute for Sustainable futures, Sydney, May 2001

WRSC (2002?) *21st Century Melbourne: A WaterSmart City* Final Report – Summary. Water Resources Strategy for the Melbourne Area Committee

WSAA (2001) *The Australian Urban Water Industry 2001 WSAA Facts*, Water Supply Association of Australia, Melbourne.

*****

Appendix 1 Model Inputs

Analysis of Current Water Prices

The information in Table 28 was provided by the Water Service Association of Australia, based on water and wastewater revenues reported by it members for 2001.

Average variable charge = $\frac{\text{(Total Variable Charges / Total number of Properties)}}{\text{(Total Consumption / Total number of Properties)}}$

Where:
Total Variable Charges = ∑ (Average Variable Charge x Number of Properties)
Total Consumption = ∑ (Average Consumption x Number of Properties)

Solely variable charge = $\frac{\text{(Total Charges / Total number of Properties)}}{\text{(Total Consumption / Total number of Properties)}}$

Where:
Total Charges = ∑ (Average Variable Charge + Service Charge) x Number of Properties

Net Cost to Utility = $\frac{\sum[(\text{WDRC x RRR}) / \text{Consumption}) \text{ x Number of Properties}]}{\text{Total number of Properties}}$

Where:
WDRC = Written Down Replacement Cost of Fixed Assets
RRR = Economic Real Rate of Return
Where RRR = $\frac{\text{Revenue – (OMA + Current Cost Depreciation)}}{\text{WDRC}}$

Net Benefit to Community = Solely Variable Charge – Net Cost to the Utility

Notes by WSAA (paraphrased by author)

The current variable charge is not the marginal cost of supply: part of the marginal cost is in the fixed charge component.

Over the period 2003-2030 about there is highly likely to be a movement towards lowered fixed charges and higher variable charges.

Dollars are based on 2001 figures (2003 figures won't be available for about 3 months). CPI adjustment to 2003 is reasonable. $NZ have been corrected to $A.

In terms of future price increases over 30 years, it is reasonable to assume matching CPI in the near future. In the medium term it is likely some major augmentation will be necessary for some cities in around 10 years. In the absence of demand management, and other cheap sources which are very limited, desalination is a major option. This currently costs about $1.50 per kl for treatment and up to double this if

the plant is run intermittently. Conventional treatment technologies used at the moment cost about 20-30c/kl.

Thus if a 10% augmentation with desalinated water takes place, (Sydney are predicting this by 2010) treatment costs may rise by some 65%. (10% @ $1.50 plus 90% @ 30c). Treatment costs are roughly 50% of total O&M costs, so this would cause overall O&M costs to rise by around 33%. This scenario is possible for Sydney, Perth, Gold Coast and, given a couple more years of drought, Melbourne. As a consequence utilities will however be everything they can to minimise this by demand management

Getting the costs to the utility of a customer saving a kl is more difficult. The cost estimates are based on existing assets, but not on the cost of the next increment of supply to be added in the medium term. The costs computed (indicated as Net Cost to Utility in the following table) need to be offset by the benefit to the utility of delaying the next augmentation.

*****

Table 28 Analysis of Water and Wastewater Charges Reported by Water Service Association of Australia Members, 2001

LOCATION	AVERAGE VARIABLE CHARGE ($/kL)			SOLELY VARIABLE CHARGE ($/kL)			NET COST TO UTILITY ($/kL)			NET BENEFIT TO COMMUNITY ($/kL)		
	Water	Wastewater	Combined	Water	Wastewater	Combined	Water	Wastewater	Combined	Water	Wastewater	Combined
NSW	0.92	0.41	1.33	1.20	1.01	2.21	0.58	0.58	1.16	0.62	0.43	1.05
VIC	0.68	0.79	1.47	0.90	1.10	2.00	0.46	0.47	0.93	0.44	0.63	1.07
QLD	0.61	-	-	1.17	1.08	2.25	1.03	1.38	2.41	0.14	-0.30	-0.16
SA	0.91	-	-	1.36	1.06	2.42	0.78	1.81	2.59	0.58	-0.75	-0.17
WA	0.61	-	-	1.02	1.05	2.07	0.83	1.81	2.64	0.19	-0.76	-0.57
TAS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NT	0.63	-	-	0.81	0.55	1.36	0.63	0.08	0.71	0.18	0.47	0.65
ACT	0.86	-	-	1.26	1.13	2.39	0.66	0.65	1.31	0.60	0.48	1.08
Auckland, NZ	0.93	2.21	3.14	1.02	2.27	3.29	0.01	0.01	0.02	1.01	2.26	3.27
AVERAGE	***0.77***	***0.93***	***1.70***	***1.09***	***1.09***	***2.18***	***0.62***	***0.84***	***1.46***	***0.47***	***0.25***	***0.72***

Source: WSAA

Showers

Figure 27 Projected share of new showers installed in new construction – BAU and with labelling

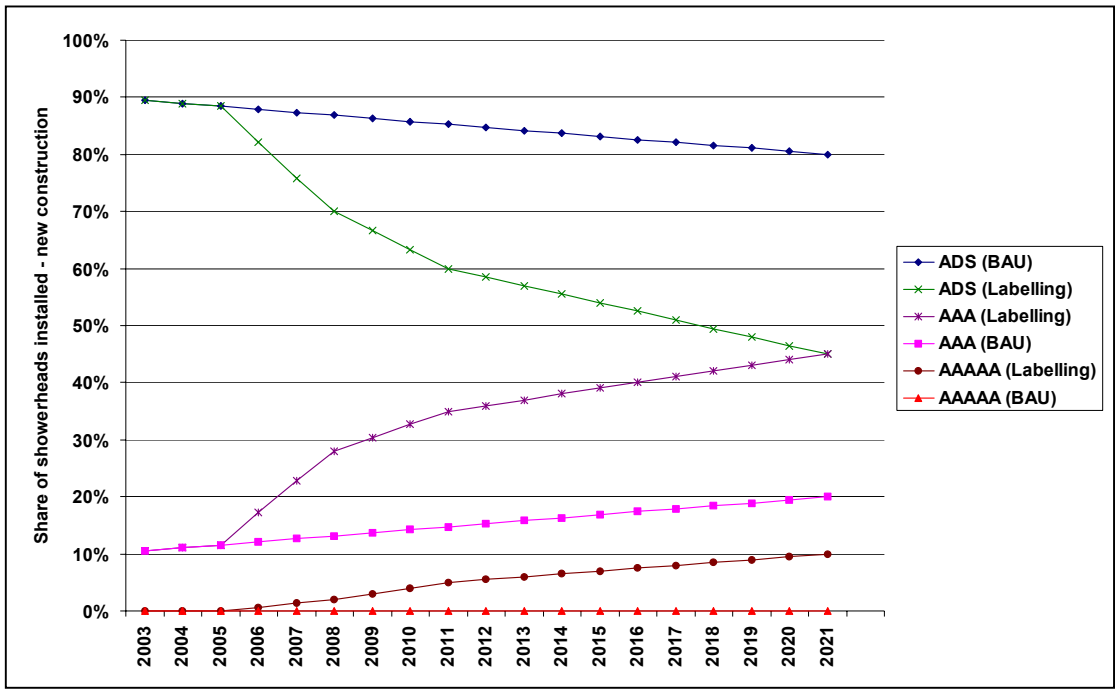


Figure 28 Projected share of new showers installed in renovations – BAU and with labelling

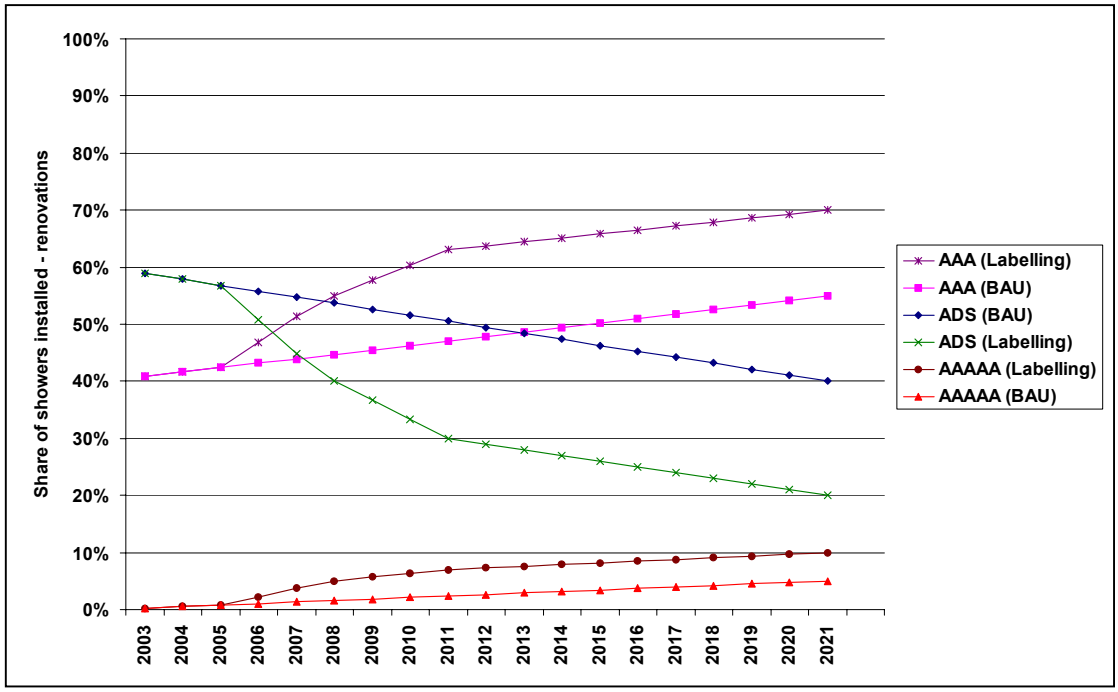


Figure 29 Percentage of showers in use by type, BAU

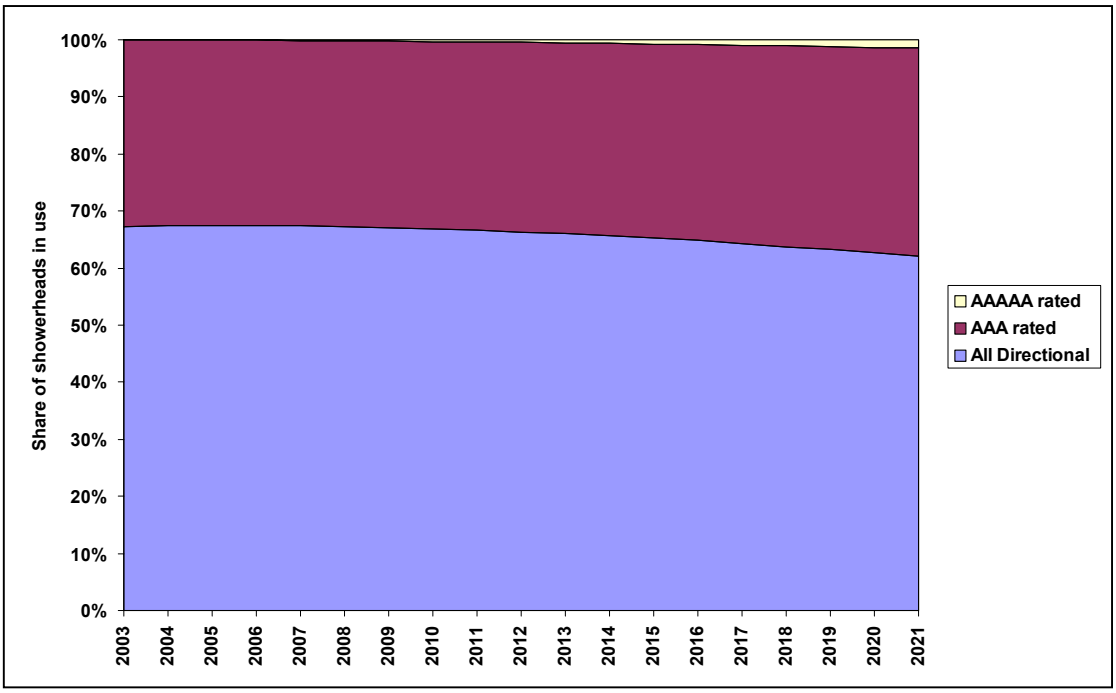
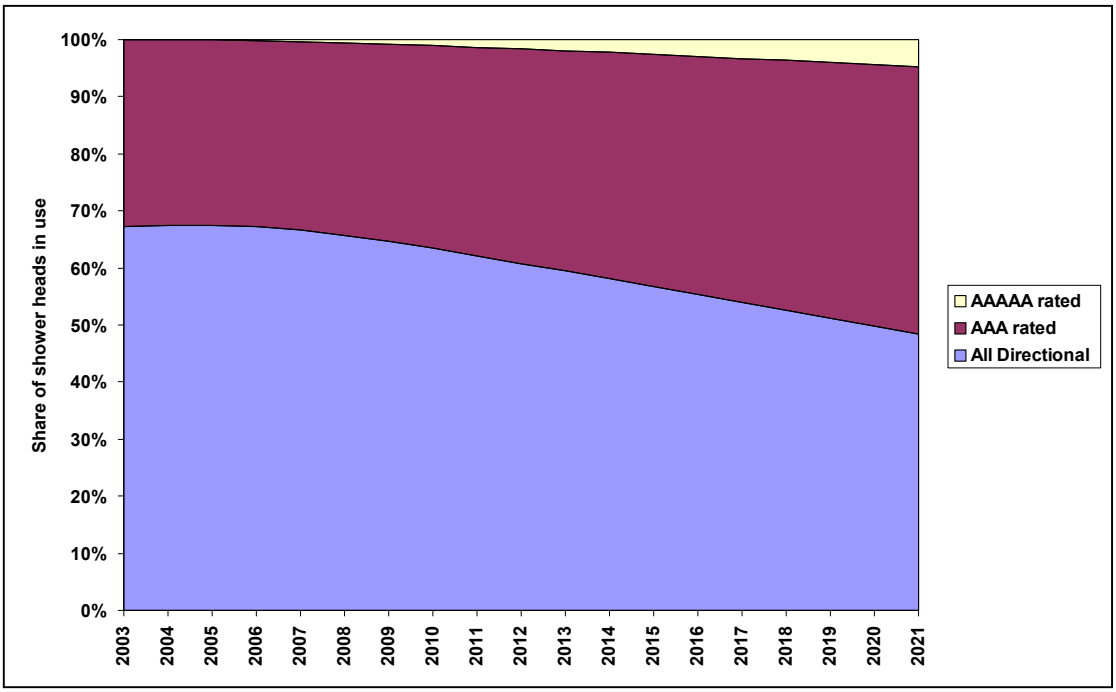


Figure 30 Percentage of showers in use by type, with labelling



Toilets

Figure 31 Projected share of new toilets installed in new construction – BAU and with labelling

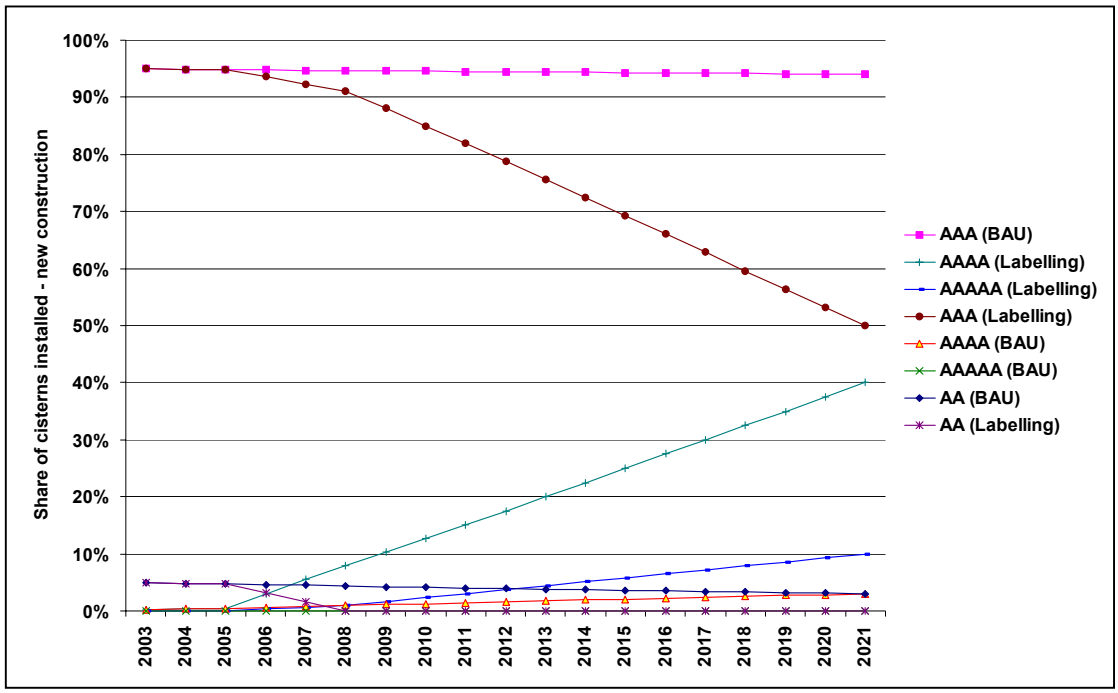


Figure 32 Projected share of new toilets installed in renovations – BAU and with labelling

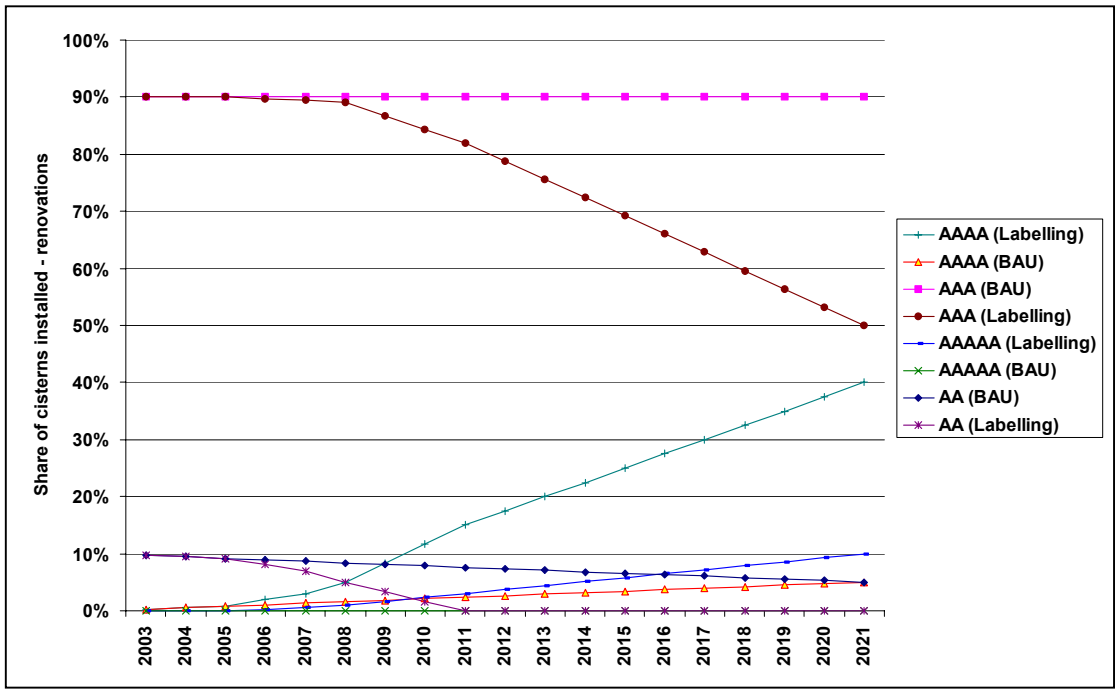


Figure 33 Percentage of toilets in use by type, BAU

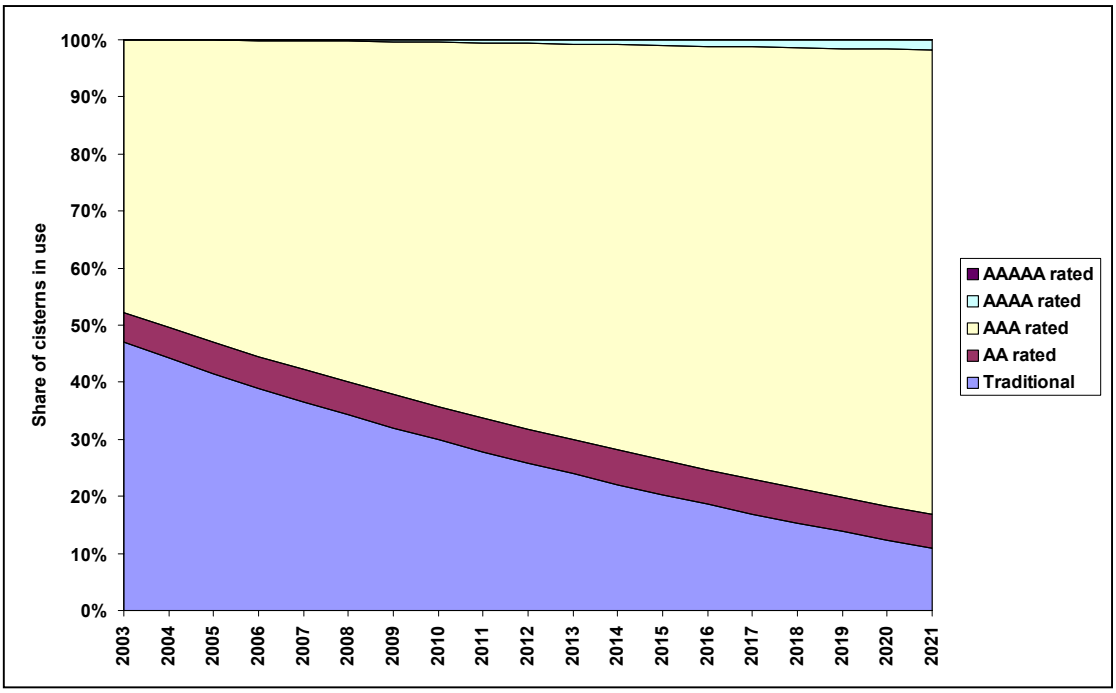
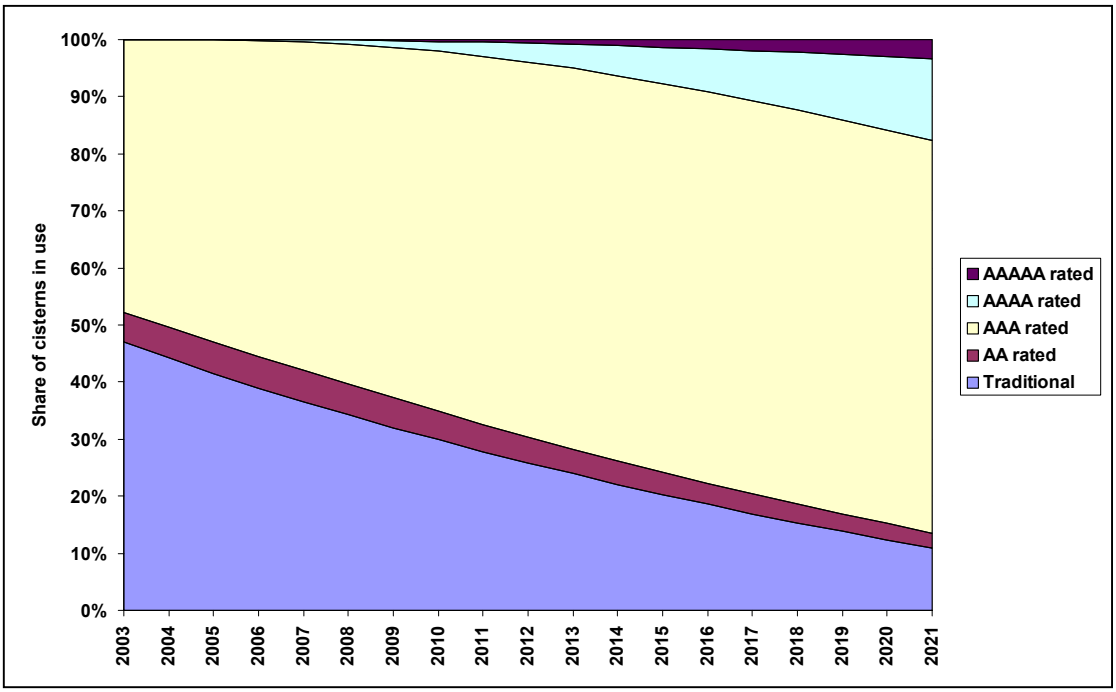


Figure 34 Percentage of toilets in use by type, with labelling



Clothes Washers

Figure 35 Historical and projected share of clothes washer sales by type, Australia

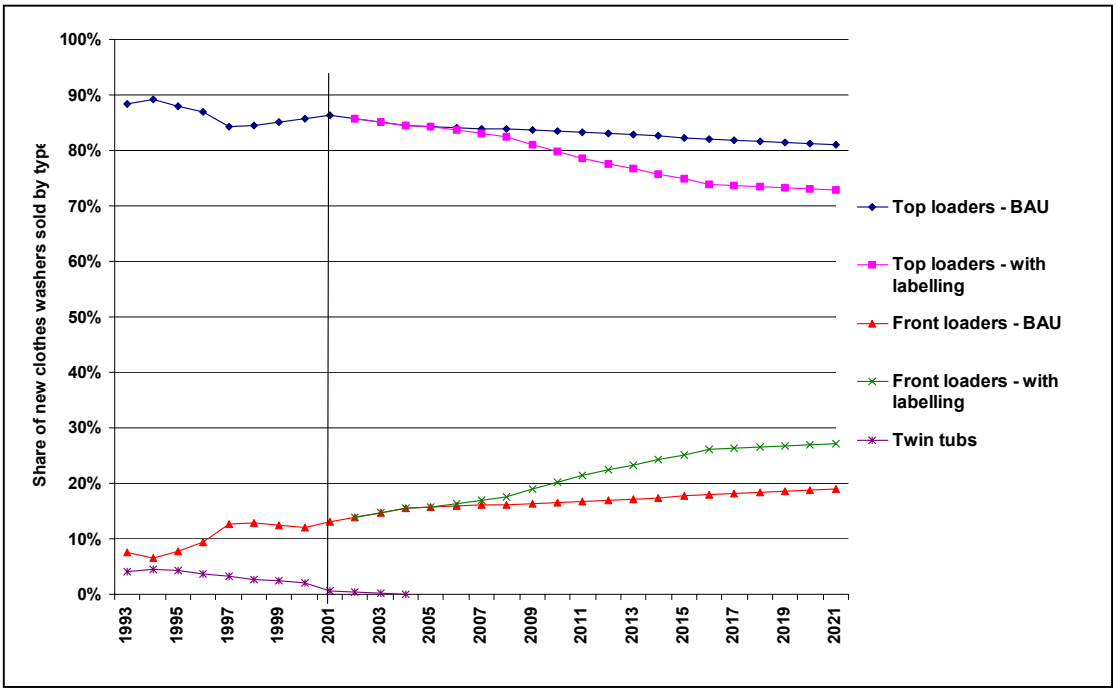


Figure 36 Projected front loader share of clothes washer sales by State

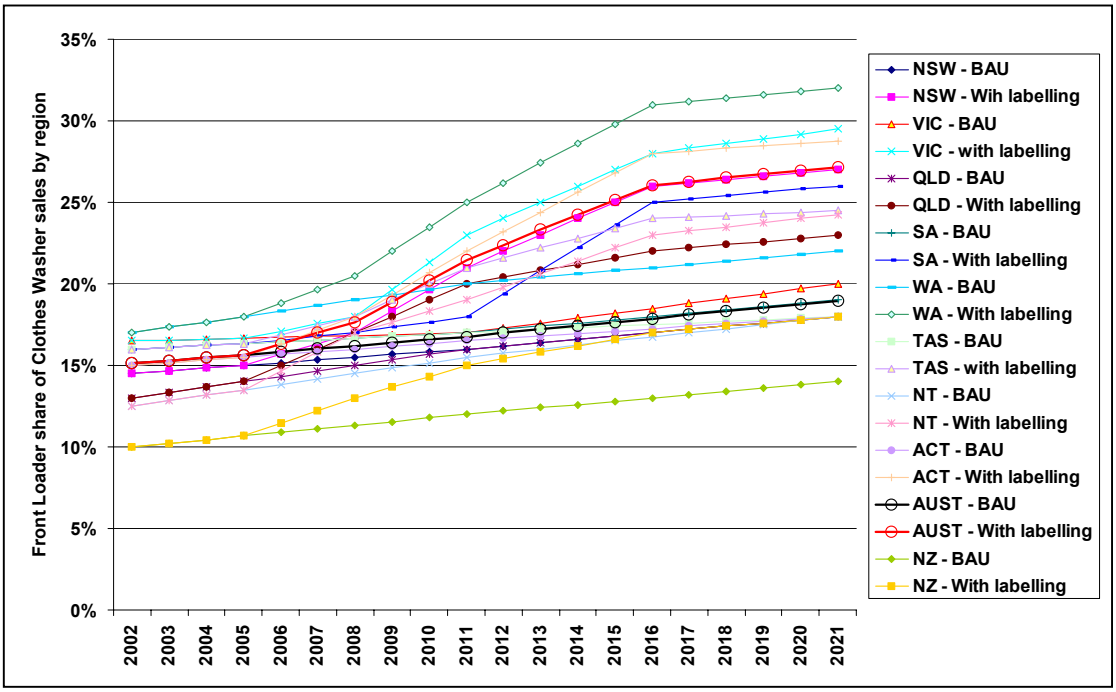


Figure 37 Historical and projected water consumption per wash, clothes washers, Australia

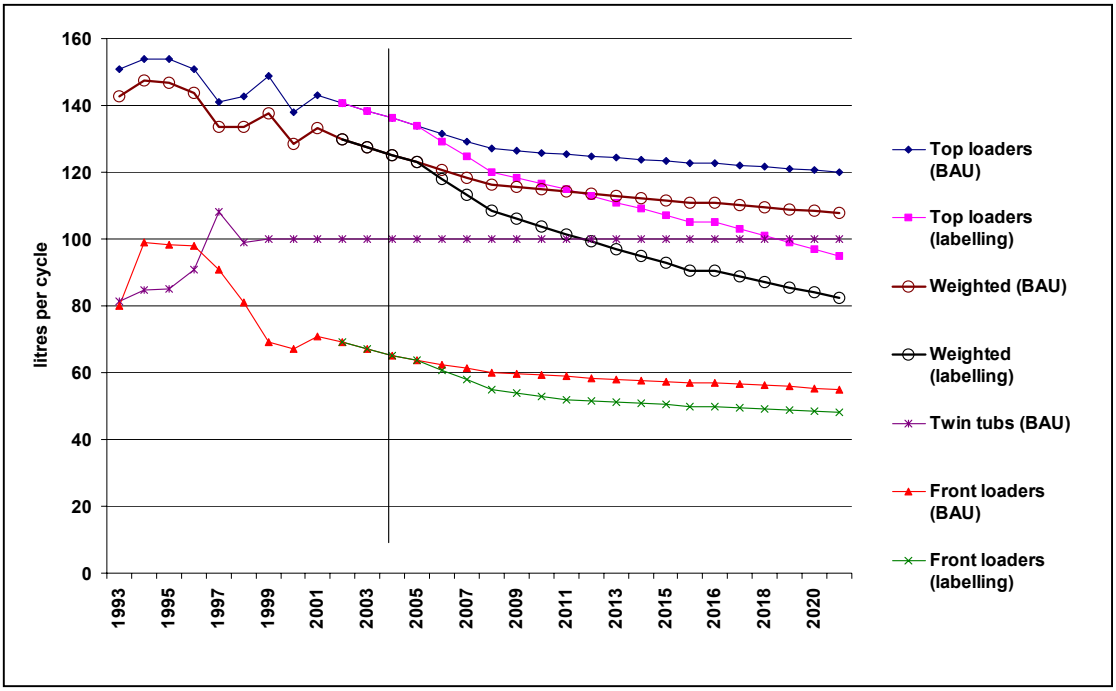


Figure 38 Historical and projected water consumption per kilogram of load (at full load), clothes washers, Australia

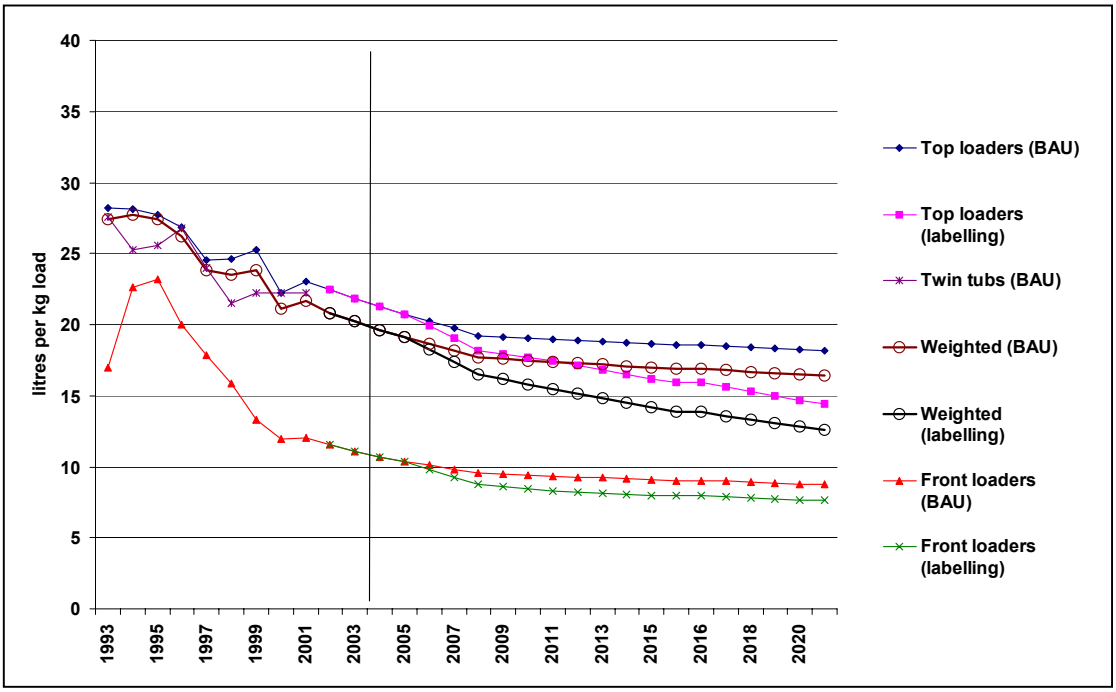
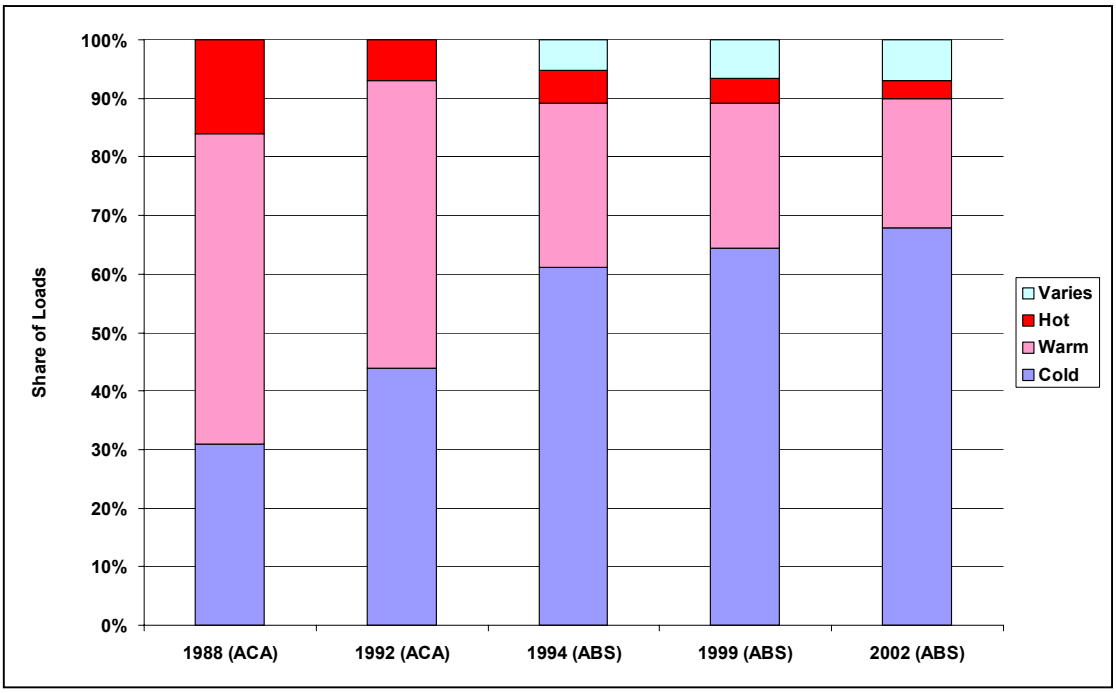
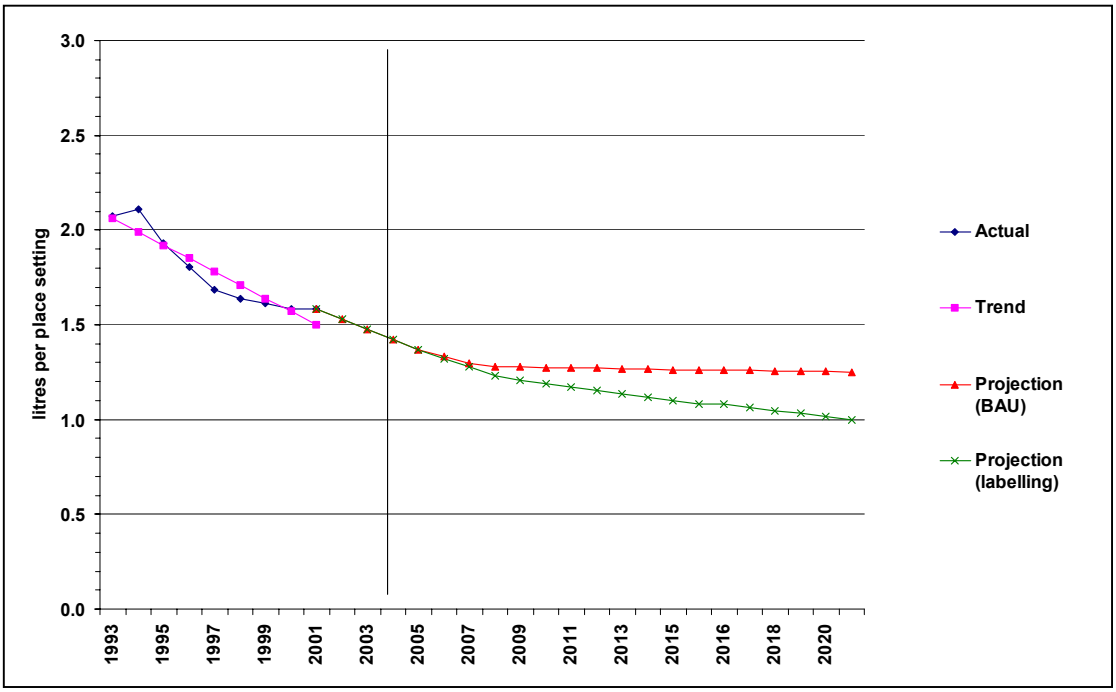


Figure 39 Trends in preferred clothes washing temperature, 1998 - 2002



Dishwashers

Figure 40 Historical and projected litres per place setting, dishwashers, Australia



Appendix 2 Model Outputs

Table 29 summarises the benefit/cost ratios of the 18 cases used to test the sensitivity of model outputs a range of assumptions regarding cost/price growth and discount rates. The cases are summarised in detail in the tables referenced. Each case is built on the projections of labelling-induced reductions in the consumption of water, electricity and gas summarised in Table 30, but the reductions are valued differently.

Table 29 Summary of Benefit/Cost Ratios

Perspective	Cost/Price Growth	Discount rates		
		0%	5%	10%
Resource Cost	No change	5.3 Table 31	3.5 Table 32	2.5 Table 33
	Medium increase	7.3 Table 34	4.7 Table 35	**3.2** **Table 36**
	High increase	9.6 Table 37	6.0 Table 38	4.1 Table 39
Retail Price	No change	7.0 Table 40	4.6 Table 41	3.3 Table 42
	Medium increase	8.8 Table 43	5.7 Table 44	**4.0** **Table 45**
	High increase	10.6 Table 46	6.8 Table 47	4.7 Table 48

Table 30 Projected total resource savings for the period 2003 - 2021

Product	Water and energy savings			Greenhouse savings	
	Water GL	Elect GWh	Gas PJ	Elect Mt CO_2-e	Gas Mt CO_2-e
Showers - res use	130	2092	7.7		
Showers - com use	24	387	1.4		
Toilets- res use	91	77	0.0		
Toilets- com use	45	38	0.0		
Clothes washers	285	1363	4.5		
Dishwashers	14	291	0.2		
Taps - res use	7	116	0.4		
Taps - com use	1	11	0.0		
Urinals	13	11	0.0		
Total	610	4384	14.3	3.7	0.9
Household uses	527	3938	12.8	3.3	0.8
Commercial uses	82	446	1.5	0.4	0.1
Showers	154	2478	9.1		
Toilets	136	114	0.0		
Household appliances	299	1654	4.7		
Taps	8	127	0.5		
Urinals	13	11	0.0		

The projected stream of monetary costs and benefits associated with the Resource Cost, Medium Increase scenario are illustrated in Figure 41, Figure 42 and Figure 43. The discounting of these cost and benefit streams at 0%, 5% and 10% respectively produces the outputs in Table 34, Table 35 and Table 36 respectively. The projected stream of monetary costs and benefits associated with the Retail Price, Medium Increase scenario

are illustrated in Figure 44, Figure 45 and Figure 46. The discounting of these cost and benefit streams at 0%, 5% and 10% respectively produces the outputs in Table 43, Table 44 and Table 45 respectively. All values in the tables are millions of 2003 dollars.

Figure 41 Resource perspective – savings by product type, medium cost increase projections (constant 2003 $)

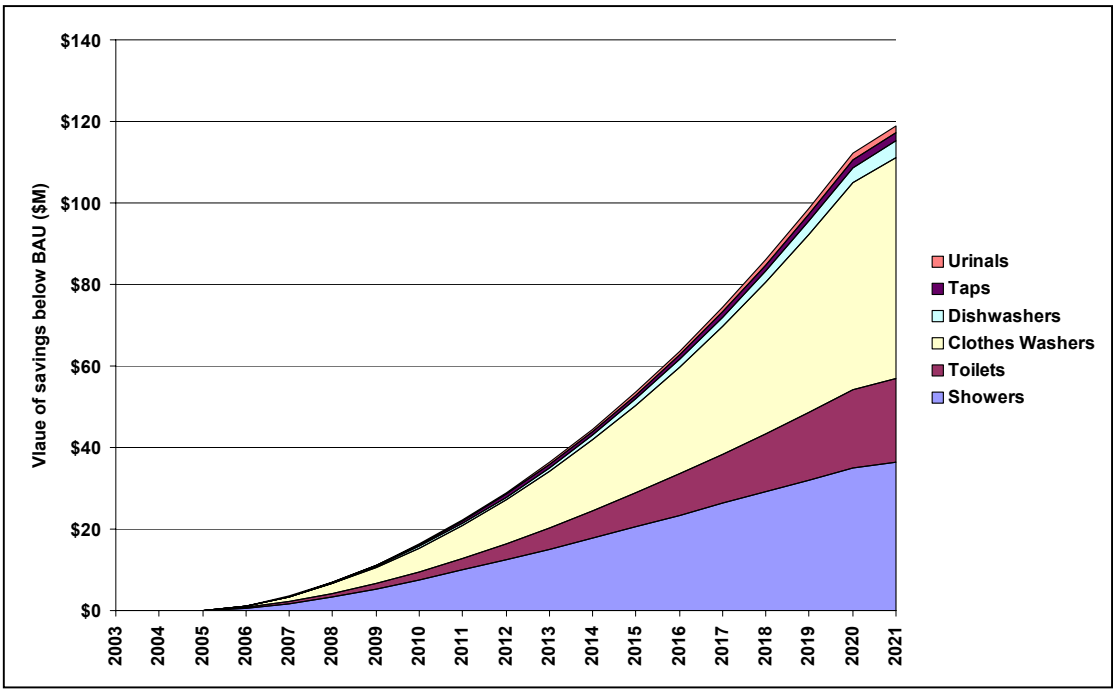


Figure 42 Resource perspective – savings by water services, electricity and gas, medium cost increase projections (constant 2003 $)

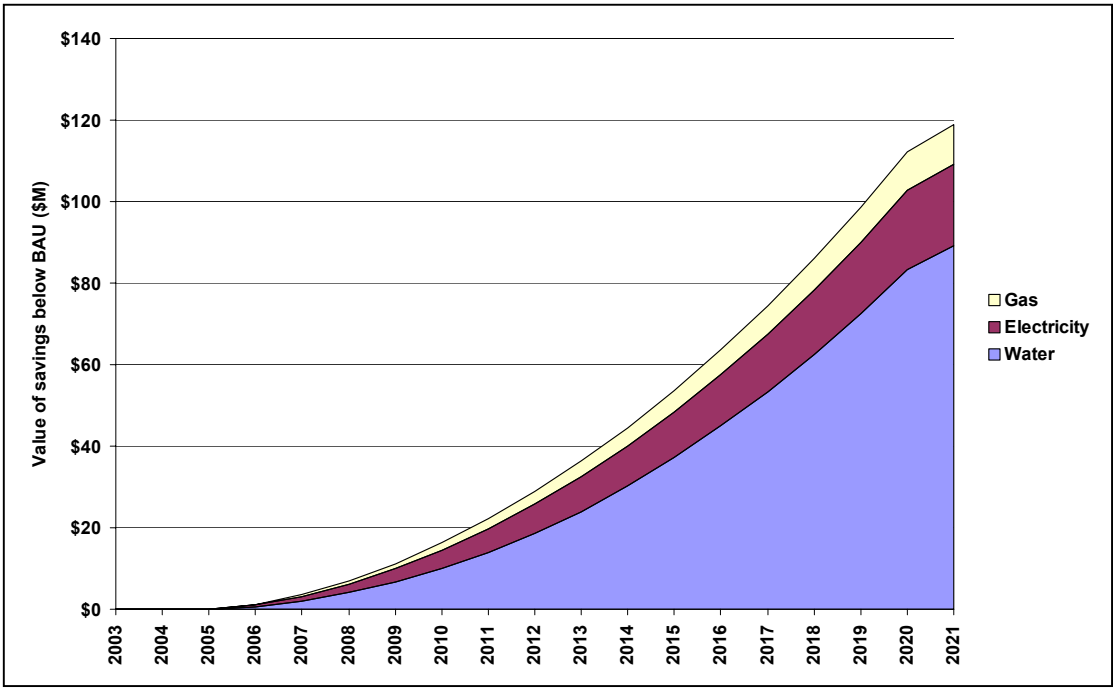


Figure 43 Resource perspective – resource costs by product type and programs costs, medium cost increase projections (constant 2003 $)

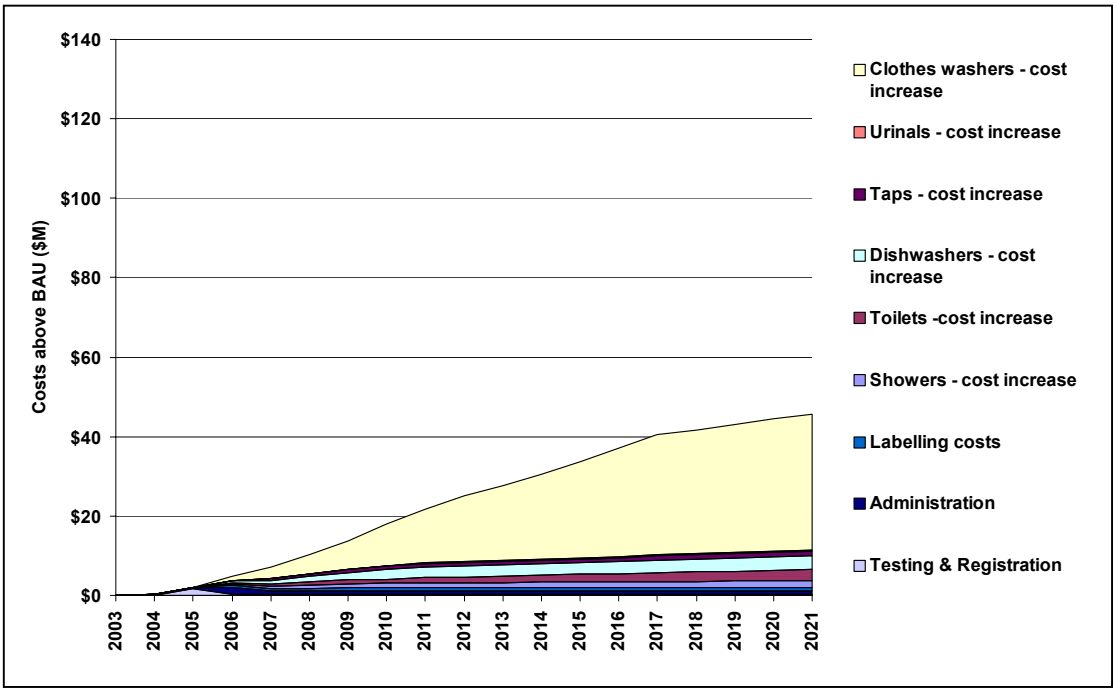


Figure 44 Retail price perspective – savings by product type, medium price increase projections (constant 2003 $)

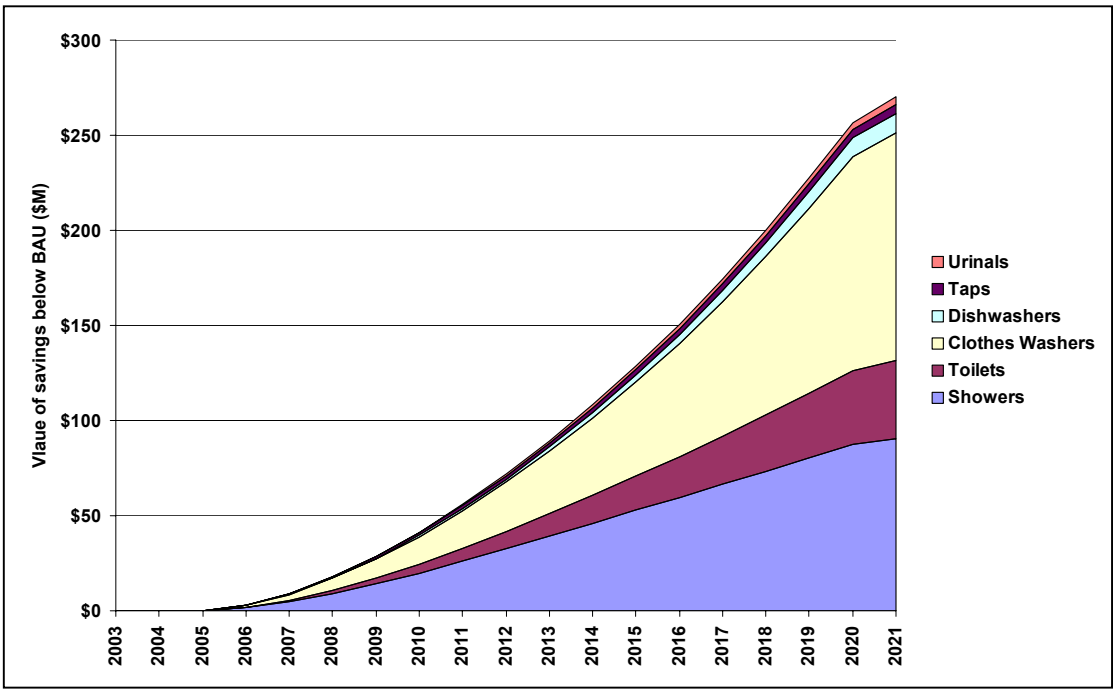


Figure 45 Retail price perspective – savings by water services, electricity and gas, medium price increase projections (constant 2003 $)

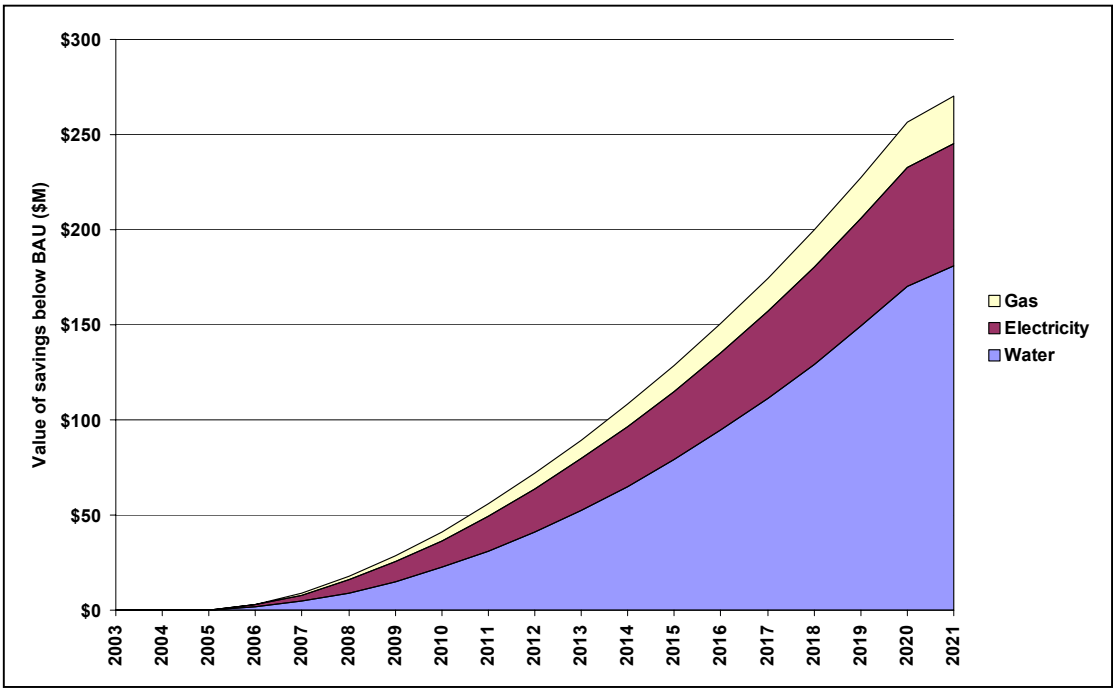


Figure 46 Retail price perspective – price increases by product type and programs costs, medium price increase projections (constant 2003 $)

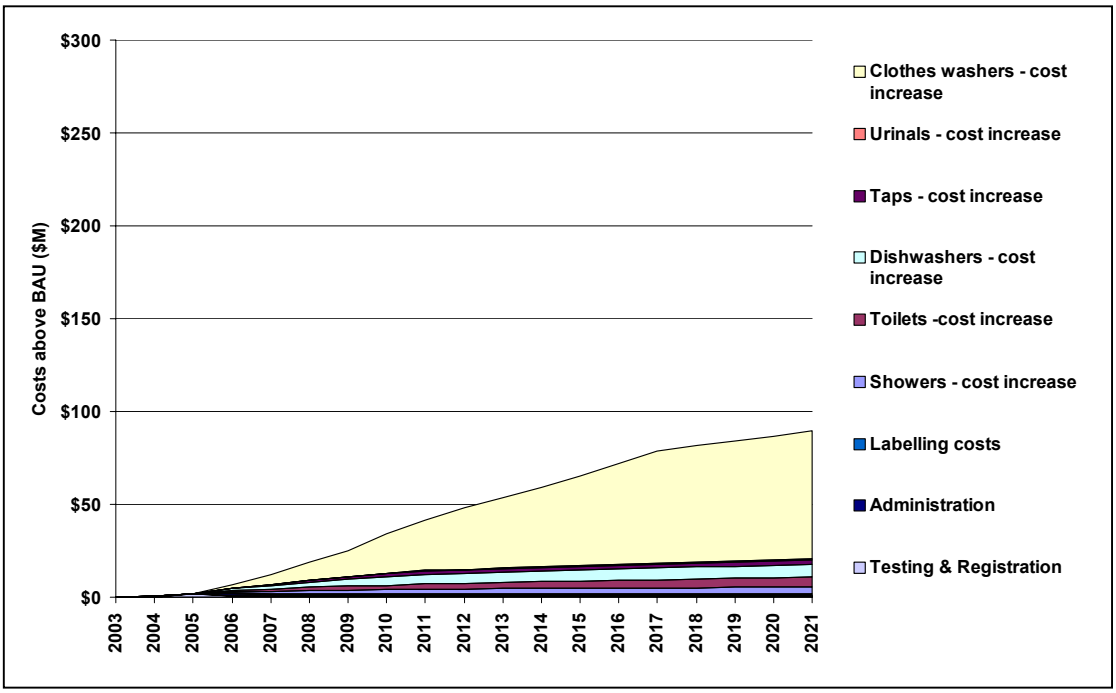


Table 31 Resource Cost Perspective, No Real Increase in Water and Energy Costs, 0% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$16.8	$2.4	$2.7	$21.9	$255.4	$212.9	$110.8	$579.1	$557.2	26.4
Showers - com use	$3.1	$0.5	$0.0	$3.5	$47.2	$39.4	$20.5	$107.0	$103.5	30.2
Toilets- res use	$17.9	$2.8	$1.4	$22.1	$205.8	$0.0	$0.0	$205.8	$183.7	9.3
Toilets- com use	$8.8	$1.4	$0.0	$10.1	$100.8	$0.0	$0.0	$100.8	$90.7	9.9
Clothes washers	$222.9	$1.3	$2.6	$226.8	$596.2	$123.1	$66.2	$785.4	$558.6	3.5
Dishwashers	$39.9	$0.6	$1.7	$42.2	$30.9	$31.8	$3.2	$65.9	$23.7	1.6
Taps - res use	$12.6	$3.7	$0.9	$17.1	$14.2	$11.8	$6.1	$32.1	$15.0	1.9
Taps - com use	$1.2	$0.4	$0.0	$1.6	$1.4	$1.1	$0.6	$3.1	$1.5	2.0
Urinals	$3.7	$0.0	$2.0	$5.7	$28.8	$0.0	$0.0	$28.8	$23.1	5.0
Administration				$6.7						
Total	$326.9	$12.9	$11.3	$357.7	$1,280.6	$420.1	$207.4	$1,908.1	$1,550.4	**5.3**
Household uses	$310.1	$10.8	$9.2	$330.1	$1,102.4	$379.6	$186.3	$1,668.3	$1,338.2	5.1
Commercial uses	$16.8	$2.2	$2.0	$21.0	$178.2	$40.5	$21.1	$239.8	$218.8	11.4
Showers	$19.8	$2.9	$2.7	$25.5	$302.6	$252.3	$131.3	$686.1	$660.7	26.9
Toilets	$26.7	$4.1	$1.4	$32.2	$306.6	$0.0	$0.0	$306.6	$274.4	9.5
Household appliances	$262.9	$1.9	$4.3	$269.0	$627.1	$154.9	$69.4	$851.3	$582.3	3.2
Taps	$13.8	$4.0	$0.9	$18.7	$15.5	$13.0	$6.7	$35.2	$16.5	1.9
Urinals	$3.7	$0.0	$2.0	$5.7	$28.8	$0.0	$0.0	$28.8	$23.1	5.0

Table 32 Resource Cost Perspective, No Real Increase in Water and Energy Costs, 5% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$9.6	$1.5	$1.9	$13.0	$94.4	$79.4	$40.7	$214.5	$201.5	16.5
Showers - com use	$1.8	$0.3	$0.0	$2.0	$17.5	$14.7	$7.5	$39.6	$37.6	19.4
Toilets- res use	$10.0	$1.7	$1.0	$12.6	$72.9	$0.0	$0.0	$72.9	$60.3	5.8
Toilets- com use	$4.9	$0.8	$0.0	$5.7	$35.7	$0.0	$0.0	$35.7	$30.0	6.3
Clothes washers	$121.7	$0.8	$1.8	$124.2	$218.1	$46.2	$24.4	$288.7	$164.5	2.3
Dishwashers	$22.7	$0.3	$1.2	$24.2	$11.0	$11.3	$1.2	$23.4	-$0.8	1.0
Taps - res use	$7.2	$2.2	$0.6	$10.0	$5.2	$4.4	$2.3	$11.9	$1.9	1.2
Taps - com use	$0.7	$0.2	$0.0	$0.9	$0.5	$0.4	$0.2	$1.1	$0.2	1.3
Urinals	$2.0	$0.0	$1.5	$3.5	$10.2	$0.0	$0.0	$10.2	$6.7	2.9
Administration				$3.6						
Total	$180.5	$7.8	$7.9	$199.8	$465.5	$156.4	$76.2	$698.2	$498.3	**3.5**
Household uses	$171.1	$6.5	$6.4	$184.0	$401.7	$141.3	$68.5	$611.4	$427.4	3.3
Commercial uses	$9.4	$1.3	$1.5	$12.2	$63.9	$15.1	$7.7	$86.7	$74.5	7.1
Showers	$11.4	$1.8	$1.9	$15.0	$111.9	$94.1	$48.2	$254.2	$239.1	16.9
Toilets	$14.9	$2.5	$1.0	$18.3	$108.6	$0.0	$0.0	$108.6	$90.3	5.9
Household appliances	$144.3	$1.1	$3.0	$148.4	$229.1	$57.5	$25.5	$312.2	$163.7	2.1
Taps	$7.9	$2.4	$0.6	$10.9	$5.7	$4.8	$2.5	$13.1	$2.1	1.2
Urinals	$2.0	$0.0	$1.5	$3.5	$10.2	$0.0	$0.0	$10.2	$6.7	2.9

Table 33 Resource Cost Perspective, No Real Increase in Water and Energy Costs, 10% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$5.9	$1.0	$1.4	$8.3	$41.2	$35.0	$17.6	$93.8	$85.5	11.4
Showers - com use	$1.1	$0.2	$0.0	$1.3	$7.6	$6.5	$3.3	$17.3	$16.1	13.7
Toilets- res use	$5.9	$1.1	$0.7	$7.7	$30.2	$0.0	$0.0	$30.2	$22.4	3.9
Toilets- com use	$2.9	$0.5	$0.0	$3.4	$14.8	$0.0	$0.0	$14.8	$11.3	4.3
Clothes washers	$70.6	$0.5	$1.3	$72.4	$92.1	$20.2	$10.4	$122.7	$50.2	1.7
Dishwashers	$13.7	$0.2	$0.9	$14.8	$4.5	$4.6	$0.5	$9.6	-$5.3	0.6
Taps - res use	$4.4	$1.4	$0.4	$6.3	$2.3	$1.9	$1.0	$5.2	-$1.1	0.8
Taps - com use	$0.4	$0.1	$0.0	$0.6	$0.2	$0.2	$0.1	$0.5	-$0.1	0.9
Urinals	$1.2	$0.0	$1.2	$2.4	$4.2	$0.0	$0.0	$4.2	$1.8	1.8
Administration				$2.0						
Total	$106.1	$5.0	$6.0	$119.2	$197.1	$68.4	$32.8	$298.2	$179.0	**2.5**
Household uses	$100.5	$4.2	$4.8	$109.5	$170.2	$61.7	$29.5	$261.4	$151.9	2.4
Commercial uses	$5.6	$0.8	$1.2	$7.7	$26.8	$6.7	$3.3	$36.8	$29.2	4.8
Showers	$6.9	$1.1	$1.4	$9.5	$48.8	$41.4	$20.9	$111.1	$101.6	11.7
Toilets	$8.8	$1.6	$0.7	$11.2	$44.9	$0.0	$0.0	$44.9	$33.8	4.0
Household appliances	$84.3	$0.7	$2.2	$87.3	$96.6	$24.8	$10.9	$132.2	$45.0	1.5
Taps	$4.8	$1.6	$0.4	$6.8	$2.5	$2.1	$1.1	$5.7	-$1.1	0.8
Urinals	$1.2	$0.0	$1.2	$2.4	$4.2	$0.0	$0.0	$4.2	$1.8	1.8

Table 34 Resource Cost Perspective, Medium Real Increase in Water and Energy Costs, 0% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$16.8	$2.4	$2.7	$21.9	$380.6	$233.7	$121.8	$736.1	$714.2	33.6
Showers - com use	$3.1	$0.5	$0.0	$3.5	$70.3	$43.2	$22.5	$136.1	$132.5	38.3
Toilets- res use	$17.9	$2.8	$1.4	$22.1	$310.6	$0.0	$0.0	$310.6	$288.5	14.1
Toilets- com use	$8.8	$1.4	$0.0	$10.1	$152.2	$0.0	$0.0	$152.2	$142.1	15.0
Clothes washers	$222.9	$1.3	$2.6	$226.8	$895.7	$134.9	$72.6	$1,103.2	$876.4	4.9
Dishwashers	$39.9	$0.6	$1.7	$42.2	$46.6	$35.0	$3.5	$85.2	$43.0	2.0
Taps - res use	$12.6	$3.7	$0.9	$17.1	$21.1	$13.0	$6.8	$40.9	$23.7	2.4
Taps - com use	$1.2	$0.4	$0.0	$1.6	$2.0	$1.2	$0.7	$3.9	$2.4	2.5
Urinals	$3.7	$0.0	$2.0	$5.7	$43.5	$0.0	$0.0	$43.5	$37.8	7.6
Administration				$6.7						
Total	$326.9	$12.9	$11.3	$357.7	$1,922.8	$461.0	$227.8	$2,611.6	$2,253.9	**7.3**
Household uses	$310.1	$10.8	$9.2	$330.1	$1,654.7	$416.6	$204.7	$2,275.9	$1,945.8	6.9
Commercial uses	$16.8	$2.2	$2.0	$21.0	$268.1	$44.4	$23.2	$335.7	$314.7	16.0
Showers	$19.8	$2.9	$2.7	$25.5	$451.0	$276.9	$144.3	$872.1	$846.7	34.3
Toilets	$26.7	$4.1	$1.4	$32.2	$462.8	$0.0	$0.0	$462.8	$430.6	14.4
Household appliances	$262.9	$1.9	$4.3	$269.0	$942.4	$169.9	$76.1	$1,188.4	$919.4	4.4
Taps	$13.8	$4.0	$0.9	$18.7	$23.2	$14.2	$7.4	$44.8	$26.1	2.4
Urinals	$3.7	$0.0	$2.0	$5.7	$43.5	$0.0	$0.0	$43.5	$37.8	7.6

Table 35 Resource Cost Perspective, Medium Real Increase in Water and Energy Costs, 5% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$9.6	$1.5	$1.9	$13.0	$135.8	$86.0	$44.1	$265.9	$252.9	20.5
Showers - com use	$1.8	$0.3	$0.0	$2.0	$25.1	$15.9	$8.2	$49.1	$47.1	24.0
Toilets- res use	$10.0	$1.7	$1.0	$12.6	$106.8	$0.0	$0.0	$106.8	$94.2	8.5
Toilets- com use	$4.9	$0.8	$0.0	$5.7	$52.3	$0.0	$0.0	$52.3	$46.6	9.2
Clothes washers	$121.7	$0.8	$1.8	$124.2	$318.8	$50.1	$26.5	$395.3	$271.1	3.2
Dishwashers	$22.7	$0.3	$1.2	$24.2	$16.2	$12.3	$1.3	$29.8	$5.6	1.2
Taps - res use	$7.2	$2.2	$0.6	$10.0	$7.5	$4.8	$2.5	$14.8	$4.7	1.5
Taps - com use	$0.7	$0.2	$0.0	$0.9	$0.7	$0.5	$0.2	$1.4	$0.5	1.6
Urinals	$2.0	$0.0	$1.5	$3.5	$15.0	$0.0	$0.0	$15.0	$11.4	4.2
Administration				$3.6						
Total	$180.5	$7.8	$7.9	$199.8	$678.2	$169.5	$82.7	$930.4	$730.6	**4.7**
Household uses	$171.1	$6.5	$6.4	$184.0	$585.1	$153.1	$74.3	$812.6	$628.6	4.4
Commercial uses	$9.4	$1.3	$1.5	$12.2	$93.1	$16.4	$8.4	$117.9	$105.7	9.7
Showers	$11.4	$1.8	$1.9	$15.0	$160.9	$101.9	$52.3	$315.1	$300.0	21.0
Toilets	$14.9	$2.5	$1.0	$18.3	$159.2	$0.0	$0.0	$159.2	$140.8	8.7
Household appliances	$144.3	$1.1	$3.0	$148.4	$335.0	$62.4	$27.7	$425.1	$276.7	2.9
Taps	$7.9	$2.4	$0.6	$10.9	$8.3	$5.2	$2.7	$16.2	$5.3	1.5
Urinals	$2.0	$0.0	$1.5	$3.5	$15.0	$0.0	$0.0	$15.0	$11.4	4.2

Table 36 Resource Cost Perspective, Medium Real Increase in Water and Energy Costs, 10% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$5.9	$1.0	$1.4	$8.3	$56.9	$37.4	$18.9	$113.2	$105.0	13.7
Showers - com use	$1.1	$0.2	$0.0	$1.3	$10.5	$6.9	$3.5	$20.9	$19.7	16.6
Toilets- res use	$5.9	$1.1	$0.7	$7.7	$42.7	$0.0	$0.0	$42.7	$35.0	5.5
Toilets- com use	$2.9	$0.5	$0.0	$3.4	$20.9	$0.0	$0.0	$20.9	$17.5	6.1
Clothes washers	$70.6	$0.5	$1.3	$72.4	$130.4	$21.6	$11.2	$163.2	$90.8	2.3
Dishwashers	$13.7	$0.2	$0.9	$14.8	$6.4	$5.0	$0.5	$11.9	-$2.9	0.8
Taps - res use	$4.4	$1.4	$0.4	$6.3	$3.2	$2.1	$1.0	$6.3	$0.0	1.0
Taps - com use	$0.4	$0.1	$0.0	$0.6	$0.3	$0.2	$0.1	$0.6	$0.0	1.1
Urinals	$1.2	$0.0	$1.2	$2.4	$6.0	$0.0	$0.0	$6.0	$3.6	2.5
Administration				$2.0						
Total	$106.1	$5.0	$6.0	$119.2	$277.5	$73.2	$35.2	$385.9	$266.7	**3.2**
Household uses	$100.5	$4.2	$4.8	$109.5	$239.7	$66.1	$31.6	$337.4	$227.9	3.1
Commercial uses	$5.6	$0.8	$1.2	$7.7	$37.8	$7.1	$3.6	$48.5	$40.8	6.3
Showers	$6.9	$1.1	$1.4	$9.5	$67.5	$44.3	$22.4	$134.1	$124.6	14.1
Toilets	$8.8	$1.6	$0.7	$11.2	$63.7	$0.0	$0.0	$63.7	$52.5	5.7
Household appliances	$84.3	$0.7	$2.2	$87.3	$136.9	$26.6	$11.7	$175.1	$87.9	2.0
Taps	$4.8	$1.6	$0.4	$6.8	$3.5	$2.3	$1.1	$6.9	$0.1	1.0
Urinals	$1.2	$0.0	$1.2	$2.4	$6.0	$0.0	$0.0	$6.0	$3.6	2.5

Table 37 Resource Cost Perspective, High Real Increase in Water and Energy Costs, 0% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$16.8	$2.4	$2.7	$21.9	$522.5	$260.6	$136.0	$919.1	$897.2	41.9
Showers - com use	$3.1	$0.5	$0.0	$3.5	$96.6	$48.2	$25.1	$169.9	$166.3	47.9
Toilets- res use	$17.9	$2.8	$1.4	$22.1	$430.0	$0.0	$0.0	$430.0	$407.9	19.5
Toilets- com use	$8.8	$1.4	$0.0	$10.1	$210.7	$0.0	$0.0	$210.7	$200.6	20.8
Clothes washers	$222.9	$1.3	$2.6	$226.8	$1,236.3	$150.1	$80.9	$1,467.4	$1,240.6	6.5
Dishwashers	$39.9	$0.6	$1.7	$42.2	$64.6	$39.2	$3.9	$107.7	$65.5	2.6
Taps - res use	$12.6	$3.7	$0.9	$17.1	$29.0	$14.5	$7.5	$51.0	$33.9	3.0
Taps - com use	$1.2	$0.4	$0.0	$1.6	$2.8	$1.4	$0.7	$4.9	$3.3	3.1
Urinals	$3.7	$0.0	$2.0	$5.7	$60.2	$0.0	$0.0	$60.2	$54.5	10.5
Administration				$6.7						
Total	$326.9	$12.9	$11.3	$357.7	$2,652.7	$513.9	$254.2	$3,420.9	$3,063.1	**9.6**
Household uses	$310.1	$10.8	$9.2	$330.1	$2,282.4	$464.4	$228.4	$2,975.2	$2,645.0	9.0
Commercial uses	$16.8	$2.2	$2.0	$21.0	$370.3	$49.6	$25.9	$445.7	$424.7	21.3
Showers	$19.8	$2.9	$2.7	$25.5	$619.1	$308.8	$161.1	$1,089.0	$1,063.5	42.8
Toilets	$26.7	$4.1	$1.4	$32.2	$640.7	$0.0	$0.0	$640.7	$608.5	19.9
Household appliances	$262.9	$1.9	$4.3	$269.0	$1,300.9	$189.3	$84.8	$1,575.1	$1,306.1	5.9
Taps	$13.8	$4.0	$0.9	$18.7	$31.8	$15.9	$8.3	$55.9	$37.2	3.0
Urinals	$3.7	$0.0	$2.0	$5.7	$60.2	$0.0	$0.0	$60.2	$54.5	10.5

Table 38 Resource Cost Perspective, High Real Increase in Water and Energy Costs, 5% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$9.6	$1.5	$1.9	$13.0	$181.7	$94.6	$48.7	$325.0	$312.1	25.0
Showers - com use	$1.8	$0.3	$0.0	$2.0	$33.6	$17.5	$9.0	$60.1	$58.0	29.4
Toilets- res use	$10.0	$1.7	$1.0	$12.6	$144.9	$0.0	$0.0	$144.9	$132.3	11.5
Toilets- com use	$4.9	$0.8	$0.0	$5.7	$71.0	$0.0	$0.0	$71.0	$65.3	12.4
Clothes washers	$121.7	$0.8	$1.8	$124.2	$431.5	$55.1	$29.2	$515.8	$391.6	4.2
Dishwashers	$22.7	$0.3	$1.2	$24.2	$22.1	$13.6	$1.4	$37.1	$12.9	1.5
Taps - res use	$7.2	$2.2	$0.6	$10.0	$10.1	$5.3	$2.7	$18.0	$8.0	1.8
Taps - com use	$0.7	$0.2	$0.0	$0.9	$1.0	$0.5	$0.3	$1.7	$0.8	1.9
Urinals	$2.0	$0.0	$1.5	$3.5	$20.3	$0.0	$0.0	$20.3	$16.7	5.7
Administration				$3.6						
Total	$180.5	$7.8	$7.9	$199.8	$916.1	$186.6	$91.2	$1,193.9	$994.1	**6.0**
Household uses	$171.1	$6.5	$6.4	$184.0	$790.3	$168.6	$82.0	$1,040.8	$856.8	5.7
Commercial uses	$9.4	$1.3	$1.5	$12.2	$125.9	$18.0	$9.3	$153.1	$140.9	12.5
Showers	$11.4	$1.8	$1.9	$15.0	$215.3	$112.1	$57.7	$385.1	$370.1	25.6
Toilets	$14.9	$2.5	$1.0	$18.3	$215.9	$0.0	$0.0	$215.9	$197.6	11.8
Household appliances	$144.3	$1.1	$3.0	$148.4	$453.6	$68.7	$30.6	$552.9	$404.5	3.7
Taps	$7.9	$2.4	$0.6	$10.9	$11.1	$5.8	$3.0	$19.8	$8.9	1.8
Urinals	$2.0	$0.0	$1.5	$3.5	$20.3	$0.0	$0.0	$20.3	$16.7	5.7

Table 39 Resource Cost Perspective, High Real Increase in Water and Energy Costs, 10% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$5.9	$1.0	$1.4	$8.3	$74.0	$40.7	$20.6	$135.2	$127.0	16.4
Showers - com use	$1.1	$0.2	$0.0	$1.3	$13.7	$7.5	$3.8	$25.0	$23.7	19.8
Toilets- res use	$5.9	$1.1	$0.7	$7.7	$56.6	$0.0	$0.0	$56.6	$48.9	7.3
Toilets- com use	$2.9	$0.5	$0.0	$3.4	$27.7	$0.0	$0.0	$27.7	$24.3	8.1
Clothes washers	$70.6	$0.5	$1.3	$72.4	$172.5	$23.5	$12.2	$208.3	$135.9	2.9
Dishwashers	$13.7	$0.2	$0.9	$14.8	$8.6	$5.5	$0.6	$14.6	-$0.2	1.0
Taps - res use	$4.4	$1.4	$0.4	$6.3	$4.1	$2.3	$1.1	$7.5	$1.2	1.2
Taps - com use	$0.4	$0.1	$0.0	$0.6	$0.4	$0.2	$0.1	$0.7	$0.2	1.3
Urinals	$1.2	$0.0	$1.2	$2.4	$7.9	$0.0	$0.0	$7.9	$5.5	3.3
Administration				$2.0						
Total	$106.1	$5.0	$6.0	$119.2	$365.6	$79.7	$38.4	$483.6	$364.4	**4.1**
Household uses	$100.5	$4.2	$4.8	$109.5	$315.8	$71.9	$34.4	$422.2	$312.7	3.9
Commercial uses	$5.6	$0.8	$1.2	$7.7	$49.7	$7.7	$3.9	$61.4	$53.7	8.0
Showers	$6.9	$1.1	$1.4	$9.5	$87.7	$48.2	$24.3	$160.2	$150.7	16.8
Toilets	$8.8	$1.6	$0.7	$11.2	$84.3	$0.0	$0.0	$84.3	$73.2	7.6
Household appliances	$84.3	$0.7	$2.2	$87.3	$181.1	$29.0	$12.8	$222.9	$135.6	2.6
Taps	$4.8	$1.6	$0.4	$6.8	$4.5	$2.5	$1.3	$8.2	$1.4	1.2
Urinals	$1.2	$0.0	$1.2	$2.4	$7.9	$0.0	$0.0	$7.9	$5.5	3.3

Table 40 Retail Price Perspective, No Real Increase in Water and Energy Costs, 0% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$33.5	$2.4	$2.7	$38.7	$575.1	$686.6	$277.0	$1,538.8	$1,500.1	39.8
Showers - com use	$6.2	$0.5	$0.0	$6.6	$106.3	$126.9	$51.2	$284.4	$277.8	42.8
Toilets- res use	$35.9	$2.8	$1.4	$40.0	$463.3	$0.0	$0.0	$463.3	$423.3	11.6
Toilets- com use	$17.6	$1.4	$0.0	$18.9	$227.1	$0.0	$0.0	$227.1	$208.1	12.0
Clothes washers	$445.9	$1.3	$2.6	$449.7	$1,342.3	$397.9	$165.4	$1,905.6	$1,455.9	4.2
Dishwashers	$79.8	$0.6	$1.7	$82.1	$70.7	$105.3	$8.0	$184.0	$101.8	2.2
Taps - res use	$25.1	$3.7	$0.9	$29.7	$31.9	$38.1	$15.4	$85.4	$55.7	2.9
Taps - com use	$2.4	$0.4	$0.0	$2.8	$3.1	$3.7	$1.5	$8.2	$5.4	3.0
Urinals	$7.3	$0.0	$2.0	$9.4	$64.9	$0.0	$0.0	$64.9	$55.5	6.9
Administration				$6.7						
Total	$653.8	$12.9	$11.3	$684.6	$2,884.7	$1,358.5	$518.5	$4,761.7	$4,077.1	**7.0**
Household uses	$620.2	$10.8	$9.2	$640.2	$2,483.4	$1,227.9	$465.8	$4,177.1	$3,536.9	6.5
Commercial uses	$33.5	$2.2	$2.0	$37.7	$401.3	$130.6	$52.7	$584.6	$546.9	15.5
Showers	$39.7	$2.9	$2.7	$45.3	$681.5	$813.6	$328.2	$1,823.2	$1,777.9	40.2
Toilets	$53.5	$4.1	$1.4	$58.9	$690.4	$0.0	$0.0	$690.4	$631.4	11.7
Household appliances	$525.7	$1.9	$4.3	$531.8	$1,413.0	$503.2	$173.4	$2,089.5	$1,557.7	3.9
Taps	$27.5	$4.0	$0.9	$32.5	$35.0	$41.8	$16.9	$93.6	$61.2	2.9
Urinals	$7.3	$0.0	$2.0	$9.4	$64.9	$0.0	$0.0	$64.9	$55.5	6.9

Table 41 Retail Price Perspective, No Real Increase in Water and Energy Costs, 5% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$19.2	$1.5	$1.9	$22.6	$212.7	$256.1	$101.7	$570.5	$547.9	25.3
Showers - com use	$3.5	$0.3	$0.0	$3.8	$39.3	$47.3	$18.8	$105.5	$101.6	27.6
Toilets- res use	$19.9	$1.7	$1.0	$22.6	$164.1	$0.0	$0.0	$164.1	$141.5	7.3
Toilets- com use	$9.8	$0.8	$0.0	$10.6	$80.4	$0.0	$0.0	$80.4	$69.8	7.6
Clothes washers	$243.3	$0.8	$1.8	$245.9	$491.2	$149.5	$61.0	$701.7	$455.8	2.9
Dishwashers	$45.3	$0.3	$1.2	$46.9	$25.2	$37.4	$2.9	$65.4	$18.5	1.4
Taps - res use	$14.4	$2.2	$0.6	$17.2	$11.8	$14.2	$5.6	$31.7	$14.5	1.8
Taps - com use	$1.4	$0.2	$0.0	$1.6	$1.1	$1.4	$0.5	$3.0	$1.4	1.9
Urinals	$4.1	$0.0	$1.5	$5.6	$23.0	$0.0	$0.0	$23.0	$17.4	4.1
Administration				$3.6						
Total	$360.9	$7.8	$7.9	$380.3	$1,048.8	$505.9	$190.5	$1,745.3	$1,365.0	**4.6**
Household uses	$342.2	$6.5	$6.4	$355.1	$905.0	$457.2	$171.2	$1,533.4	$1,178.3	4.3
Commercial uses	$18.8	$1.3	$1.5	$21.6	$143.8	$48.7	$19.3	$211.9	$190.3	9.8
Showers	$22.7	$1.8	$1.9	$26.4	$252.0	$303.4	$120.5	$676.0	$649.6	25.6
Toilets	$29.7	$2.5	$1.0	$33.2	$244.5	$0.0	$0.0	$244.5	$211.3	7.4
Household appliances	$288.6	$1.1	$3.0	$292.7	$516.4	$186.9	$63.8	$767.1	$474.4	2.6
Taps	$15.8	$2.4	$0.6	$18.8	$12.9	$15.6	$6.2	$34.7	$15.9	1.8
Urinals	$4.1	$0.0	$1.5	$5.6	$23.0	$0.0	$0.0	$23.0	$17.4	4.1

Table 42 Retail Price Perspective, No Real Increase in Water and Energy Costs, 10% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$11.7	$1.0	$1.4	$14.1	$92.8	$112.9	$44.0	$249.7	$235.6	17.7
Showers - com use	$2.2	$0.2	$0.0	$2.3	$17.2	$20.9	$8.1	$46.2	$43.8	19.7
Toilets- res use	$11.9	$1.1	$0.7	$13.7	$67.9	$0.0	$0.0	$67.9	$54.2	5.0
Toilets- com use	$5.8	$0.5	$0.0	$6.3	$33.3	$0.0	$0.0	$33.3	$26.9	5.2
Clothes washers	$141.1	$0.5	$1.3	$143.0	$207.4	$65.4	$26.0	$298.8	$155.8	2.1
Dishwashers	$27.4	$0.2	$0.9	$28.6	$10.3	$15.2	$1.2	$26.7	-$1.8	0.9
Taps - res use	$8.8	$1.4	$0.4	$10.7	$5.2	$6.3	$2.4	$13.9	$3.2	1.3
Taps - com use	$0.8	$0.1	$0.0	$1.0	$0.5	$0.6	$0.2	$1.3	$0.3	1.4
Urinals	$2.4	$0.0	$1.2	$3.6	$9.5	$0.0	$0.0	$9.5	$5.9	2.6
Administration				$2.0						
Total	$212.2	$5.0	$6.0	$225.3	$444.0	$221.2	$82.0	$747.2	$521.9	**3.3**
Household uses	$201.0	$4.2	$4.8	$210.0	$383.6	$199.7	$73.6	$656.9	$446.9	3.1
Commercial uses	$11.2	$0.8	$1.2	$13.3	$60.4	$21.5	$8.4	$90.3	$77.0	6.8
Showers	$13.9	$1.1	$1.4	$16.5	$110.0	$133.7	$52.1	$295.8	$279.4	18.0
Toilets	$17.7	$1.6	$0.7	$20.0	$101.2	$0.0	$0.0	$101.2	$81.2	5.1
Household appliances	$168.6	$0.7	$2.2	$171.5	$217.7	$80.6	$27.2	$325.5	$153.9	1.9
Taps	$9.6	$1.6	$0.4	$11.6	$5.6	$6.9	$2.7	$15.2	$3.5	1.3
Urinals	$2.4	$0.0	$1.2	$3.6	$9.5	$0.0	$0.0	$9.5	$5.9	2.6

Table 43 Retail Price Perspective, Medium Real Increase in Water and Energy Costs, 0% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$33.5	$2.4	$2.7	$38.7	$780.0	$753.7	$304.5	$1,838.2	$1,799.5	47.5
Showers - com use	$6.2	$0.5	$0.0	$6.6	$144.2	$139.3	$56.3	$339.8	$333.1	51.1
Toilets- res use	$35.9	$2.8	$1.4	$40.0	$634.5	$0.0	$0.0	$634.5	$594.5	15.9
Toilets- com use	$17.6	$1.4	$0.0	$18.9	$311.0	$0.0	$0.0	$311.0	$292.0	16.4
Clothes washers	$445.9	$1.3	$2.6	$449.7	$1,829.0	$435.9	$181.5	$2,446.4	$1,996.7	5.4
Dishwashers	$79.8	$0.6	$1.7	$82.1	$96.8	$115.9	$8.8	$221.5	$139.4	2.7
Taps - res use	$25.1	$3.7	$0.9	$29.7	$43.3	$41.8	$16.9	$102.0	$72.3	3.4
Taps - com use	$2.4	$0.4	$0.0	$2.8	$4.2	$4.0	$1.6	$9.8	$7.0	3.5
Urinals	$7.3	$0.0	$2.0	$9.4	$88.8	$0.0	$0.0	$88.8	$79.5	9.5
Administration				$6.7						
Total	$653.8	$12.9	$11.3	$684.6	$3,931.8	$1,490.7	$569.6	$5,992.0	$5,307.4	**8.8**
Household uses	$620.2	$10.8	$9.2	$640.2	$3,383.6	$1,347.4	$511.7	$5,242.7	$4,602.4	8.2
Commercial uses	$33.5	$2.2	$2.0	$37.7	$548.1	$143.3	$57.9	$749.4	$711.6	19.9
Showers	$39.7	$2.9	$2.7	$45.3	$924.2	$893.0	$360.8	$2,177.9	$2,132.6	48.1
Toilets	$53.5	$4.1	$1.4	$58.9	$945.4	$0.0	$0.0	$945.4	$886.5	16.0
Household appliances	$525.7	$1.9	$4.3	$531.8	$1,925.8	$551.9	$190.3	$2,668.0	$2,136.1	5.0
Taps	$27.5	$4.0	$0.9	$32.5	$47.5	$45.9	$18.5	$111.8	$79.4	3.4
Urinals	$7.3	$0.0	$2.0	$9.4	$88.8	$0.0	$0.0	$88.8	$79.5	9.5

Table 44 Retail Price Perspective, Medium Real Increase in Water and Energy Costs, 5% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$19.2	$1.5	$1.9	$22.6	$280.2	$277.4	$110.4	$667.9	$645.4	29.6
Showers - com use	$3.5	$0.3	$0.0	$3.8	$51.8	$51.3	$20.4	$123.5	$119.6	32.3
Toilets- res use	$19.9	$1.7	$1.0	$22.6	$219.4	$0.0	$0.0	$219.4	$196.8	9.7
Toilets- com use	$9.8	$0.8	$0.0	$10.6	$107.5	$0.0	$0.0	$107.5	$96.9	10.1
Clothes washers	$243.3	$0.8	$1.8	$245.9	$654.4	$162.0	$66.2	$882.5	$636.7	3.6
Dishwashers	$45.3	$0.3	$1.2	$46.9	$33.8	$40.7	$3.1	$77.6	$30.8	1.7
Taps - res use	$14.4	$2.2	$0.6	$17.2	$15.6	$15.4	$6.1	$37.1	$19.9	2.2
Taps - com use	$1.4	$0.2	$0.0	$1.6	$1.5	$1.5	$0.6	$3.6	$2.0	2.2
Urinals	$4.1	$0.0	$1.5	$5.6	$30.7	$0.0	$0.0	$30.7	$25.1	5.5
Administration				$3.6						
Total	$360.9	$7.8	$7.9	$380.3	$1,394.8	$548.2	$206.8	$2,149.8	$1,769.5	**5.7**
Household uses	$342.2	$6.5	$6.4	$355.1	$1,203.2	$495.5	$185.8	$1,884.5	$1,529.5	5.3
Commercial uses	$18.8	$1.3	$1.5	$21.6	$191.5	$52.8	$21.0	$265.3	$243.7	12.3
Showers	$22.7	$1.8	$1.9	$26.4	$332.0	$328.6	$130.8	$791.4	$765.0	30.0
Toilets	$29.7	$2.5	$1.0	$33.2	$326.9	$0.0	$0.0	$326.9	$293.7	9.9
Household appliances	$288.6	$1.1	$3.0	$292.7	$688.1	$202.7	$69.3	$960.2	$667.4	3.3
Taps	$15.8	$2.4	$0.6	$18.8	$17.0	$16.9	$6.7	$40.6	$21.8	2.2
Urinals	$4.1	$0.0	$1.5	$5.6	$30.7	$0.0	$0.0	$30.7	$25.1	5.5

Table 45 Retail Price Perspective, Medium Real Increase in Water and Energy Costs, 10% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$11.7	$1.0	$1.4	$14.1	$118.5	$120.7	$47.2	$286.4	$272.3	20.3
Showers - com use	$2.2	$0.2	$0.0	$2.3	$21.9	$22.3	$8.7	$52.9	$50.6	22.6
Toilets- res use	$11.9	$1.1	$0.7	$13.7	$88.4	$0.0	$0.0	$88.4	$74.7	6.5
Toilets- com use	$5.8	$0.5	$0.0	$6.3	$43.3	$0.0	$0.0	$43.3	$37.0	6.8
Clothes washers	$141.1	$0.5	$1.3	$143.0	$269.5	$70.0	$27.9	$367.5	$224.5	2.6
Dishwashers	$27.4	$0.2	$0.9	$28.6	$13.5	$16.5	$1.3	$31.2	$2.7	1.1
Taps - res use	$8.8	$1.4	$0.4	$10.7	$6.6	$6.7	$2.6	$15.9	$5.2	1.5
Taps - com use	$0.8	$0.1	$0.0	$1.0	$0.6	$0.6	$0.3	$1.5	$0.5	1.6
Urinals	$2.4	$0.0	$1.2	$3.6	$12.4	$0.0	$0.0	$12.4	$8.8	3.4
Administration				$2.0						
Total	$212.2	$5.0	$6.0	$225.3	$574.7	$236.9	$88.0	$899.5	$674.2	**4.0**
Household uses	$201.0	$4.2	$4.8	$210.0	$496.5	$213.9	$79.0	$789.4	$579.4	3.8
Commercial uses	$11.2	$0.8	$1.2	$13.3	$78.2	$23.0	$9.0	$110.2	$96.9	8.3
Showers	$13.9	$1.1	$1.4	$16.5	$140.4	$143.0	$55.9	$339.3	$322.9	20.6
Toilets	$17.7	$1.6	$0.7	$20.0	$131.7	$0.0	$0.0	$131.7	$111.7	6.6
Household appliances	$168.6	$0.7	$2.2	$171.5	$283.0	$86.5	$29.2	$398.7	$227.1	2.3
Taps	$9.6	$1.6	$0.4	$11.6	$7.2	$7.3	$2.9	$17.4	$5.8	1.5
Urinals	$2.4	$0.0	$1.2	$3.6	$12.4	$0.0	$0.0	$12.4	$8.8	3.4

Table 46 Retail Price Perspective, High Real Increase in Water and Energy Costs, 0% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$33.5	$2.4	$2.7	$38.7	$983.1	$840.4	$340.0	$2,163.5	$2,124.9	56.0
Showers - com use	$6.2	$0.5	$0.0	$6.6	$181.7	$155.3	$62.8	$399.9	$393.3	60.2
Toilets- res use	$35.9	$2.8	$1.4	$40.0	$804.3	$0.0	$0.0	$804.3	$764.3	20.1
Toilets- com use	$17.6	$1.4	$0.0	$18.9	$394.2	$0.0	$0.0	$394.2	$375.2	20.8
Clothes washers	$445.9	$1.3	$2.6	$449.7	$2,316.1	$485.1	$202.3	$3,003.6	$2,553.9	6.7
Dishwashers	$79.8	$0.6	$1.7	$82.1	$123.0	$129.7	$9.8	$262.4	$180.3	3.2
Taps - res use	$25.1	$3.7	$0.9	$29.7	$54.6	$46.6	$18.9	$120.1	$90.4	4.0
Taps - com use	$2.4	$0.4	$0.0	$2.8	$5.3	$4.5	$1.8	$11.6	$8.8	4.2
Urinals	$7.3	$0.0	$2.0	$9.4	$112.6	$0.0	$0.0	$112.6	$103.2	12.0
Administration				$6.7						
Total	$653.8	$12.9	$11.3	$684.6	$4,974.8	$1,661.7	$635.6	$7,272.2	$6,587.6	**10.6**
Household uses	$620.2	$10.8	$9.2	$640.2	$4,281.1	$1,501.9	$571.0	$6,353.9	$5,713.7	9.9
Commercial uses	$33.5	$2.2	$2.0	$37.7	$693.8	$159.8	$64.7	$918.3	$880.5	24.3
Showers	$39.7	$2.9	$2.7	$45.3	$1,164.8	$995.8	$402.8	$2,563.4	$2,518.1	56.6
Toilets	$53.5	$4.1	$1.4	$58.9	$1,198.5	$0.0	$0.0	$1,198.5	$1,139.5	20.3
Household appliances	$525.7	$1.9	$4.3	$531.8	$2,439.1	$614.8	$212.1	$3,266.0	$2,734.2	6.1
Taps	$27.5	$4.0	$0.9	$32.5	$59.8	$51.1	$20.7	$131.6	$99.2	4.1
Urinals	$7.3	$0.0	$2.0	$9.4	$112.6	$0.0	$0.0	$112.6	$103.2	12.0

Table 47 Retail Price Perspective, High Real Increase in Water and Energy Costs, 5% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$19.2	$1.5	$1.9	$22.6	$347.7	$305.3	$121.7	$774.6	$752.0	34.3
Showers - com use	$3.5	$0.3	$0.0	$3.8	$64.3	$56.4	$22.5	$143.2	$139.4	37.5
Toilets- res use	$19.9	$1.7	$1.0	$22.6	$274.8	$0.0	$0.0	$274.8	$252.2	12.2
Toilets- com use	$9.8	$0.8	$0.0	$10.6	$134.7	$0.0	$0.0	$134.7	$124.1	12.7
Clothes washers	$243.3	$0.8	$1.8	$245.9	$819.2	$178.2	$73.0	$1,070.4	$824.5	4.4
Dishwashers	$45.3	$0.3	$1.2	$46.9	$42.5	$45.1	$3.5	$91.0	$44.2	1.9
Taps - res use	$14.4	$2.2	$0.6	$17.2	$19.3	$16.9	$6.8	$43.0	$25.8	2.5
Taps - com use	$1.4	$0.2	$0.0	$1.6	$1.9	$1.6	$0.7	$4.1	$2.5	2.6
Urinals	$4.1	$0.0	$1.5	$5.6	$38.5	$0.0	$0.0	$38.5	$32.9	6.9
Administration				$3.6						
Total	$360.9	$7.8	$7.9	$380.3	$1,742.7	$603.6	$228.0	$2,574.3	$2,194.0	**6.8**
Household uses	$342.2	$6.5	$6.4	$355.1	$1,503.4	$545.5	$204.9	$2,253.8	$1,898.7	6.3
Commercial uses	$18.8	$1.3	$1.5	$21.6	$239.3	$58.1	$23.1	$320.5	$298.9	14.8
Showers	$22.7	$1.8	$1.9	$26.4	$411.9	$361.7	$144.2	$917.8	$891.4	34.8
Toilets	$29.7	$2.5	$1.0	$33.2	$409.5	$0.0	$0.0	$409.5	$376.3	12.3
Household appliances	$288.6	$1.1	$3.0	$292.7	$861.6	$223.3	$76.5	$1,161.4	$868.7	4.0
Taps	$15.8	$2.4	$0.6	$18.8	$21.2	$18.6	$7.4	$47.1	$28.3	2.5
Urinals	$4.1	$0.0	$1.5	$5.6	$38.5	$0.0	$0.0	$38.5	$32.9	6.9

Table 48 Retail Price Perspective, High Real Increase in Water and Energy Costs, 10% Discount Rate

	Costs				Benefits				Net	Benefit/
	Increase	Labelling	Test, Reg	Total	Water	Elect	Gas	Total	Benefits	cost
	$M	$M	$M	$M	$M	$M	$M	$M	$M	
Showers - res use	$11.7	$1.0	$1.4	$14.1	$144.2	$131.2	$51.4	$326.8	$312.7	23.1
Showers - com use	$2.2	$0.2	$0.0	$2.3	$26.7	$24.3	$9.5	$60.4	$58.1	25.8
Toilets- res use	$11.9	$1.1	$0.7	$13.7	$109.1	$0.0	$0.0	$109.1	$95.4	8.0
Toilets- com use	$5.8	$0.5	$0.0	$6.3	$53.4	$0.0	$0.0	$53.4	$47.1	8.4
Clothes washers	$141.1	$0.5	$1.3	$143.0	$332.5	$76.2	$30.5	$439.1	$296.2	3.1
Dishwashers	$27.4	$0.2	$0.9	$28.6	$16.8	$18.0	$1.4	$36.2	$7.7	1.3
Taps - res use	$8.8	$1.4	$0.4	$10.7	$8.0	$7.3	$2.9	$18.1	$7.5	1.7
Taps - com use	$0.8	$0.1	$0.0	$1.0	$0.8	$0.7	$0.3	$1.7	$0.8	1.8
Urinals	$2.4	$0.0	$1.2	$3.6	$15.3	$0.0	$0.0	$15.3	$11.7	4.2
Administration				$2.0						
Total	$212.2	$5.0	$6.0	$225.3	$706.7	$257.7	$95.9	$1,060.3	$835.0	**4.7**
Household uses	$201.0	$4.2	$4.8	$210.0	$610.5	$232.8	$86.1	$929.4	$719.4	4.4
Commercial uses	$11.2	$0.8	$1.2	$13.3	$96.1	$25.0	$9.8	$130.9	$117.6	9.9
Showers	$13.9	$1.1	$1.4	$16.5	$170.9	$155.5	$60.9	$387.2	$370.8	23.5
Toilets	$17.7	$1.6	$0.7	$20.0	$162.5	$0.0	$0.0	$162.5	$142.5	8.1
Household appliances	$168.6	$0.7	$2.2	$171.5	$349.2	$94.3	$31.9	$475.4	$303.8	2.8
Taps	$9.6	$1.6	$0.4	$11.6	$8.8	$8.0	$3.1	$19.9	$8.2	1.7
Urinals	$2.4	$0.0	$1.2	$3.6	$15.3	$0.0	$0.0	$15.3	$11.7	4.2

*****