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Regulation Impact Statement: Minimum water efficiency standards for clothes washers and water efficiency labelling for combined washer-dryers

April 2010

The Water Efficiency Labelling and Standards (WELS) scheme is an Australian Government initiative in partnership with state and territory governments.



Regulation Impact Statement: Minimum water efficiency standards for clothes washers and water efficiency labelling for combined washer-dryers

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Summary

Background

The *Water Efficiency Labelling and Standards Act 2005* (WELS Act) mandates water efficiency labelling for a range of products, and minimum water efficiency standards (WES) for a subset of those products.

In November 2006, the Environment Protection and Heritage Council (EPHC) agreed to consider water efficiency labelling and standards for combination washer-dryers (CWDs) that use water in dryer-mode, evaporative air conditioners, instantaneous gas hot water systems, hot water circulators and domestic irrigation flow controllers. Governments also agreed to consider the introduction of new minimum WES for clothes washers (CWs), taps, dishwashers (DWs), CWDs, showers, urinals and other products, and to consider raising the minimum WES for toilets.

This Regulation Impact Statement (RIS) was commissioned by the Department of the Environment, Water, Heritage and the Arts (DEWHA), with the following terms of reference:

- Analyse the costs and benefits of introducing minimum WES for CWs. At present these are covered by WELS labelling only.
- Analyse the costs and benefits of introducing minimum WES for DWs. At present these are covered by WELS labelling only.
- Analyse the costs and benefits of extending the WELS scheme to the water used in the drying function of CWDs. At present, these are only covered with regard to the WELS labelling of their washing function.

There was debate at the commencement of the WELS scheme about whether mandatory WES should also be adopted, but the original RIS concluded that WES could not be justified for any product but toilets at the time. Minimum WES for CW and DW can now be reassessed because there is sufficient information about the market to underpin a stringent analysis, thanks to the WELS scheme (any CW and DW supplied in Australia since 2005 has to be registered under the scheme).

The Problem

The problem is that with increasingly variable, and in some areas scarce, water supplies within Australia due to the impacts of climate change and increases in population:

- there is a need to balance supply and demand for potable water; and
- there is a need to incorporate into individual purchase decisions for appliances the full social costs and benefits.

The urban water market is liable to a number of market failures due to the nature of the product and the market itself. Urban water pricing is based on long-term costs for supply investments, rather than adjusting for short term variations in inflows, and the demand for household indoor water is relatively inelastic.

To address the problem, governments have focused on a range of supply augmentation and demand management policies in addition to improving pricing signals. In general demand management responses are considered more cost-effective than investments in supply augmentation. However, demand management responses also have limitations to what can be achieved, particularly in relation to reducing household indoor water consumption, which has been shown to be relatively inelastic.

Rationale for WELS

The WELS scheme falls within the range of demand management measures that have been introduced by governments. The WELS scheme currently provides information about the water consumption and relative water efficiency of household water-using products. In this way, the WELS scheme assists demand management by providing better information on the choices available.

The WELS scheme has been found to be one of the most cost-effective water management options available to governments, and its predicted water savings are used by water utilities in developing their water usage forecasts and supply plans. In this way, the WELS scheme plays a role for governments in their efforts to balance the supply and demand for potable water, as water savings achieved by the WELS scheme can potentially delay decisions on making additional investments in supply augmentation. This results in a more efficient outcome for the whole of society in balancing the supply and demand for potable water, as the WELS scheme is more cost-effective than supply augmentation options.

A key benefit of the WELS scheme is its ability to achieve water savings in a way that does not affect the user utility. Water savings can be achieved while still achieving the same performance outcomes, such as washing clothes or flushing a toilet. However, although the WELS scheme assists consumers in identifying water efficient products, some consumers may still purchase inefficient products which collectively lead to an suboptimal outcome for the whole of society. To address this problem, the WELS scheme was also established to provide for minimum WES, in addition to labelling. To date, toilets are the only product subject to a minimum WES under the WELS scheme.

This RIS attempts to address the problem by considering the case for the establishment of minimum WES for CWs and DWs, as well as the inclusion into the WELS scheme of the water-using dryer-mode of CWDs for labelling and minimum WES.

The regulations proposed in this RIS would represent appropriate Government intervention in the urban water market so long as the benefits of doing so are assessed as outweighing the costs and are found to be the preferred method of addressing the problem.

Options considered

The measures considered in the RIS have the objectives of addressing the identified problems in a way which increases net benefits to purchasers of appliances and to other users of water. These policy objectives would be realised if the proposed measures:

- increase projected water savings (i.e. they are effective);
- make purchasers/users of the affected appliances as a group better off – or at least no worse off (i.e. they are privately cost-effective);

- make non-purchasing owners/users of the affected appliances as a group better off (i.e. the benefits can be realised despite unmotivated intermediaries);
- have acceptable impacts on product choice;
- carry low risks of reducing supplier price competition;
- are consistent with environmental protection, consumer protection and other general public policy objectives; and
- make water users as a group better off – or at least no worse off – in terms of the costs of water services they face.

The following options to address the problem were considered, and compared with the ‘business-as-usual’ (BAU) option of continuing with the existing WELS labels only:

- voluntary labelling and minimum WES.
- mandatory ‘Water Warning’ labels.
- rebate schemes.
- mandatory water efficiency labelling and mandatory minimum WES, including:
 - a new mandatory water efficiency label for drying-mode water use of CWDs.
 - new mandatory WES for CWs, CWDs and DWs.

Preferred Options

The assessment of the options are summarised in Table S1 and Table S2. The measures which best meet the criteria are a combination of mandatory WELS labelling and minimum WES.

CWs are high water users, so the potential water savings from minimum WES are high. The top loader clothes washer market still offers models that use up to 189 litres to wash a typical 5 kilogram (kg) load, compared with the most water-efficient models which use just 56 litres to wash the same load and meet the same Australia Standards.

The absence of readily accessible information on drying-mode water use means that most consumers are unaware that CWDs use water for this purpose, and those who are aware are not able to compare the performance of alternative models. Water supply authority rebate schemes have been compromised because many payments for the purchase of ‘water-efficient’ CWs (generally those with a Star Rating Index or SRI of 4.0 or more) have been made for CWD purchases, which in fact *increase* water use compared with the alternatives. There is therefore some urgency in implementing a labelling scheme to identify CWDs as water users in drying mode.

DWs use much less water per wash than CWs (typically 15 to 20 litres) so the water savings available from any feasible minimum WES levels are very small in comparison.

Table S1. Assessment of options compared with status quo

Measure	Projected water savings	Impact on product purchasers	Impact on specifiers, intermediaries	Risk to choice, competition	Impact on other water users	Consumer protection
Voluntary WELS labelling	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected
Mandatory WELS labelling	Moderate savings	All benefit from higher average efficiency; label users benefit more	No impact; no incentive to use label	Can enhance competition by making efficiency a selling point	Benefit from lower water demand; costs borne by purchasers	Moderate; very inefficient products still on the market
Rebates (assuming no WELS)	Moderate savings	Recipients benefit from rebate as well as from lower running costs	Can influence if rebate rules allow	No risk	High; worse off if rebate scheme not cost-effective	No effect
Water warning labels (alone)	Very little savings	Minimal	None	No risk	Benefit from lower water demand; costs borne by purchasers	Moderate; very inefficient products still on the market
Voluntary minimum WES	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected
Mandatory minimum WES: low level	Some savings	Do not need to be aware; better off if minimum WES level meets criteria	Influences all purchases, including these	Very little risk	Benefit from lower water demand; costs borne by purchasers	High; very inefficient products excluded from market
Mandatory minimum WES: higher level	High savings	Do not need to be aware; better off if minimum WES level meets criteria	Influences all purchases, including these	Some risk; levels need to be set carefully	Benefit from lower water demand; costs borne by purchasers	High; very inefficient products excluded from market

Table S2. Summary of preferred options

Product	Method of test	Rating method	WELS labelling	Washing mode minimum WES level	Drying mode minimum WES level
Clothes washer; top loader	No change	No change	No change	SRI = 3.0	NA
Clothes washer; front loader	No change	No change	No change	SRI = 3.0	NA

Product	Method of test	Rating method	WELS labelling	Washing mode minimum WES level	Drying mode minimum WES level
Combined washer-dryer	Stage 1: No change Stage 2: develop new combined test	1. Add drying-mode SRI to AS/NZS 6400 2. Add process SRI to AS/NZS 6400	1. New label with drying-mode SRI & litres/load dried 2. Replace with process SRI & litres/load processed	SRI = 3.0	NA
Dishwasher	No change	No change	No change	NA	NA

Projected Costs and Benefits: End User Perspective

It is projected that the implementation of the preferred options will lead to annual water savings approaching 27,000 mega litres (ML) per year by 2027, compared with BAU. This is about 7.1 per cent of the projected BAU water consumption of the appliances covered. About 88 per cent of this would come from minimum WES for CWs, and the rest from labelling CWD drying-mode water use.

The measures will also lead to significant energy savings from lower water heating requirements for top loading (TL) CWs, from a reduction in clothes drying energy and a reduction in future energy requirements for water supply desalination and pumping. It is projected that the measure will lead to a reduction of 240 kilotonne (Kt) of carbon dioxide-equivalent (CO₂-e) emission per year below BAU by 2027. Electricity would account for 82 per cent of the energy saved and 91 per cent of the emissions saved, because of the high greenhouse-intensity compared with natural gas and liquefied petroleum gas (LPG).

The value of projected water and energy savings (including the effects of CO₂ prices) has been calculated under a wide range of price scenarios, ranging from no real increase in water, wastewater and energy prices to moderate and higher rates of increase.

It is projected that the combined effect of minimum WES for CWs and dryer-mode labelling for CWDs could reduce national household expenditure on water, wastewater and energy by more than \$87 million per year by 2027. About 48 per cent of the savings will come from reduced expenditure on water, eight per cent from wastewater and 42 per cent from energy.

The proposed measures would rely on water and energy tests that have been, or will be carried out in any case. The costs of administration and of adding an extra physical label to CWDs are small (Table S3). There is only a weak relationship between water efficiency and product price, but some buyers could be forced to pay more for a CW than would otherwise be the case. Buyers who divert from a single CWD purchase to a two-product purchase (CW plus CD) will in most cases spend less for the two products than for the one. On these assumptions, benefits are expected to exceed costs by the fourth year of implementation, and increase rapidly thereafter (Figure S1).

The net present value (NPV) of cost and benefits has been tested under a range of scenarios and discount rates, and has been found to be highly robust. Benefit/cost ratios are high in all jurisdictions (Table S3) and there is a very low probability that the overall benefit/cost ratio of the proposed

package of measures will fall below 2.0 NPV nationally, even at high discount rates and low rates of price growth.

The main non-quantifiable cost to consumers of WES is a likely restriction in the range of TL CW models available on the market, at least until suppliers introduce additional WES-compliant models. The main non-quantifiable cost to consumers of CWD drying-mode water use labelling is the possible loss of convenience of single-operation washing and drying to those purchasers who are diverted away from CWDs once they become aware of their total water consumption. However, this is voluntary in that buyers determine this choice for themselves.

Figure S1. Projected Costs, Savings and Net Benefits from minimum WES for CWs and CWD WELS labelling, Australia

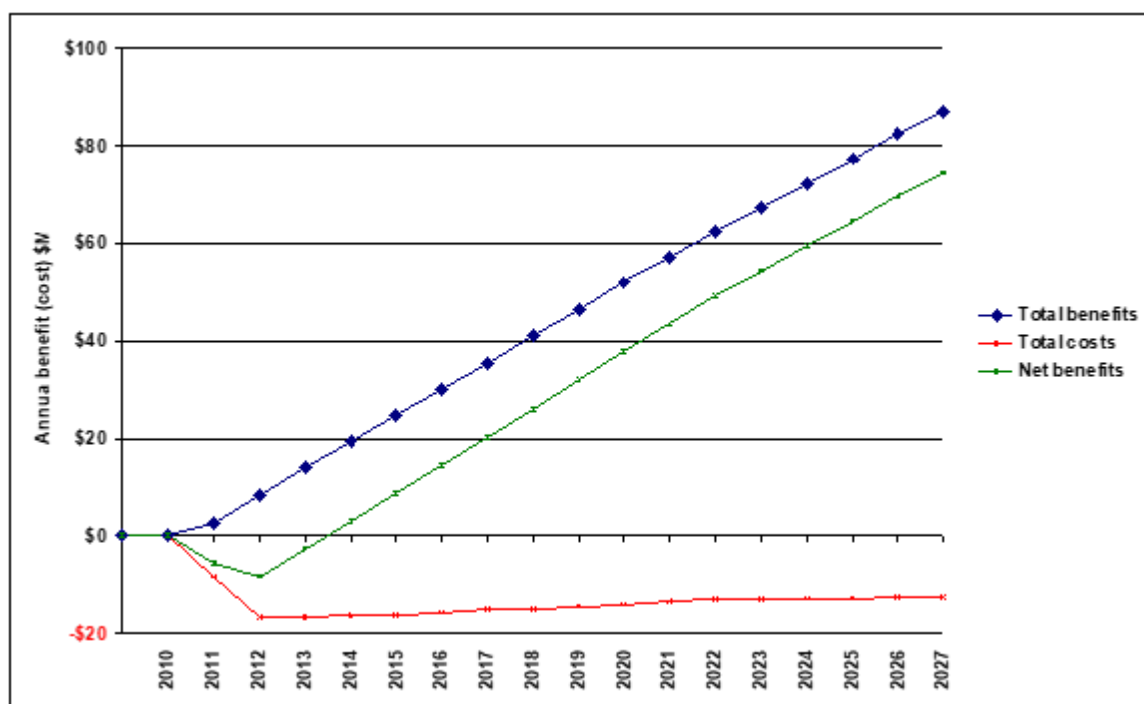


Table S3. Impacts and cost-effectiveness by jurisdiction

State/Territory	ML saved 2010-27	Cost \$M (a)	Benefit \$M (a)	Net benefit \$M (a)	B/C ratio
NSW	78375	25.3	189.5	164.2	7.5
Vic	60805	18.0	224.7	206.8	12.5
Qld	58652	18.4	83.7	65.2	4.5
SA	17465	4.7	44.9	40.2	9.5
WA.	27571	6.6	44.4	37.8	6.7
Tas	6059	1.8	16.7	14.9	9.3
NT	1777	0.4	1.9	1.5	5.0
ACT	3833	0.9	8.9	7.9	9.6
Total	254537	76.2	614.7	538.5	8.2
Admin cost (national)	-	2.0	NA	NA	NA
Total with admin cost	-	78.2	614.7	536.5	7.9

(a) Net present value of costs and benefits incurred over the period 2010 to 2027, at a discount rate of seven per cent.

Supply Cost Perspective

The cost and benefits to this point have been assessed from the perspective of the appliance buyers/users. If supply/production costs are substituted for retail costs, both costs and benefits decline in absolute terms, but not symmetrically. There would be a benefit in reduced wastewater management costs which are not at present signalled to users, and which would increase the benefit/cost ratio from the societal perspective.

Measures which reduce the demand for water are directly substitutable for measures which augment the supply of water, and their costs can be compared. The levelised costs of the measures analysed in this RIS are estimated at \$ 0.12 to \$ 0.17 per kilolitre (kl). This is well below the levelised cost of all supply side options, and lower than all the demand side options other than the 'outdoor water efficiency' measures (Table S4).

Table S4. Summary of water demand side and supply side option costs

Demand Reduction Options

Options	Approx. levelised unit cost (\$/kl)
Outdoor water efficiency (a)	\$0.10 – \$0.20
WELS measures covered in this RIS (c)(b)	\$0.12 - \$0.17
WELS (programs implemented to date) (a)(b)	\$0.13 - \$ 0.21
Shower head programs (shower head exchanges, rebates, and retrofits) (a)	\$0.50 – \$0.60
Building regulations (a)	\$0.30 – \$4.00
Clothes washer rebates (c)	\$2.10 – \$2.60

Supply augmentation

Options	Approx. levelised unit cost (\$/kl)
Desalination (a)	\$1.19 – \$2.55
New storage (a)	\$1.26 – \$3.58
New recycling schemes in Sydney (a)	\$1.00 – \$5.50
Residential Rainwater Tanks (a)	\$3.00 - \$4.00

Source: (a) ISF (2008). (b) 3.5 per cent to 10.0 per cent discount rates; upper cost estimates. (c) Calculated in this RIS: same range of discount rates used here to maintain comparability with other studies.

Consultations

The Consultation RIS was released for a nine week public comment phase in November 2008. A public forum was held in Sydney in December 2008 and submissions were received up to the end of January 2009. The analysis and recommendations in the Consultation RIS were revised to take account of stakeholder submissions, especially with respect to higher WES levels and harmonised WES levels for TL and FL CWs.

All submissions but one supported the implementation of minimum WES for CWs and the labelling of CWD drying-mode water use, but there were different opinions on the minimum WES levels and on the modes of labelling recommended in the Consultation RIS. One submission argued that CWs with lower water use have higher environmental impact because their lower rinse volumes leave more undissolved detergent residues in the waste water.

The following changes were made to this Decision RIS in response to the submissions:

- The analysis was repeated with more recent market information. While the Consultation RIS relied on data on product sales in calendar 2006, this Decision RIS also uses sales data from 2007 and 2008;
- Water price projections were updated (and significantly increased) to take account of later regulator price determinations;
- Energy price projections were updated (and significantly increased) to take account of the projected impacts of the Carbon Pollution Reduction Scheme (CPRS);
- Greenhouse gas intensity projections were revised (and slightly lowered) to take account of the projected impacts of the CPRS;
- The proposal for different minimum WES levels for TL and front loading (FL) CWs has been omitted in favour of a single minimum WES level;
- The proposal for DW minimum WES has been omitted;
- The proposal for a star rating WELS label and a minimum WES for drying-mode water use of CWDs has been omitted in favour of a WELS Water Warning label; and
- The proposal to cover stand-alone condenser clothes dryers (CD) using mains water has been omitted, since there are no such models on the market.

Recommendations

It is recommended that:

- 1) A minimum water efficiency standard for the washing function of clothes washers and combined washer dryers (CWDs) should be adopted, with the same minimum WES level to apply to all product types, including top loading and front loading.
- 2) The initial minimum WES level for clothes washers of 5.0 kg capacity or greater should be a Star Rating Index of 3.0, as calculated in accordance with AS/NZS 6400, *Water Efficient Products – Rating and Labelling*.
- 3) In order to maintain consumer choice in smaller capacity clothes washers, the initial minimum WES level for clothes washers of less than 5.0 kg capacity should be a Star Rating Index of 2.5, as calculated in accordance with AS/NZS 6400.
- 4) The above measures should apply to all CW models manufactured or imported following a notice period of at least 12 months, but not more than 18 months from EPHC decision (i.e. they would take effect between the second half of 2011 or the beginning of 2012.

- 5) Once the market impacts of the initial minimum WES levels become clear, consideration should be given to further raising the WES levels to 4.0 (and 3.0 for units of less than 5.0 kg), following a further notice period.
- 6) There should be no minimum water efficiency standard for dishwashers for the time being.
- 7) A method of rating and labelling the water consumption of the drying mode of combined washer dryers should be required by the WELS scheme, most likely through inclusion in AS/NZS 6400.
- 8) The CWD drying mode label should have the following elements:
 - a 'Water Warning' or similar heading (as provided for in AS/NZS 6400);
 - the total litres of water consumed during drying, as recorded in existing tests; and
 - the maximum drying load capacity (in kg), as recorded in existing tests.
- 9) The display of the CWD drying label at the point of sale should be mandatory for all CWDs manufactured or imported following a notice period of 12 months from EPHC decision.
- 10) Work should commence on a new 'combined function' test for CWDs, which would measure the energy and water used to wash and dry a complete load of the maximum capacity for which the unit can perform those functions without removal or disturbance of the load.
- 11) When developed, the test should become the basis for a 'combined function' rating which could initially be included on the water rating and energy rating websites, and could eventually replace the drying-mode WELS label.

Abbreviations

ABS	Australian Bureau of Statistics
AEEMA	Australian Electrical and Electronics Manufacturers Association
AGO	Australian Greenhouse Office
AiG	Australian Industry Group
AS/NZS	Joint Australian and New Zealand standard
BAU	Business as usual
DEWHA	Department of the Environment, Water, Heritage and the Arts
DEUS	Department of Energy, Utilities and Sustainability, New South Wales
DW	Dishwasher
CD	Clothes Dryer
CESA	Consumer Electronic Suppliers Association
COAG	Council of Australian Governments
CPRS	Carbon Pollution Reduction Scheme
CW	Clothes washer
CWD	Combined clothes washer-dryer
CWD-D	CWD: performance on the drying function
CWD-W	CWD: performance on the washing function
EES	Energy Efficient Strategies
EPHC	Environment Protection and Heritage Council
FL	Front loader (type of clothes washer)
gl	gigalitre (one million ML)
GWA	George Wilkenfeld and Associates
Kt	kilotonne (one thousand tonnes)
kl	kilolitre (one thousand litres)
KPA	kilopascal (a measure of pressure)
l/min	litres per minute (a measure of flow rate)

LPG	Liquefied petroleum gas
MEPS	Minimum energy performance standards
MI	Megalitre (one million litres)
NATA	National Association of Testing Authorities
NPV	Net present value
NWI	National Water Initiative
OBPR	Office of Best Practice Regulation (Commonwealth)
OP	Off peak (electricity tariff)
ORR	Office of Regulation Review (Commonwealth)
RIS	Regulation Impact Statement
TL	Top loader (type of clothes washer)
TTMRA	Trans Tasman Mutual Recognition Agreement
WEL	Water efficiency labelling
WELS	Water Efficiency Labelling Scheme (the program)
WES	Water efficiency standards
SRI	Star Rating Index: the decimal value calculated by the WELS algorithms on which the star rating is based. For example, a product with a SRI of 3.7 would have a WELS star rating of 3.5.
WSAA	Water Services Association of Australia

1 The problem

Consistent with COAG Best Practice Regulation Guidelines (2007) this section establishes a case for action by considering the problem that requires addressing.

The urban water market

The increasing variability, and in some areas scarcity, of water supplies within Australia, has focused attention to a greater degree on water management issues. In particular, for urban areas:

- there is a need to balance supply and demand for potable water; and
- there is a need to incorporate into individual purchase decisions for household appliances the full social costs and benefits.

The supply of potable water is generally managed by government entities, who plan and invest in its supply and distribution, and act as retailers. However, the supply of potable water is impacted by climate change, which is leading to greater variability and reduced flows from rainfall. Climate modelling projections indicate that precipitation in all Australian capital cities is likely to decline significantly in future years (Table 1).

Table 1. Projected percentage changes in rainfall, Australian capital cities

Capital cities	2030 (Scenario A1B)	2070 (Scenario B1)	2070 (Scenario A1F1)
Adelaide	-4	-7	-13
Brisbane	-3	-5	-9
Canberra	-3	-5	-9
Darwin	0	-1	-1
Hobart	-1	-3	-6
Melbourne	-4	-6	-11
Perth	-6	-11	-19
Sydney	-3	-4	-8

Source: CSIRO & BoM 2007. Projected percentage change in annual rainfall compared with 1990; 50th percentile estimate.

At the same time as supplies of water are becoming more variable, overall demand for potable water will increase with population growth.

Pricing and market failure

Accurate price signals will assist in managing the supply and demand of water. In a perfect market environment the price of water could effectively be set where supply meets demand to achieve market equilibrium. Pricing has a critical role in urban water management, but there are market issues that limit the degree to which price signals can achieve market equilibrium. These include:

- Water supply costs generally reflect the fixed costs and timeframes of infrastructure investment (supply augmentation) and maintenance;

- Water prices are largely influenced by these supply costs, and therefore do not accurately address fluctuations in water demand and availability, particularly in the short and medium term; and
- Demand for potable water, particularly within households for indoor water needs, has been found to be relatively inelastic and therefore is not strongly responsive to changes in price. A 2008 survey by the Australian Bureau of Statistics (ABARE) found that price elasticities of demand for residential water ranged from -0.15 in the Australian Capital Territory (ACT) (very unresponsive) to -0.94 in Perth (relatively unresponsive) (also see Annex B).

Due to the above reasons, the urban water market can demonstrate market failures, as pricing is based on long-term costs for supply investments, rather than adjusting for short term variations in inflows, and the demand for household indoor water is relatively inelastic.

Market failure occurs where the free market fails to generate an efficient outcome or maximise net benefits (OBPR 2007). Two key market failures in the urban water market that are pertinent to this RIS are:

- *Externalities* – “Externalities occur where a cost or benefit from a transaction is received or borne by people not directly involved in the transaction” (OBPR 2007). In the case of the urban water market, the nature of potable water pricing (which is largely based on supply infrastructure and maintenance costs) means that users do not bear the full costs of the water they consume. As such, over-consumption is possible, which in turn reduces the amount of water available to others and increases the likelihood of the imposition of water restrictions. Further, over-consumption of water also impacts on longer-term water pricing, because it brings forward the need for supply augmentation investments earlier than it may have otherwise been needed. In effect, externalities in the urban water market result in an inefficient outcome where the price and quantity of potable water partly reflects private cost considerations rather than the full social costs and benefits.
- *Information Asymmetries* – Information asymmetries occur when one party in a transaction has more information than another and this information has an important bearing on the price or terms of the transaction (OBPR 2007). In the case of household water-using products, many consumers are unaware at time of purchase of the likely lifetime water costs of a particular appliance. In the absence of this information, individuals may choose inefficient appliances which collectively lead to the need for supply augmentation investments when a demand response, through the purchase of efficient appliances, would have been more cost effective.

Given the difficulties discussed in accurately pricing potable water, together with the presence of clear market failures, there is a case for government intervention in addressing the problem, where the benefits outweigh the costs of doing so. Before making such a recommendation, however, consideration should first be given to what existing measures are already in place.

Managing the problem

As well as considering ways for more accurate pricing signals, governments have focused on a combination of supply augmentation and demand management policies to better balance the supply and demand for potable water.

Supply augmentation - Investments in supply augmentation, such as through building new dams and desalination plants and subsidising the installation of rainwater tanks, are a key measure for governments in meeting increasing water scarcity. Supply augmentation can theoretically address any increases in water demand or reductions in availability. However supply augmentation is generally costly. For example, a recent study assessed the costs of desalination to have an approximate levelised unit cost of \$1.19 to \$2.55 per kl of water supplied (ISF 2008). The study also found other supply augmentation options to be relatively expensive, including new surface storage (\$1.26 to \$3.58 p/kl), residential rainwater tanks (\$3.00 to \$4.00 p/kl) and new recycling schemes (\$1.00 to \$5.50 p/kl).

In addition to cost considerations, supply augmentation investments also take significant time and effort to complete, and can lead to additional environmental costs such as increased energy usage and greenhouse gas emissions.

Demand management - Demand management measures are generally more cost-effective than investments in supply augmentation. The same 2008 study that priced the above supply augmentation examples, also priced several demand management options. The study found the demand reduction measures it reported to be considerably more cost-effective than supply augmentation options. For example, outdoor water efficiency measures were priced at a rate of \$0.10 to \$0.20 p/kl, while various indoor water efficiency rebate, exchange and retrofit programs were priced between \$0.50 and \$0.60 p/kl.

However, although demand management measures may be more cost-effective than investments in supply augmentation, these have limitations. Put simply, there is a limit to how far demand for water can be continually reduced, as water is an essential household product and household water demand is relatively inelastic. Also, some demand management options, such as water restrictions on outdoor water usage, have a number of significant economic and social costs, such as the cost of purchasing and installing outdoor watering systems to meet council requirements, the deterioration of lawns and gardens due to lack of watering, and lost productivity and time due to the need to hand water gardens. In addition, the nature of outdoor water restrictions can result in inefficient outcomes, such as when decisions about when to water gardens are based on the day of the week, rather than based on when watering is actually needed.

As such, although urban water restrictions have resulted in a reduction in per capita household water consumption since their introduction in 2001, these come at a significant cost, estimated by the Productivity Commission (2008) to amount to billions of dollars.

The WELS Scheme

The WELS scheme falls within the range of demand management measures that have been introduced by governments. The WELS scheme currently provides information about the water consumption and relative water efficiency of household water-using products. In this way, the WELS scheme assists demand management by providing better information on the choices available.

Since its introduction in 2005, the WELS scheme has been found to be a highly cost-effective water management measure, achieving water savings at a levelised unit cost of between \$0.08 and \$0.21 p/kl (ISF 2008). The same 2008 study also assessed results from the initial years of the WELS

scheme's operation and predicted future savings that are expected to be achieved under the scheme. By 2021, the WELS scheme was predicted to save over 800 gigalitres of water, over nine million megawatt hours of energy, and result in greenhouse gas emission reductions of over six million tonnes (ISF 2008). The reduced energy and greenhouse gas emissions are largely attributed to reductions in hot water consumption, as well as reduced energy needed for pumping and treatment of water and wastewater. In total, the WELS scheme is predicted to save consumers over \$1 billion by 2021 (ISF 2008).

Significantly, water utilities factor water savings expected from the WELS scheme into their water plans and forecasts. In this way, the WELS scheme plays a role for governments in their efforts to balance the supply and demand for potable water, as water savings achieved by the WELS scheme can potentially delay decisions on making additional investments in supply augmentation. This results in a more efficient outcome for the whole of society in balancing the supply and demand for potable water, as the WELS scheme is more cost-effective than supply augmentation options.

A key benefit of the WELS scheme is its ability to achieve water savings in a way that does not affect the user utility. Water savings can be achieved while still achieving the same performance outcomes, such as washing clothes or flushing a toilet. However, although the WELS scheme assists consumers in identifying water efficient products, some consumers may still purchase inefficient products which collectively lead to suboptimal outcome for the whole of society. To address this problem, the WELS scheme was also established to provide for minimum water efficiency standards (WES), in addition to labelling.

The setting of minimum WES enables governments to allow only the supply of products within Australia that are deemed to meet minimum levels of water efficiency. To date, toilets are the single example of the application of minimum WES under the WELS scheme. Under the existing minimum WES for toilets, the average flush volume must not exceed 5.5 litres, which is equivalent to a WELS rating of 1 star.

Conclusion and relevance of the proposed regulation

Consistent with the WELS expansion work program requested by the Environment, Protection and Heritage Council in November 2006, this RIS is investigating the introduction of minimum WES for clothes washing machines (including top loading, front loading, and the washing-mode of combined washer dryers) and dishwashers, and the introduction of WELS labelling and/or minimum WES for the water-using dryer-mode of combined washer dryers.

This Problem chapter has outlined the problem being addressed by the proposed regulations. The problem is viewed as two-fold:

- there is a need to balance supply and demand for potable water; and
- there is a need to incorporate into individual purchase decisions for appliances the full social costs and benefits.

The previous pages have demonstrated the existence of market failures within the urban water market. These failures lead to difficulties for governments in balancing supply and demand for potable water – particularly in light of predictions of increased variability of water supply due to the impacts of climate change and increases in population. The Problem chapter has outlined existing

efforts by governments to address these issues. Efforts have largely been based around supply augmentation investments and demand management measures.

The WELS scheme falls within the range of demand management measures currently pursued by States, Territories and the Australian Government. Through the provision of water consumption and water efficiency information about a number of products, as well as the setting of minimum WES, the scheme attempts to better align individual purchasing decisions with what is most cost-effective for the whole of society in balancing the supply and demand for potable water.

The proposals under examination in this RIS are consistent with efforts to address the problem, while not replicating any existing measures (which would make the proposed regulation unnecessary). Clothes washing machines are a significant water user within households, estimated to account for 22 per cent of household indoor water consumption, only behind showers at 31 per cent, and toilets at 24 per cent (EES 2007; GWA 2005a).

Despite the presence of WELS scheme labelling for clothes washing machines during the past five years, and considerable increases in the availability of water efficient clothes washing machines, there still exists a large divergence in the water efficiency of models currently available for supply. The top loader clothes washer market still offers models that use up to 189 litres to wash a typical 5 kg load, compared with 56 litres for the most water-efficient models. Therefore, further water efficiencies can be achieved from clothes washing machines that can assist in meeting demand management objectives and delaying more costly investments in supply augmentation.

In addition, clothes washing machines and dishwashers are products which can be considered for minimum WES, as water efficiencies can be achieved without impacting on user utility. For example, by using the WELS scheme to choose a highly water efficient clothes washing machine, consumers can save over 100 litres of water per use compared to an inefficient model of the same capacity, while still achieving a wash that meets Australian Standards for clothes washing machines.

Separately, potential WELS labelling of the water using dryer-mode of combined washer dryers may assist in addressing the problem outlined in this chapter. In the absence of information about the water consumption of the dryer-mode of these products, consumers are likely to be unaware that these products use water in dryer-mode, and therefore may be unknowingly purchasing machines that use more water than is desirable from a whole of society perspective, as well as in some cases from a private cost perspective as well.

This RIS gives consideration to the range of policy options available (including alternatives to the proposed regulations), and the costs, benefits, and impacts of the preferred option.

Scope of this regulation impact statement

Terms of reference

This RIS was commissioned by the Department of the Environment, Water, Heritage and the Arts (DEWHA), with the following terms of reference:

- Analyse the costs and benefits of introducing minimum WES for CWs.
- Analyse the costs and benefits of introducing minimum WES for DWs.

- Analyse the costs and benefits of extending the WELS scheme to the water used in the drying function of CWDs – these are currently only covered with regard to the WELS labelling of their washing function.

The extension of WELS coverage or changes in the mode or stringency of WELS coverage for other products is analysed in other reports being prepared for DEWHA.

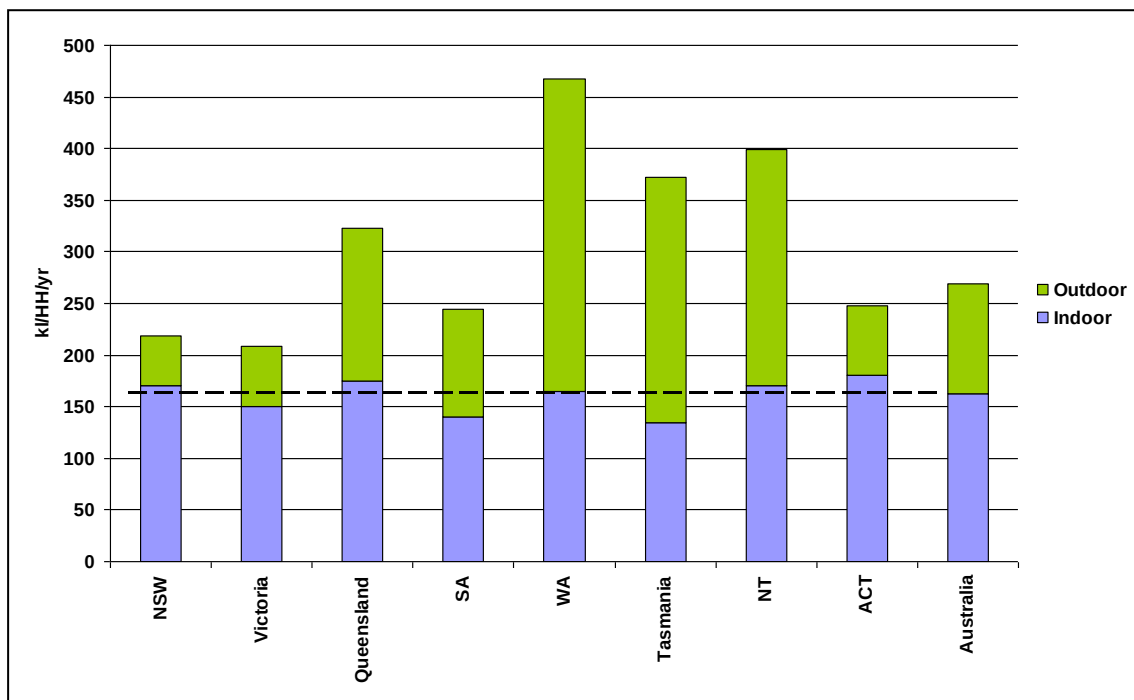
George Wilkenfeld and Associates (GWA) previously reviewed the case for mandatory water efficiency labelling and standards while preparing the RIS for the current WELS scheme (GWA 2004). A number of factors have changed since 2004 such as:

- The risks of freshwater scarcity have increased (possibly as an early indication of climate change).
- The projected price of water to users has increased with the commitment to construct seawater desalination plants (see preceding section).
- The projected monetary value of the energy used for heating water has increased, with the likely internalisation of the cost of greenhouse gas emissions via an Australian Emissions Trading Scheme or other mechanisms.
- Some products which then had negligible market share now have significant market share and aggregate water use (e.g. CWDs).
- There is now more and better data on the water use of products, partly as a result of the operation of WELS.

Scope in relation to household water use

In reviewing the case for WELS labelling or minimum WES for a given product, one important criterion is the contribution to household water use. The data on indoor water use in Australian households are fairly reliable, because the stock of indoor water-using products is well documented, and the patterns of use are reasonably consistent from household to household (GWA 2005a). Estimates of outdoor use are somewhat less reliable, but can be inferred by the difference between estimated indoor use and reported total household use (ABS 2006). On average, about 61 per cent of national household water is used indoors, and 39 per cent outdoors. Average indoor water use is fairly constant from State to State, but outdoor water use varies considerably (Figure 1). Indoor water use has also been fairly stable over time, and has not been affected by permanent and temporary water saving measures, which mostly target outdoor water use.

Figure 1. Estimated average household water use by State, 2007



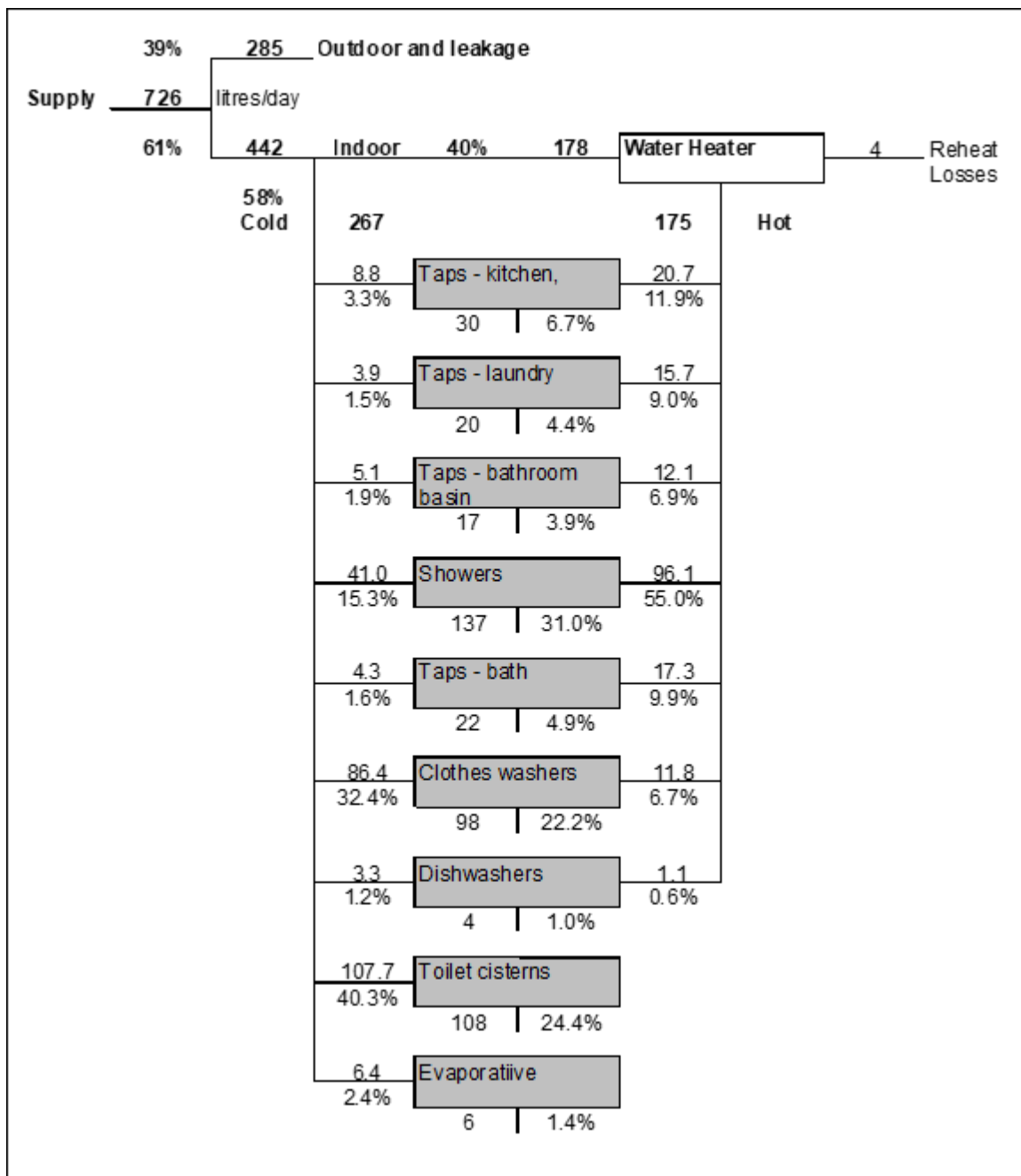
Source: Author estimates, based on ABS 4610.0 (2006)

The indoor end uses of water in the average household are illustrated in Figure 1 and Figure 2. CWs account for about 22 per cent of household indoor water use, the largest segment after showers (31 per cent) and toilets (24 per cent). DWs account for only about one per cent of indoor water use. The reasons for this difference are:

- DWs are present in about 45 per cent of households, while CWs are present in over 96 per cent of households (Figure 4). The ownership of DWs is projected to increase steadily, but the ownership of CWs is already close to saturation (i.e. 100 per cent). However, the front loader share of the total CW stock has increased rapidly since 2000, and this is projected to continue.
- CWs are used much more frequently than DWs.
- The average CW uses far more water per cycle than the average DW.

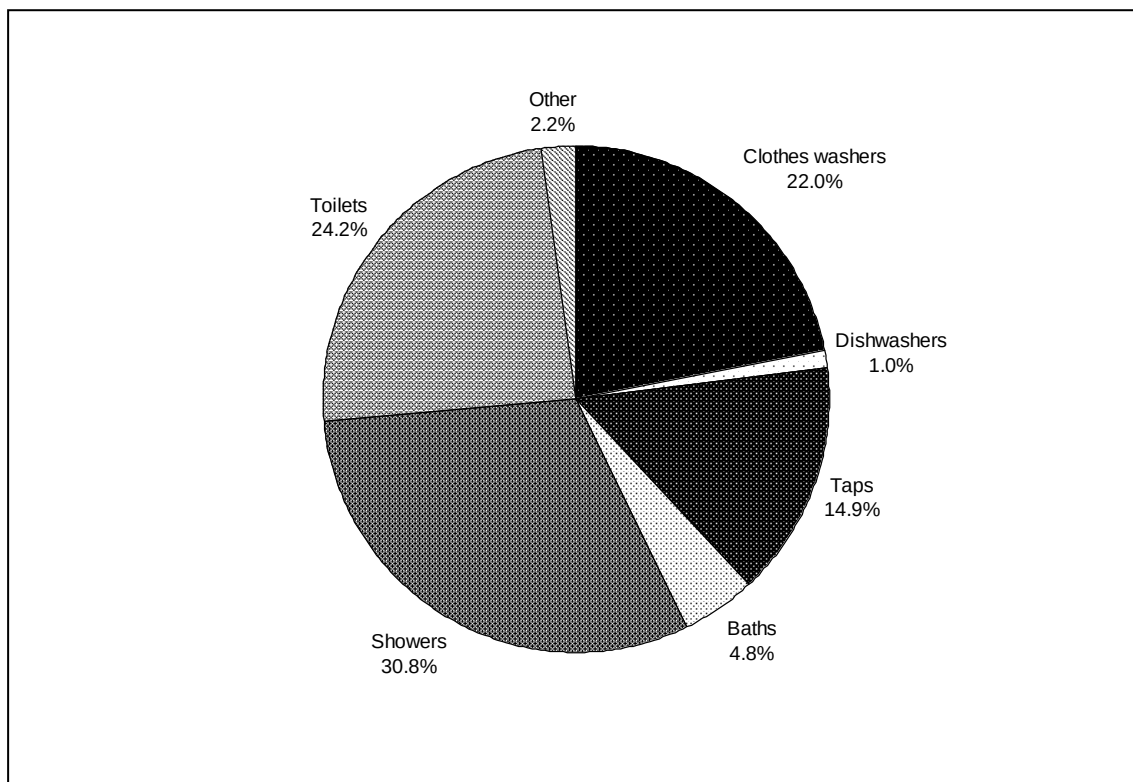
Most of the water used by CWs and DWs is taken from the cold supply, although some of it may be heated by the appliance itself. About 12 per cent of CW water use and 25 per cent of DW water use is taken from the hot supply.

Figure 2. Estimated average daily household water demand (without water restrictions)



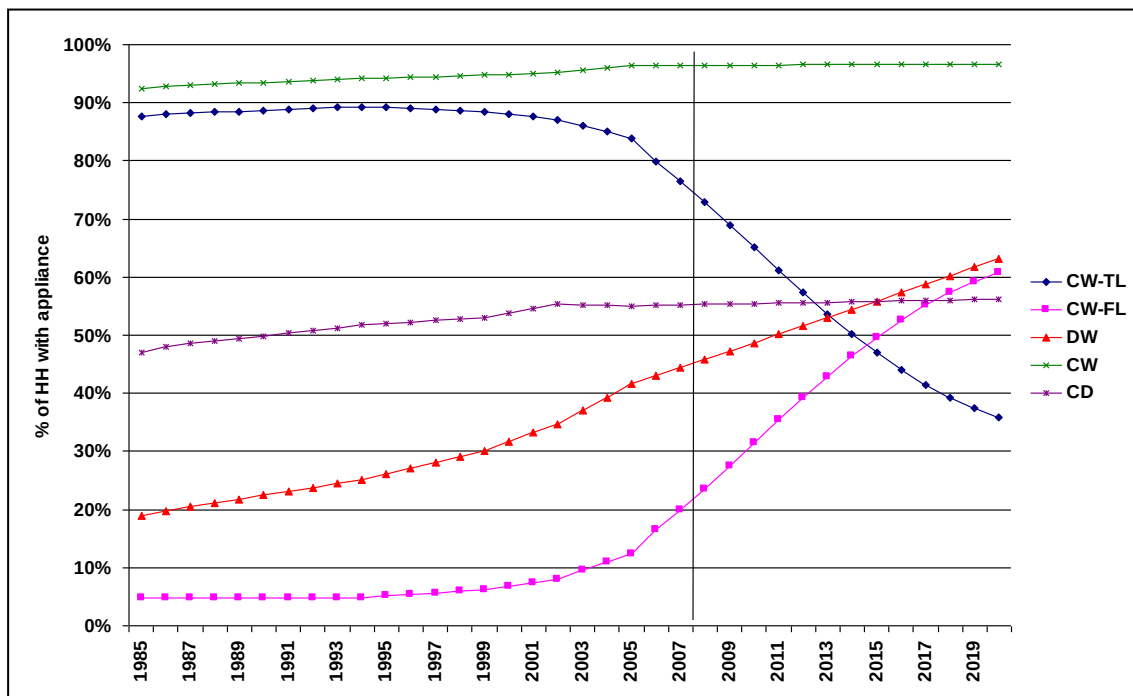
Source: Author estimate based on EES (2007) and GWA (2005a). Values are litres of water per day.

Figure 3. End use shares of indoor household water use, Australia, 2007



Source: Figure 2

Figure 4. Household ownership of clothes washers, dryers and dishwashers



Source: EES 2007

2 Objectives of the regulation

Objectives

The primary objective of the proposed regulations is to bring about reductions in the consumption of water in Australian households below what it is otherwise projected to be (i.e. the 'business as usual' case), in a cost-effective manner, in order to assist in balancing of the supply and demand for potable water and to assist in better incorporating into individual purchasing decisions whole of society costs and benefits. The value of water savings to consumers should exceed any additional costs of more water-efficient products.

The secondary objectives of the proposed regulations 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.

Assessment criteria

The primary assessment criterion is the extent to which an option meets the primary and secondary objectives, which will be realised in direct proportion to the magnitude of projected water savings.

The following secondary assessment criteria have been adopted:

- Does the option make purchasers/users of the affected appliances as a group better off – or at least no worse off – in terms of their expenditure on clothes washing, clothes drying and dishwashing services (i.e. is the option privately cost-effective)?
- Does the option make non-purchasing owners/users of the affected appliances better off as a group (i.e. can the benefits be realised despite the actions of intermediaries)?
- Are the risks of reducing buyer choice or supplier price competition acceptably low?
- Is the option consistent with environmental protection, consumer protection and other general public policy objectives?
- Does the option make water users as a group better off – or at least no worse off – in terms of the costs of water services they face?

3 WELS and cleaning appliances

Operation of the WELS scheme

Label awareness and recognition

Although the WELS scheme was only introduced in mid 2005, there is considerable information about how product purchasers use energy and water labels. The energy label was first introduced in 1986 and consumers have carried across much of their familiarity with the energy label to the WELS label. Indeed, adopting a similar format to the energy label was a deliberate strategy to accelerate user recognition.

It will be some time before the WELS label achieves the 99 per cent recognition level of the energy label (Table 2). Nevertheless, the awareness rate is rising steadily: from 53 per cent in 2008 to 56 per cent in 2009. Consumer trust in the integrity of the WELS label is also high, and approaching the levels associated with the energy label. The share of respondents regarding the WELS label as 'very credible' is almost the same as for the energy label, although the share for 'quite credible' is somewhat lower.

Table 2 indicates that 92 per cent of respondents who were aware of the WELS label said that it helped them in their purchase to a 'great' or a 'moderate' extent, almost as high as for the energy label (94 per cent). Respondents gave fewer examples of the way in which the labels actually helped in their purchases in 2009 than in 2008. This was most likely due to less direct experience with using the labels: only 46 per cent reported purchasing a water using product in 2009 compared with 68 per cent in 2008. This was probably due to the deferment of discretionary appliance purchases and home renovations in the period of uncertainty following the global financial crisis (Solutions 2009).

Table 2. Awareness and use of Energy Label and Water Efficiency Label, 2008 and 2009

Labels	Energy label May 2008(a)	Energy label 2009(b)	WELS label May 2008(a)	WELS label 2009(b)
Number in survey sample	1100	1112	1100	1112
'Aware of label before today' (before being shown the label)	97%	94%	59%	61%
'Have you seen this label before?'	99%	99%	53%	56%
Label helped in purchase decision - 'to great extent'	56%	49%	57%	51%
• 'to moderate extent'	38%	45%	35%	41%
• 'to a small extent or not at all'	6%	6%	8%	8%
In what ways did it help? (% of those aware of label)	-	-	-	-
• help to compare energy/water consumption or energy/water use	81%	71%	87%	80%
• star ratings help compare energy/water efficiency (more stars more efficient)	87%	78%	78%	72%
• help to compare running costs	77%	60%	56%	47%
• help to compare environmental impact	52%	34%	46%	46%
• help to compare lifecycle cost	25%	13%	27%	13%
• help to compare greenhouse gas emissions	33%	18%	20%	12%
• none/unsure/other	0%	2%	1%	1%
How credible do you believe these rating labels to be?	-	-	-	-
• Very credible	24%	22%	24%	21%
• Quite credible	65%	66%	56%	57%
• Other	11%	11%	20%	22%

Source: (a) Quantum Research supplied by DEWHA; (b) Solutions Marketing and Research Pty Ltd research supplied by DEWHA.

Modes of label use

Appliance buyers read and use labels in different ways. Artcraft Research (2005) found that suitability for purpose and price are the main criteria in compiling a short list of appliances for consideration, but then energy and water factors often influence the final decision. Artcraft identified four main buyer segments:

- 35-40 per cent of buyers use the label to select a product with a lower running cost. Some of these buyers weigh capital costs against running costs to try to minimise lifecycle costs. This segment relies mainly on the water consumption value on the label.
- 35-40 per cent of buyers use the label to select a product with a higher efficiency, without necessarily quantifying differences in consumption (indeed, a product could be more efficient but still use more energy or water because it is larger). This segment relies mainly on the star ratings on the label.
- 10-15 per cent of buyers want to minimise the harm to the environment caused by the product's operation, and generally rely on the star rating labels.
- 10-15 per cent of buyers aware of the label do not use it.

Analysis by GWA of appliance retail sales data from GfK (EES 2009) and manufacture, import and export data from ABS and BIS-Shrapnel (2006) indicates that, for the period 1993-2002, 21 per cent of DWs and 16 per cent of CWs were purchased through the wholesale and bulk supply channels used by 'large intermediaries' (e.g. builders, kitchen renovators, commercial and institutional buyers). In addition, a significant share of retail sales is purchased by 'small intermediaries' such as landlords. A reasonable estimate is that, overall, about 20 per cent of WELS labelled DW and CW are purchased by intermediaries who are mainly highly sensitive to capital cost and not very concerned with running costs or water efficiency.

Table 3. Buyer segments with regard to WELS labels

WELS labels	% of Purchases	From Table 2	% of Purchases	From Table 2	% of Purchases	From Artcraft Research (2005)	% of Purchases
Intermediary purchases (a)	20%	-	20%	-	20%	-	20%
Direct purchases	80%	-	-	-	-	-	-
Not aware of WELS label	-	44%	35%	-	35%	-	35%
Aware of WELS label	-	56%	45%	-	-	-	-
Aware but do not use in purchase	-	-	-	8%	4%	-	4%
Use in purchase	-	-	-	92%	41%	-	-
Mainly use stars (b)	-	-	-	-	-	71%	29%
Mainly use numbers	-	-	-	-	-	12%	5%
Use both	-	-	-	-	-	18%	7%
Total	100%	100%	100%	100%	100%	100%	100%

(a) Author estimates. (b) Applying energy label user segmentation in Artcraft Research (2005)

The market segmentation estimates summarised in Table 3 indicate that about 41 per cent of purchases of WELS-labelled products are currently influenced by the content of the label. This indicates measures other than labelling (such as minimum standards) are necessary if it is a policy objective to influence the water efficiency of the other 59 per cent of purchases.

Product Familiarity

WELS covers a range of products, and the common colours and layout of the labels (a layout which it shares with the energy label) are intended to allow buyers to quickly recognise and interpret the label when they see it in a new context. Nevertheless buyers will be more familiar with some products than others, and so are better able to integrate a range of factors, including the WELS label, into their purchase decision.

Of the products covered in this RIS, product familiarity is highest with TL CWs: 86 per cent of purchasers are replacing a previous TL CW. Conversely, familiarity is lowest with front loader CWs: only 31 per cent of buyers are replacing a product of the same type.

Table 4. Buyer familiarity in cleaning appliance purchases

Cleaning appliance	Dishwasher purchases	Clothes washer purchases – top loading	Clothes washer purchases – front loading
Number in sample	303	325	242
Replacing broken/worn appliance of same type	46%	86%	31%
Replacing top loading CW	NA	NA	62%
Replacing front loading CW	NA	4%	NA
First purchase of this type of appliance, of which:	43%	9%	7%
Renovation	19%	NA	NA
setting up new home	7%	9%	7%
other	17%	NA	NA
Other	11%	NA	NA

Source: Derived by author from BIS Shrapnel (2006)

Table 5. Importance of energy and water label in purchase decision

Year	Dishwasher Energy label influence	Dishwasher Water label influence	Clothes washer Energy rating label influence on final purchase decision	Clothes washer Water rating label influence on final purchase decision
2002	2.9	NA	2.7	NA
2004	3.1	3.2	3.1	3.3
2006	3.1	3.3	3.2 • Top loader: 2.9 • Front loader: 3.8	3.6 • Top loader: 3.1 • Front loader: 4.1

Source: BIS Shrapnel (2006). Average of responses on a 5 point scale, 1 = 'No influence at all', 5 = 'Vital/critical influence'.

Relationship to Minimum Standards

Of the buyers who use the label in their purchase decision, only a minority (47 per cent) use it to support a systematic analysis of running costs, and even fewer (13 per cent) use it to consciously weight capital costs against expected lifetime running costs (Table 2).

This does not invalidate the label – on the contrary, it confirms its ability to operate on many levels and to drive efficiency trends in many ways. It also means that the managers of the label (in this case, Governments) have an obligation to be aware of the ways in which buyers (and sellers) use the label and ensure that these are consistent with the public interest. For example, considerable effort has been made to ensure that the energy and water consumption tests on which the labels are based are fairly representative of actual use.

Governments already enforce minimum washing, drying and rinsing performance standards for CWs and DWs, in addition to the safety standards which apply to all products. This is partly a consumer protection measure, to avoid suppliers compromising product function to achieve an artificially high water or energy rating, and partly in response to community expectations that products should be ‘fit for purpose’.

Although it could be argued that product quality should be left to the market, the proliferation of import brands has introduced additional risks for consumers, for example:

- Some importers of poorly-performing products are not, and do not expect to be, in the Australian market for long enough to be disciplined by the market via a reputation for poorly performing or inefficient product; and
- As product energy and water standards rise in other countries, failing to match those standards increase the risks of poor quality products that cannot be sold elsewhere being diverted to Australia.

International Standards and Labelling Programs

Australia is by no means the only country with programs to influence the operating efficiency of CWs, DWs and CWDs, and although almost every other program targets energy rather than water use.

Table 6 indicates the countries and trading bloc with labels and/or minimum performance standards for the products under consideration in this RIS. All of the standards programs are mandatory, except for the European Union standards program for CW and DW, and the Brazilian CW standards.

Table 6. Countries with labels and standards for products under consideration

Countries	Clothes washers Labels	Clothes washers Standards	Clothes washer-dryers Labels	Clothes washer-dryers Standards	Dishwashers Labels	Dishwashers Standards
Algeria	-	U	-	-	U	-
Argentina	U	-	-	-	-	-
Australia	M	-	-	-	M	-
Austria	V	-	-	-	-	-
Brazil	M	V	-	-	-	-
Canada	M	M	M	M	M	M

Countries	Clothes washers Labels	Clothes washers Standards	Clothes washer-dryers Labels	Clothes washer-dryers Standards	Dishwashers Labels	Dishwashers Standards
Chile	U	-	-	-	U	-
Chinese Taipei	V	-	-	-	-	-
Colombia	U	-	-	-	-	-
Czech Republic	V	-	-	-	-	-
Egypt	M	M	-	-	-	-
European Union	M	V(a)	M	-	M	V(a)
Hong Kong, China	V	-	-	-	-	-
Indonesia	-	U	-	-	-	-
Iran	M	-	-	-	-	-
Israel	M	M	-	-	M	M
Jordan	M	-	-	-	-	-
Malaysia	-	U	-	-	-	-
Mexico	M	M	-	-	-	-
New Zealand	M	-	-	-	M	-
Nordic Union	V	-	-	-	-	-
PR China	M	M	-	-	-	-
Peru	U	U	-	-	-	-
RO Korea	M	M	-	-	M	M
Russia	-	U	-	-	-	M
Singapore	V	-	-	-	-	-
Slovakia	V	-	-	-	-	-
South Africa	V	-	-	-	-	-
Switzerland	M	V(a)	M	-	M	V(a)
Thailand	V	-	-	-	-	-
Turkey	M	-	-	-	M	-
USA	M	M	-	-	M	M
Vietnam	U	-	-	-	U	-

Source: <http://www.clasponline.org/clasp.online.worldwide.php?product=11> U=Under consideration. V=Voluntary. M=Mandatory. (a) Weighted average target negotiated between European Commission and European Committee of Manufacturers of Domestic Equipment (CECED). Switzerland also participates.

Rebate programs

Water authorities justify incentive programs on the grounds that:

- increasing the efficiency of water use is directly substitutable for augmenting supply; and
- the cost per kl saved from the payment of rebates for CWs and other products (which represent a cost to other water users as well as to the beneficiaries, since the costs are recovered from the entire rate base) are less than the costs of augmenting supply.

Several water authorities offer rebates to customers who purchase products considered to reduce the demand for fresh water, such as low flow shower heads, rainwater tanks and CWs that meet certain water efficiency criteria.

In February 2003, the Western Australia (WA) Water Corporation began to offer rebates of \$150 each for the purchase of CWs with ratings of AAAA or better, on the old Water Services Association of Australia (WSAA) scheme. At first only FL CWs were able to achieve the rating, but some TL suppliers introduced complying models. The WA Auditor-General reported that 129,299 rebates were paid for CWs purchases to the end of 2005, equivalent to an expenditure rate of \$6.5 m per year.¹

The FL share of CWs sold in WA increased from 18 per cent in 2002 to 38 per cent in 2003 and even higher in the following years.² Even so, the number of rebates exceeded the number of FL CWs sold over the period, so many must have gone to TL CWs. This would not necessarily reduce effectiveness, because the water saved by transferring a purchase from a TL of average water-efficiency to one of higher water efficiency is greater than the water saved through transferring a FL purchase in the same way. However, transferring from a TL directly to an FL would save even more water.

A rebate program's effectiveness depends critically on the assessment of what each rebate recipient would have purchased in the absence of the rebate: if not the very same product (in which case that rebate payment is wasted) than what model and of what water efficiency.

The WA Auditor-General attempted to estimate the cost of water saved through the WA rebate scheme. Although it did not question the WA Water Corporation's estimates of the nominal water saved per purchase (26 kl/yr, or 71 litres per wash with daily use), it did question the assumption that every rebate prompted a purchase that would otherwise have gone to a less efficient model: i.e. a 'diversion rate' of 100 per cent. On these assumptions the Water Corporation calculated a program cost of \$0.72/kl saved, compared with supply costs of \$0.82-1.20/kl.

Given the very high take-up of rebates it is inevitable that many rebates would have gone to 'free riders' who would have purchased the target product in any case. BIS Shrapnel (2006) reports that of those who received a rebate for the purchase of a front loader in WA, Queensland (QLD) or New South Wales (NSW) in 2006: 'Almost 50 per cent of the respondents who received a price rebate indicated that they would have purchased the front loader model irrespective of the rebate.'

It is also likely that the water saving per actual diversion in WA was over-estimated. The Victorian water authorities briefly offered a rebate for AAAA CWs between October and December 2003, estimating a saving of 16 kl/yr.³ Using a 50 per cent diversion rate and a more realistic estimate of 16 kl/yr saved per diversion, the cost to the WA Water Corporation would have been $\$0.72/0.5 \times 26/16 = \2.34 per kl, or between two and three times the cost of water supply augmentation.

¹ Sales data compiled by GfK. Personal Communication from Energy Efficient Strategies, 2008.

² Department of Sustainability and Environment, personal communication, 2005.

³ Department of Sustainability and Environment, personal communication, 2005.

With the introduction of WELS in 2005, water authorities continued to offer rebates for the purchase of CWs rating 4.0 stars or better, a level of water efficiency significantly higher than AAAA on the WSAA scale. Currently, water authorities in NSW, QLD and WA offer \$150 rebates (in WA the criterion was raised to 4.5 stars from 1 January 2008). Since November 2007, South Australia (SA) has offered a \$200 rebate. Rebate expenditures for CWs in NSW and QLD combined are running at about \$ 12.9 m per year (plus administrative costs). The current rates of expenditure in SA are not known. The WA Waterwise program was terminated in June 2009.⁴

About a quarter of all FL purchasers in 2006 received a water authority rebate. Assuming that half of these were influenced by the rebate, the absence of rebates would have seen the market share of FL at 35 per cent instead of 40 per cent. Therefore the removal of rebates will most likely reduce the market share of FL and result in higher CW water consumption than otherwise, unless the rebates are replaced by other measures.

Rebate programs rely on the WELS scheme to the extent that WELS ratings offer a convenient way to set rebate criteria and for customers to identify rebate-qualifying products. However, WELS and rebate programs are in effect alternative and in some ways competing ends to the same policy objectives, which (as stated above) are:

- increasing the efficiency of water use is directly substitutable for augmenting supply; and
- achieving a cost per kl saved from the payment of rebates for that is lower than the costs of augmenting supply.

The analysis in this RIS strongly supports the first contention, but the available evidence casts doubt on the latter. It is likely that intensifying WELS, through extending its coverage and/or implementing minimum standards, will reduce the costs per kl saved, and also ensure that more of those costs are borne by the private beneficiaries (i.e. those who purchase the more efficient CW) rather than by other water users.

Laundry appliances

Overview of the market

Laundry appliances wash and dry clothes. Traditionally, these tasks have been carried out in separate appliances, but CWDs were introduced to the Australian market in 2003. CWD sales grew rapidly, from around 2,000 units in 2004 to 18,000 in 2005 and 36,000 in 2006 (EES 2007a). However, the latest sales data suggests sales have stabilised: 31,000 units in 2007 and 27,000 in 2008 (EES 2009).

CWDs compete directly with conventional CWs and indirectly with conventional CDs, so to understand the laundry appliance market it is necessary to analyse sales of all of these products. All CWDs are front loading and dry using condensation rather than the more common evaporative process (these technologies are explained further in the following sections).

About 818,500 clothes washing units and 338,100 clothes drying (CD) units (with CWDs included in both categories) were sold in 2008, totalling 1.16 million units in all. TLs accounted for about 54 per

⁴<http://www.mediastatements.wa.gov.au/Pages/ByPortfolio.aspx?ItemId=131616&search=&admin=&minister=&portfolio=Water®ion=>

cent of CW sales, conventional FLs for 43 per cent and CWDs for over three per cent (Table 7). However, CWDs represented over seven per cent of sales in the FL market, where they compete directly with conventional FLs. CWDs also represented about eight per cent of total dryer sales, and accounted for the great majority of condenser dryer sales. Competition with conventional dryers is 'indirect' in that a CWD is almost always purchased primarily as a clothes washer, but once purchased it can displace (or replace) a clothes dryer.

Table 7. Laundry appliance sales, Australia, 2008

Laundry appliance	Clothes washers Units sold	Clothes washers Share	Clothes dryers Units sold	Clothes dryers Share	Total Units sold	Total Share
Clothes Washers – Top Loading	438,600	54%	-	0%	438,600	38%
Clothes washers – Front Loading	353,400	43%	-	0%	353,400	31%
Combined Washer-Dryers – all FL	26,500	3%	26,500	8%	53,000	5%
Clothes Dryers – Evaporative	-	0%	304,000	90%	304,000	26%
Clothes Dryer – Condenser	-	0%	7,600	2%	7,600	1%
All laundry products	818,500	100%	338,100	100%	1,156,600	100%

Source: Derived from GfK sales data (EES 2008, 2009)

Clothes washers

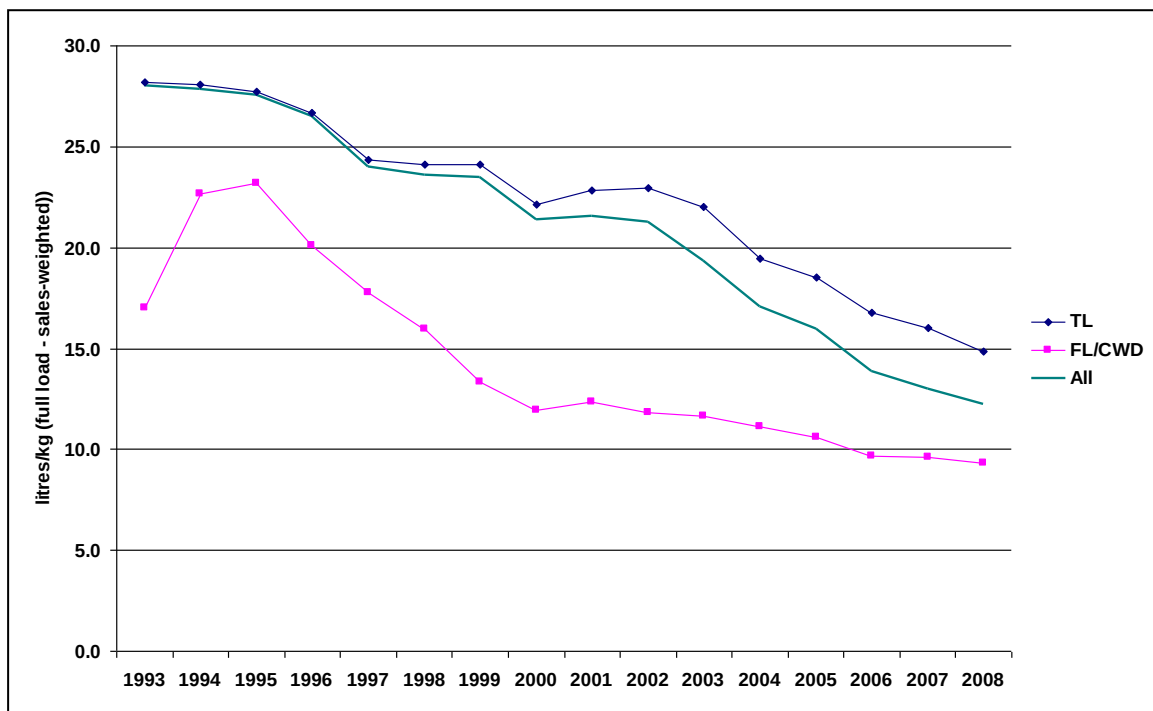
Technology and Market Trends

There are two distinct classes of CW technology – vertical axis machines where the wash load is moved by an impeller or agitator, and horizontal axis machines, where the entire drum revolves. These are generally called 'top loaders' (TL) and 'front loaders' (FL).⁵ There are also twin-tub designs (generally an impeller top loading type with a separate spin extractor) but only a handful of models remain on the market and sales are negligible.

In FL machines, the drum tumbles the load through the water, whereas in TL the load is usually immersed. On average, new FLs use about 60 per cent as much water per kg of clothes washed as TLs. This equates to a difference of 30 litres, on average, for a typical 5 kg wash load. Figure 5 illustrates the trend in average water use per kg of load capacity for CW sold in Australia between 1993 and 2008. Both TL and FL have become more water-efficient, and the average water efficiency has also increased with the growing market share of FL. Front loader market share increased steadily between 1993 and 2002, but then surged after 2003 (Figure 6). The average load capacity of FL sold also increased, from about 1.0 kg less than TL to 0.3 kg more (Figure 7).

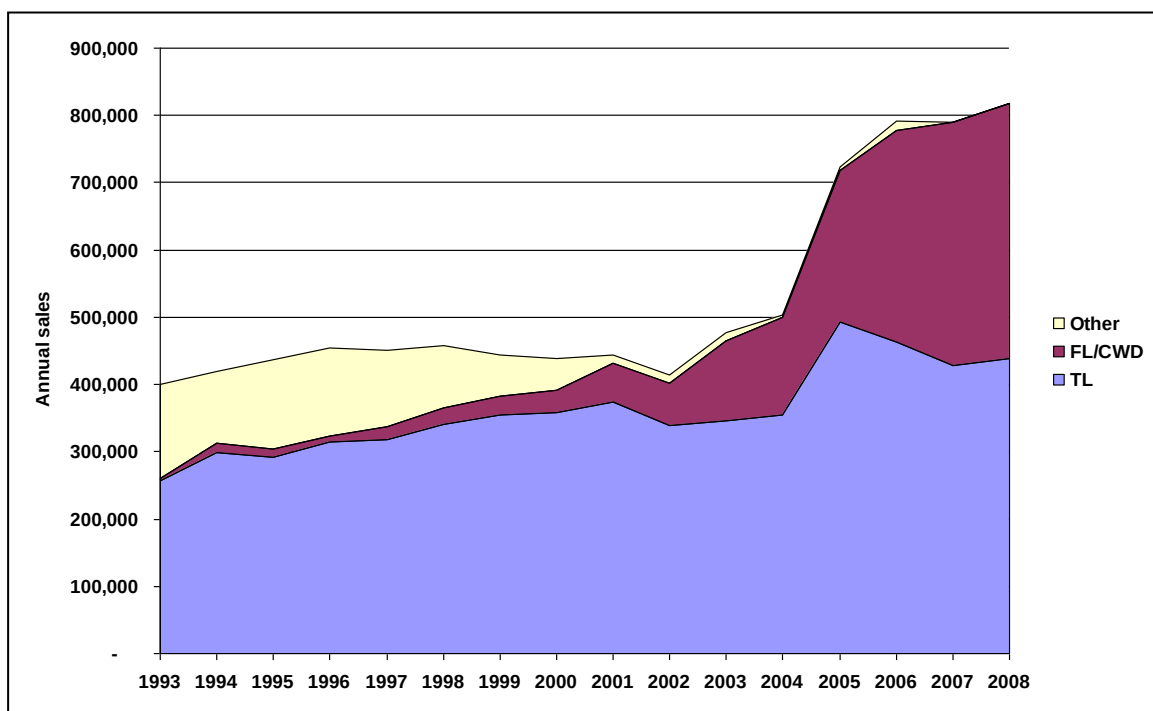
⁵ The terms 'front loader' and 'top loader' are used in this report to include all relevant variants on these basic designs. Some European top loading washers are in fact horizontal axis machines, with a loading hatch in the side of the drum. There are also US-made machines in which the drum axis is tilted upward for easier loading, at the expense of space-efficiency.

Figure 5. Sales-weighted average litres per kg, CW sold, Australia



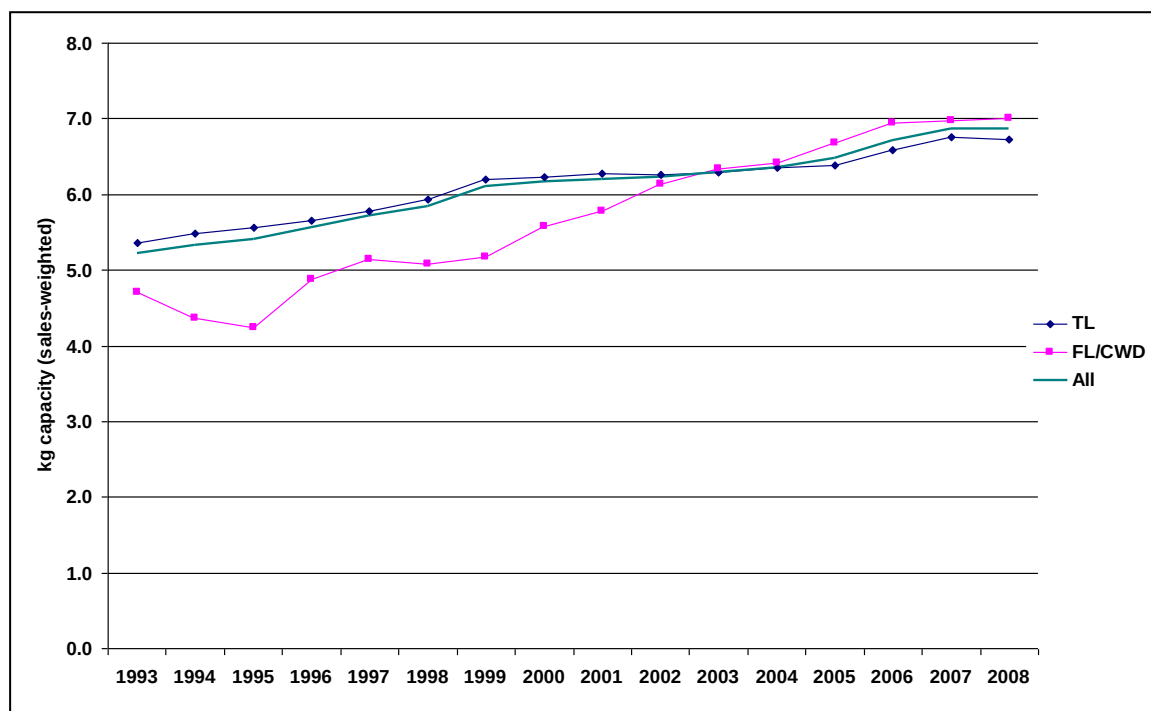
Source: EES (2009): Calendar years

Figure 6. CW sales, 1993–2008



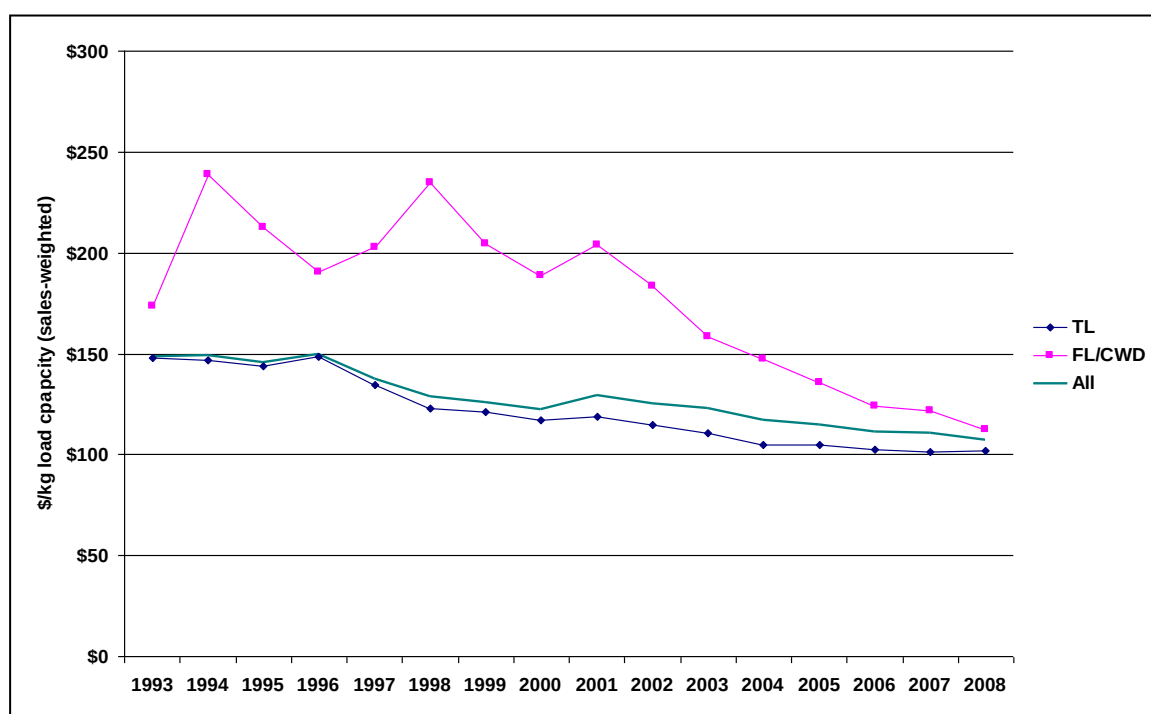
Source: EES (2009): Calendar years

Figure 7. New CWs sold: average full load capacity, 1993–2008



Source: EES (2009): Calendar years

Figure 8. New CWs sold: average sales price per kg load capacity



Source: EES (2009): Calendar years

The growing share of FLs was due to a number of factors:

- Higher consumer awareness of water efficiency due to unusually low rainfall and formal restrictions on water use.

- Reductions in the price premium that buyers had to pay for FLs of equivalent load capacity (Figure 8) in 2008 the average price premium of a FL was \$103, or 15 per cent more than a TL, down from \$462 (63 per cent more) in 1998.
- The introduction in 2001 of the voluntary 'AAAAA' water efficiency label for CW. This appeared almost exclusively on FLs.
- Water authority rebates for the purchase of 'water efficient' CWs (mainly, but not exclusively FLs), starting with WA Water in February 2003.
- The introduction of mandatory WELS efficiency labelling for CWs. These were announced in mid-2004 and phased-in between mid-2005 and the end of 2007.⁶ WELS labelling would have impacted on sales from 2005, reinforcing the trend toward FL CWs and also shifting buyer preference to the more water-efficient models on the market *within* each type.

Water Efficiency Ratings by Washer Type

The basis for water rating CWs is litres used per cycle per full load. These are the values tracked in Figure 5. For example, a 6 kg-rated machine is tested with a 6 kg test load, which must be washed, rinsed and spin-dried to the minimum standards set in AS AS/NZS 2040:2005, *Performance of household electrical appliances—Clothes washing machines* (AS/NZS 2040). Both energy and water use are recorded during the test. CWs carry energy labels, with energy star ratings calculated as specified in AS/NZS 2040, and WELS labels with star rating bands specified in AS/NZS 6400:2005, *Water-efficient products – Rating and Labelling*. These are shown in Table 8.

The star rating bands are normalised to a 1.0 star rating at 30 litres/kg. Each 30 per cent reduction in litres/kg merits an additional star, with half star levels interposed. If the CW uses between 25.1 and 30.0 litres/kg it rates 1.5 stars and so on in half star steps up to a maximum of 6.0 stars. A CW that uses more than 30 litres/kg rates 0 stars, and must carry a 'Water Warning' label. At the other end of the scale a CW that uses less than five litres/kg still rates 6.0 stars regardless of how little water it uses.

Table 8. WELS star rating criteria for CWs

Star rating	Litres/kg load capacity
0 (warning label)	> 30.0
1	25.1 – 30.0
1.5	21.1 – 25.1
2	17.7 – 21.0
2.5	14.8 – 17.6
3	12.4 – 14.7
3.5	10.4 – 12.3
4	8.7 – 10.3

⁶ Registration and labelling became mandatory for all new products from 1 July 2006. However, manufacturers and retailers of whitegoods products (which include CWs and DWs) were allowed a 'grace period' until 31 December 2007 to sell all existing products. After the 'grace period' was over, old stock that had not been sold had to be either registered or disposed.

Star rating	Litres/kg load capacity
4.5	7.3 – 8.6
5	6.1 – 7.2
5.5	5.0 – 6.0
6	< 5.0

Source: AS/NZS 6400:2005, *Performance of household electrical appliances—Clothes washing machines*

For the purposes of this study, the CW models appearing on the registers for energy and water labelling at the end of 2009, and sales in 2008, have been divided into those registered under superseded versions of AS/NZS 2040 (listed as ‘grandfathered’ on the register) and those registered under the current version of the standard (listed as ‘approved’ on the register). The ‘grandfathered’ energy label registrations under the now superseded version of AS/NZS 2040:2000 expired on 31 March 2007, but ‘will be extended (normally without charge) on an annual basis up to a maximum total registration period of five years or until such time as additional or amended regulatory requirements are introduced for this product group.’⁷ Therefore all ‘grandfathered’ models will be removed from the market by March 2012 at the latest.

The ‘approved’ models have been registered using AS/NZS 2040:2005, which includes a rinse test, among other changes. Their expiry date is 31 March 2009. It is the ‘approved’ rather than the ‘grandfathered’ models which represent typical performance over the coming years, so some of the analyses in this study are based on this sub-group. Both ‘approved’ and ‘grandfathered’ ranges have been broken down by configuration (TL, FL and CWD).

Table 9 summarises the characteristics of the 723 models registered at the end of 2007 and the 955 models registered at the end of 2009. It indicates that:

- There were 117 more TL registrations in 2009 than in 2007, 90 more FL registrations and 25 more CWD registrations. This confirms that the introduction of WELS labelling has not reduced consumer choice.
- Between 2007 and 2009, the average capacity of models on the market increased from 6.7 kg to 6.8 kg. However, the average for CWD models declined from 7.7 kg to 7.4 kg.
- Between 2007 and 2009, the average water consumption of TL models on the market declined by 0.3 l/kg (from 20.5 to 20.2), the average water consumption of FL models declined by 0.3 l/kg (from 10.9 to 10.6), and the average (washing) water consumption of CWD models increased by 0.6 l/kg (from 10.1 to 10.7).

Table 10 indicates the sales-weighted characteristics of all CWs sold in 2008 and in 2006, the first year of WELS labelling.⁸

- TLs accounted for 53 per cent of sales in 2008, down from 60 per cent in 2006.

⁷ <http://www.energyrating.gov.au/pubs/registration-expiry.pdf>

⁸ In January 2007 there were 566 models listed for energy labelling, 250 listed for AAAAA labelling on the WSAA website, and only 155 listed on the WELS website (GWA 2007b). This suggests that AAAAA labels would have been far more common during 2006 than WELS labels.

- Between 2006 and 2008, the average capacity of units purchased increased from 6.7 kg to 6.9 kg. The average for CWD models increased by 0.6 kg, from 7.0 kg to 7.6 kg.
- Between 2006 and 2008, the average water consumption of TL units purchased declined by 1.6 l/kg (from 16.8 to 15.2), the average water consumption of FL models declined by 0.3 l/kg (from 9.6 to 9.3), and the average (washing) water consumption of CWDs purchased declined by 0.1 l/kg (from 9.7 to 9.6).

Table 11 compares buyer preferences (in 2008) with the characteristics of the model range (at the end of 2007). Superseded or 'grandfathered' models accounted for about 62 per cent of the models on the register but only 24 per cent of sales. Buyer preference for newer models was most evident with CWDs.

- For TLs, buyers preferred models that were on average 26 per cent more water-efficient than the average on the model register, suggesting that WELS labelling and water authority rebates were having some influence on product choice.
- For FLs, buyers preferred models that were on average 15 per cent more water-efficient than the average on the model register, suggesting that WELS labelling and water authority rebates were having some influence on product choice.

For CWDs, buyers preferred models that were on average only five per cent more water-efficient than the average on the model register, suggesting that WELS labelling and water authority rebates were having little influence on product choice.

Table 9. Model-weighted characteristics – CWs and CWDs

Model	Product	Number 2009	Share of Total	Avg kg 2009	Avg l/kg 2009	Number 2007	Change	Avg kg 2007	Change	Avg l/kg 2007	Change
TL	Superseded standard	248	57%	7.0	22.0	207	41	6.7	0.3	21.6	0.4
TL	New standard	187	43%	6.7	17.9	111	76	6.5	0.2	18.6	-0.7
TL	Total	435	100%	6.8	20.2	318	117	6.7	0.1	20.5	-0.3
FL	Superseded standard	238	53%	6.4	11.6	225	13	6.4	0.0	11.4	0.2
FL	New standard	215	47%	7.2	9.5	138	77	6.9	0.3	10.0	-0.5
FL	Total	453	100%	6.8	10.6	363	90	6.6	0.2	10.9	-0.3
CWD	Superseded standard	31	46%	6.8	12.4	18	13	7.4	-0.6	11.1	1.3
CWD	New standard	36	54%	8.0	9.3	24	12	7.9	0.1	9.3	0.0
CWD	Total	67(a)	100%	7.4	10.7	42	25	7.7	-0.3	10.1	0.6
All	Superseded standard	517	54%	6.7	16.6	450	67	6.6	0.1	16.1	0.5
All	New standard	438	46%	7.0	13.1	273	165	6.8	0.2	13.4	-0.3
All	Total	955	100%	6.8	15.0	723	232	6.7	0.1	15.1	-0.1
TL	All registrations	435	46%	6.8	20.2	318	117	6.7	0.1	20.5	-0.3
FL	All registrations	453	47%	6.8	10.6	363	90	6.6	0.2	10.9	-0.3
CWD	All registrations	67	7%	7.4	10.7	42	25	7.7	-0.3	10.1	0.6
FL/CWD	All registrations	520	54%	6.8	10.6	405	115	6.7	0.1	10.8	-0.2
All	All registrations	955	100%	6.8	15.0	723	232	6.7	0.1	15.1	-0.1

Derived by author from energy labelling registration databases at November 2007 and November 2009. (a) Only 43 CWD models listed on waterrating.gov.au

Table 10. Sales-weighted characteristics CWs and CWDs

Model	Product	Sales 2008	Share of Total	Avg kg 2008	litres/kg Number	Avg sale price	Sales 2006	Share of Total	Avg kg 2006	litres/kg Number	Avg sale price	Changes in Number	Changes in Avg kg	Changes in l/kg	Changes in Price
TL	Superseded standard											-25324	0.2	-0.2	\$ 61
TL	New standard	305176	70%	6.8	14.7	\$ 690	318449	67%	6.8	16.9	\$ 695	-13273	0.0	-2.2	-\$ 5
TL	Total	435856	100%	6.7	15.2	\$ 687	474453	100%	6.6	16.8	\$ 669	-38597	0.1	-1.6	\$ 18
FL	Superseded standard	67708	19%	7.2	8.7	\$ 640	187757	67%	7.1	9.5	\$ 778	-120049	0.1	-0.8	-\$ 138
FL	New standard	285729	81%	6.9	9.4	\$ 779	90970	33%	6.7	10.0	\$ 929	194759	0.2	-0.6	-\$ 150
FL	Total	353437	100%	7.0	9.3	\$ 752	278727	100%	6.9	9.6	\$ 827	74710	0.1	-0.3	-\$ 75
CWD	Superseded standard	1020	4%	7.4	10.8	\$ 1,228	28009	79%	7.3	9.7	\$ 1,160	-26989	0.1	1.1	\$ 68
CWD	New standard	25458	96%	7.6	9.6	\$ 1,297	7663	21%	5.9	9.6	\$ 1,002	17795	1.7	0.0	\$ 295
CWD	Total	26478	100%	7.6	9.6	\$ 1,295	35672	100%	7.0	9.7	\$ 1,126	-9194	0.6	-0.1	\$ 169
All	Superseded standard	199408	24%	6.7	13.7	\$ 668	371770	47%	6.7	12.5	\$ 739	-172362	0.0	1.2	-\$ 71
All	New standard	616363	76%	6.9	12.1	\$ 756	417082	53%	6.7	15.3	\$ 752	199281	0.2	-3.2	\$ 4
All	Total	815771	100%	6.9	12.5	\$ 735	788852	100%	6.7	14.0	\$ 746	26919	0.2	-1.5	-\$ 11
TL	All registrations	435856	53%	6.7	15.2	\$ 687	474453	60%	6.6	16.8	\$ 669	-38597	0.1	-1.6	\$ 18
FL	All registrations	353437	43%	7.0	9.3	\$ 752	278727	35%	6.9	9.6	\$ 827	74710	0.1	-0.3	-\$ 75
CWD	All registrations	26478	3%	7.6	9.6	\$ 1,295	35672	5%	7.0	9.7	\$ 1,126	-9194	0.6	-0.1	\$ 169
FL/CWD	All registrations	379915	47%	7.0	9.3	\$ 790	314399	40%	6.9	9.7	\$ 861	65516	0.1	-0.4	-\$ 71
All	All registrations	815771	100%	6.9	12.5	\$ 735	788852	100%	6.7	14.0	\$ 746	26919	0.2	-1.5	-\$ 11

Derived by author from GfK sales data supplied by EES (2009)

Table 11. Comparison of model and sales weighting, CWs and CWDs, 2008

Model	Standard	Share of total Models end 2007	Share of total Sales 2008	litres/kg Models end 2007	litres/kg Sales 2008	litres/kg Difference	litres/kg % Diff
TL	Superseded standard	65%	30%	21.6	16.4	-5.2	-24%
TL	New standard	35%	70%	18.6	14.7	-3.9	-21%
TL	Total	100%	100%	20.5	15.2	-5.3	-26%
FL	Superseded standard	62%	19%	11.4	8.7	-2.7	-24%
FL	New standard	38%	81%	10.0	9.4	-0.6	-6%
FL	Total	100%	100%	10.9	9.3	-1.6	-15%
CWD	Superseded standard	43%	4%	11.1	10.8	-0.3	-3%
CWD	New standard	57%	96%	9.3	9.6	0.3	3%
CWD	Total	100%	100%	10.1	9.6	-0.5	-5%
All	Superseded standard	62%	24%	16.1	13.7	-2.4	-15%
All	New standard	38%	76%	13.4	12.1	-1.3	-10%
All	Total	100%	100%	15.1	12.5	-2.6	-17%
TL	All registrations	44%	53%	20.5	15.2	-5.3	-26%
FL	All registrations	50%	43%	10.9	9.3	-1.6	-15%
CWD	All registrations	6%	3%	10.1	9.6	-0.5	-5%
FL/CWD	All registrations	56%	47%	10.8	9.3	-1.5	-14%
All	All registrations	100%	100%	15.1	12.5	-2.6	-17%

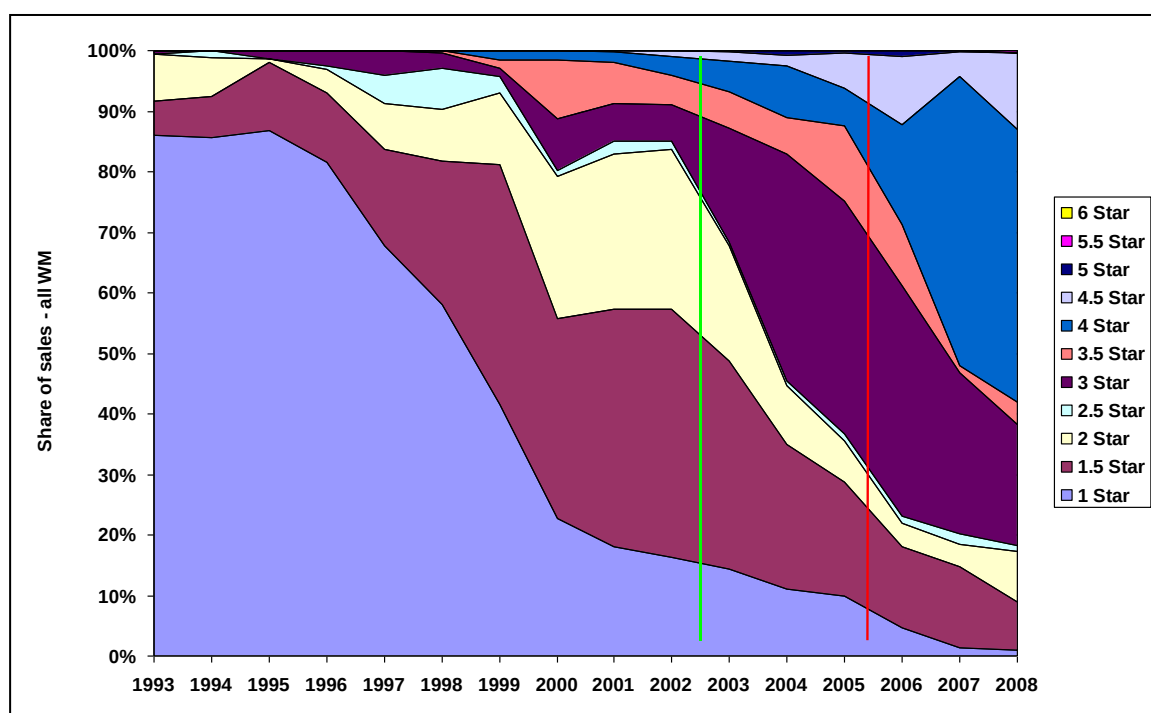
Derived by author from GfK sales data supplied by EES (2009)

While capacity can have an influence on water efficiency, this was not a factor in the higher water efficiency of purchased products. TL buyers purchased the average capacity of models on offer (6.7 kg), although for FLs they preferred slightly larger models (7.0 kg versus 6.6 kg) and for CWDs slightly smaller (7.6 kg versus 7.7 kg).

There were only minor differences between the characteristics of CWDs and FLs purchased: average capacity was larger (7.6 kg versus 7.0 kg) and average water consumption was slightly higher (9.6 l/kg versus 9.3 l/kg). This suggests that buyers saw little difference between CWDs and conventional FLs from the viewpoint of wash capacity or performance, so preference for CWDs was based mainly on their ability to dry (it cannot be brand preference because all CWD suppliers also offer conventional FLs). This capability added an average of \$543 to the purchase price of a CWD compared with a conventional FL.

Figure 9 illustrates the changes in the sales of CWs by WELS star rating since 1993. Water authority rebates were introduced in early 2003 and WELS was introduced in 2005, and 2006 was the first year in which it would have had a significant influence on the market.

Figure 9. Clothes washer sales by WELS star rating, 1993-2008



Source: Analysis of GfK sales data by EES (2009). The green vertical lines indicates introduction of water authority rebates and the red line the introduction of WELS

Capacity, user behaviour and water efficiency

The relationship between full-load capacity, actual loadings, water efficiency and energy-efficiency are complex. There are two sets of factors which can influence these relationships:

- the effects of physical design and geometry; and
- the effects of user behaviour, especially the tendency to use lower wash temperatures (for CWs) and partial loads (for both DWs and CWs).

About 72 per cent of CW users (and 89 per cent of DW users) wash partial loads at least some of the time (Table 12). This would be expected, because average CW capacities are increasing (Figure 7) at the same time as average household size is declining. Fewer people and larger CWs in a household will, all else being equal, result in more frequent washing of partial loads (unless the amount washed per person increases, and there is no indication that this is happening). Furthermore, many users think that a partial load is a full load: the Australian Consumers' Association (ACA) has found that what users think of as 'full' loads are typically about half the rated capacity.⁹

Most top loader washers fully immerse the wash load, so if a partial load is used less water is needed. However, whether less water is used depends on:

- Whether the unit has a manual fill selector (nearly all current TL models do) or an automatic fill sensor (a few TL models have this feature); and
- If the fill selection is manual, whether users choose to use it (about nine per cent say they do (Table 12)).

Table 12. Reported water-saving behaviour of Australian households, March 2007

Laundry/Kitchen	Reported actions	% of households
In Laundry	Bought a water efficient washing machine	10.9%
In Laundry	Only use washing machine when fully loaded	27.9%
In Laundry	Adjust water level when washing	8.8%
In Laundry	(Inferred by difference – use partial load washing)	72.1%
In Laundry	(Inferred by difference – use partial load washing and do not adjust level)	63.3%
In Kitchen	Bought a water efficient dishwasher	2.0%
In Kitchen	Only use dishwasher when fully loaded	11.2%
In Kitchen	(Inferred by difference – use partial load dishwashing)	88.8%

Source: ABS 4602.0, March 2007

FL CWs do not immerse the load but tumble it through water at the bottom of the sump – this is why they use about half the water per kg at full load. However, this configuration means there is much less scope to reduce water consumption for partial loads, even if the unit has part load selection and the user selects it. A recent test of the wash performance of three CWDs (which wash in the same way as conventional FLs) found that two of them used almost the same volume of water to wash a part load as a full load, even though one model was claimed to have 'load sensing'. The other used about 75 per cent as much water. The l/kg at part load washing was, at best, 70 per cent higher and, at worst, 100 per cent higher than the l/kg at full load, which is the value indicated on the label.

Another issue is whether the increase in the average rated capacity of CWs sold (Figure 7) is itself causing some of the apparent increase in water efficiency (Figure 5). Some product types require a certain amount of water to fill sumps and hoses irrespective of the load, so the larger the load capacity, the more water-efficient it appears, because the initial 'fixed' water consumption is

⁹ Choice, September 2007 p.39, confirmed in private communication with ACA, Feb 2008.

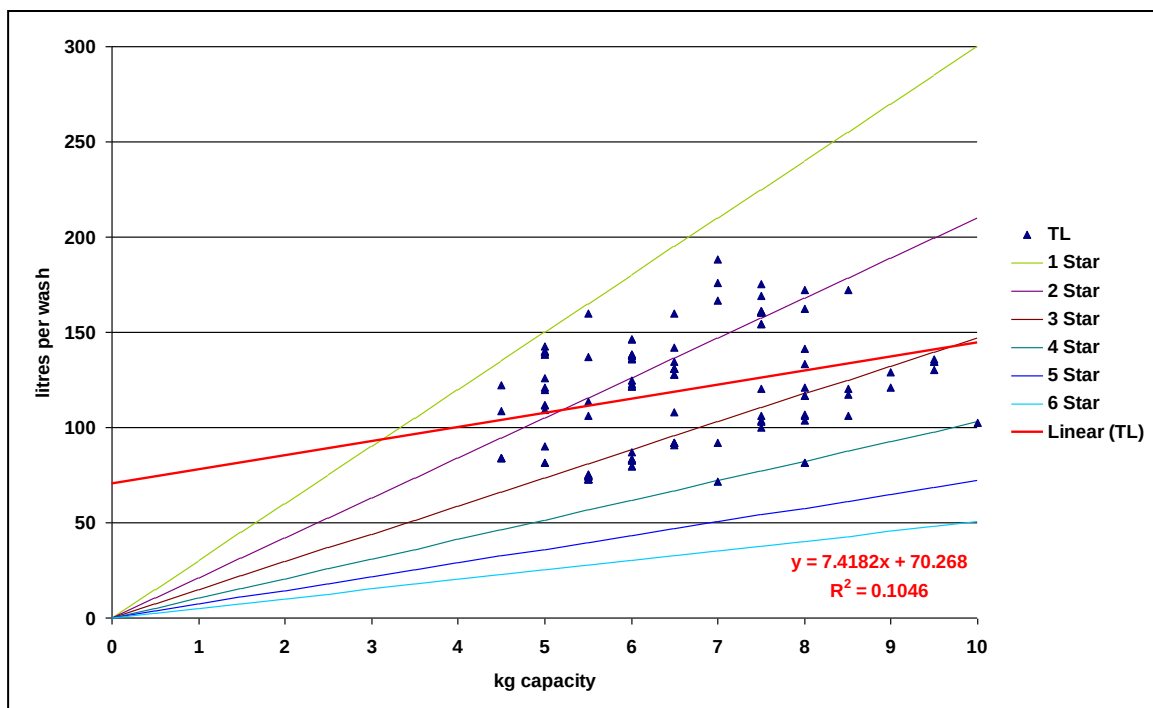
distributed across more kg of capacity. The formulae for the WELS star ratings (and energy star ratings) for several products reflect these physical factors by incorporating an 'intercept' on the vertical axis, as is the case for DWs (Figure 17).

When the WELS star bands for CWs were set in 2005, industry claimed that there was no relationship between litres/kg and rated kg capacity, so no fixed intercept was included and the star bands converged at the origin of the l/kg graph. Now that all CW models have actually been rated, it is possible to revisit this assumption.

Figure 10, Figure 11 and Figure 12 illustrate the WELS star rating bands for TLs, FLs and CWDs respectively, and plot models which are registered to the current standard, and therefore represent the latest technology. The trend relationships between capacity and water consumption are also plotted. If water efficiency were unrelated to capacity, the trend line would go through the origin (as it appears to do for FLs). The trend lines indicates a 70 l/kg 'intercept' for TLs (but the statistical correlation is weak, i.e. a low R^2 value) and a 20 l/kg intercept for CWDs (with a higher R^2 value).¹⁰ However, these results are inconclusive. The effect for CWDs is more or less as expected, but the lack of a relationship for FLs, which use the same washing technology, is surprising. Similarly, the intercept for TLs would be expected to be lower than for FLs, not higher, since total immersion suggests a more direct relationship between load and water used.

These findings suggest that if WES are to be introduced for CWs, there is no clear case for departing from the WELS star bands on statistical grounds, although there may be a case for departing on practical grounds. For example, higher WELS star rating cut-offs may disproportionately impact on smaller models.

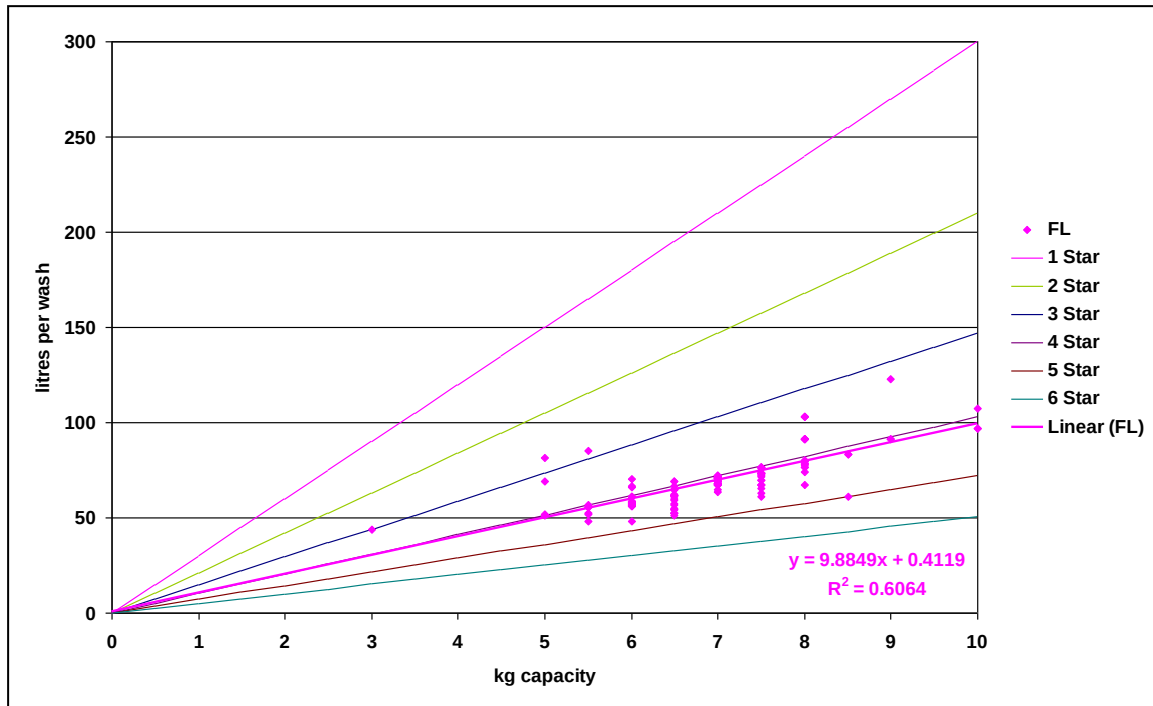
Figure 10. WELS star ratings and star bands: TL CWs



¹⁰ A perfect statistical correlation has an R^2 value of 1.

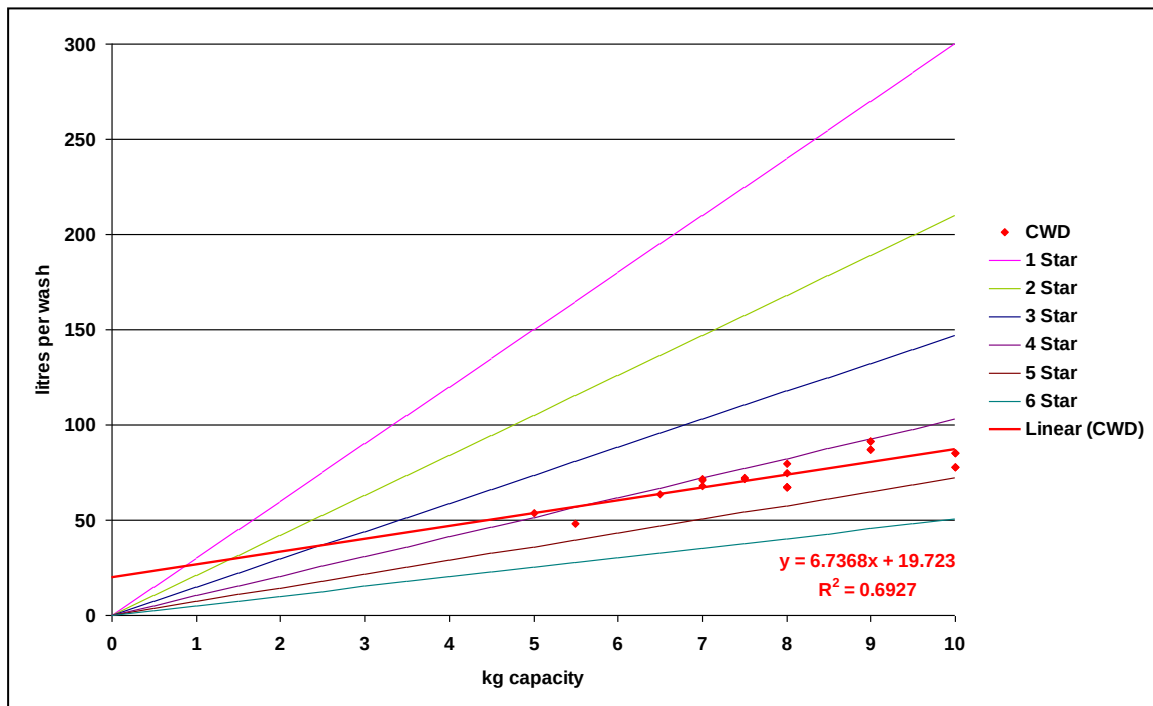
Author analysis of registered models

Figure 11. WELS star ratings and star bands: FL CWs



Author analysis of registered models

Figure 12. WELS star ratings and star bands: CWDs



Author analysis of registered models

Combined washer dryers

Technology

CWDs offer the advantage of substituting a single appliance for a separate washer and a dryer. This space-efficiency, and the fact that the dryer does not vent steam like a conventional evaporative dryer, makes CWDs increasingly popular in apartments, where space is constrained and access to the outside for venting is difficult.

CWDs also offer the convenience of allowing a load to be washed and dried in one continuous operation, without requiring anyone to be present to move clothes from the washer to the dryer or hang them on the line. This cannot be done if the washer is loaded to its rated wash capacity – the maximum drying capacity is typically 50 per cent to 60 per cent of the rated capacity. As users of all types of FL CW typically load to about half the rated capacity, this is rarely a serious constraint. For CWDs, the drying load limit may well correspond to the most common wash load in normal use.

CWDs consume water while drying as well as while washing. They are designed to avoid venting humid air outside the cabinet, so they have a water-cooled condenser to remove moisture, which is collected in a container or sent to waste. The amount of water taken from the mains for condenser cooling can be as much or more as is used for the wash cycle. There are also stand-alone condenser dryers, but they cool the condenser with air, not water.¹¹

Information to Buyers

At present the WELS scheme treats CWDs as if they were CWs, and requires labelling of water consumption for the washing function but not for the drying function. The energy labelling program treats a CWD as if it were a distinct CW (used once per day) and a CD (used once per week), but does not recognise the linkage between the functions and frequency of use in the one unit. CWDs must carry separate energy labels indicating their energy use for the washing function and for the drying function, but the energy consumption for drying is calculated for a load of standard moisture content, not for a load as it is left at the end of the same unit's wash cycle, which is generally well below standard water content (Access 2008a). This means that the drying energy consumption is only indicative of the *least* likely mode of use – as if the CWD were a stand-alone dryer – and is of limited value to buyers of laundry products.

Very few buyers are aware that CWDs use water for their drying function at all, let alone that they use, on average, more water to dry each kg of load than to wash it. This is because:

- there is no indication of this on either the energy or the WELS label;
- CWDs are identified as separate categories of CW within the supporting websites (www.energyrating.gov.au and www.waterrating.gov.au) but the listings only give energy and water consumption on the washing function, and make no mention of drying function water use; and

¹¹ Stand-alone water-cooled condenser dryers are also feasible, but there are no known commercially available models. They are not likely to be price-competitive with air-cooled condenser designs because they would incur the cost of connection to a water supply.

- the brochures made available by CWD manufacturers give water consumption on the washing function but no information on drying function water use.

The only available source of data is the *clothes dryer* registration database, which lists the total water consumption on the drying function of CWD models, as well as their total energy consumption and energy per kg. The data does not appear on the searchable website designed for public use, but can only be accessed by downloading the complete data file. Interested users would still need to match the model numbers on the CD database with those on the CW database to get the complete picture of each CWD's water use.

Although all CWDs use significant volumes of water in their drying function, there is a large range in their water efficiency, as indicated in Table 13. On average, CWDs use 121 per cent as much water to dry each kg of load as to wash it, but the range is very wide: from a low of 65 per cent to a high of 166 per cent.

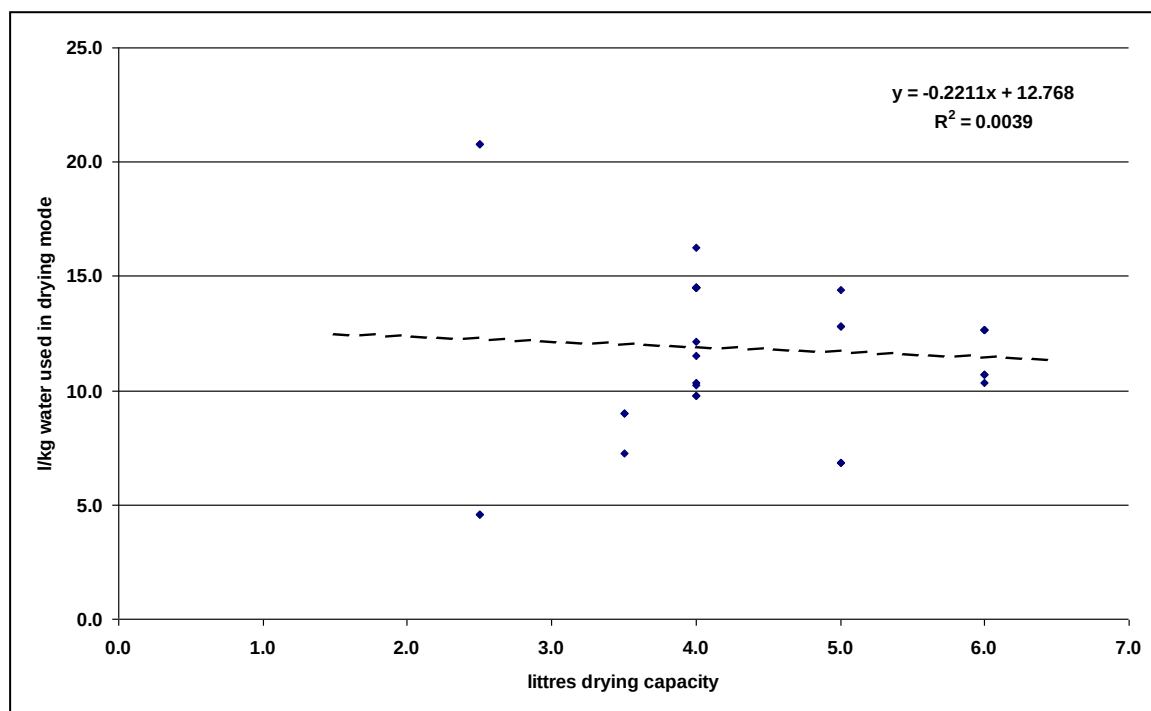
Table 13. Water use of CWDs on market, 2008

Quantity	Units	Model characteristics Average	Model characteristics Min	Model characteristics Max	Model characteristics Range	Sale-weighted Average
Washing capacity	kg	7.8	5.0	10.0	5.0	7.6
Drying capacity	kg	4.2	2.5	6.0	3.5	4.2
Dry/wash cap	kg/kg	54%	45%	67%	21%	54%
Wash water use	l/kg	9.7	7.0	12.6	5.6	9.6
Drying water use	l/kg	12.7	4.6	20.8	16.2	11.8
Dry/wash water	(l/kg)/(l/kg)	121%	65%	166%	101%	123%

Source: Derived by author from GfK sales data supplied by EES (2009).

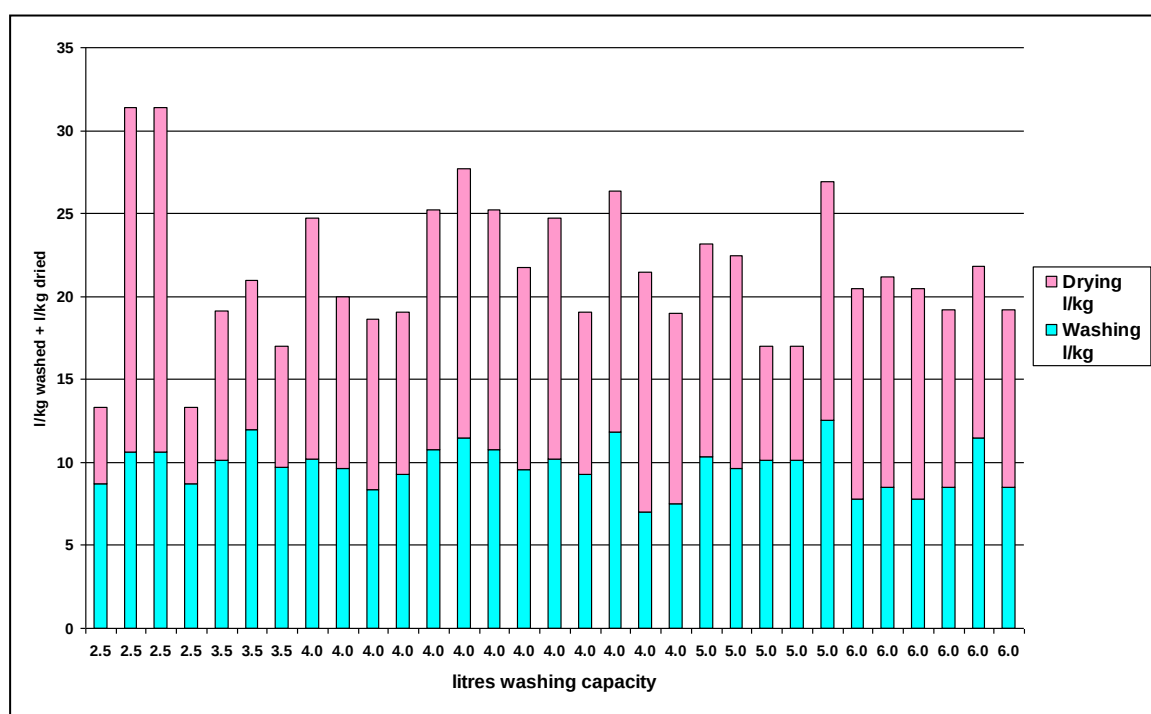
Figure 13 illustrates the variation of drying-mode water use with drying capacity. It shows that the relationship between the two is very weak, but also that at any given drying capacity there is a wide range in water consumption for drying. At the most common drying capacity (4 kg) for example, the range is from 16.3 to 9.8 litres/kg. However, the selection of a dual-function CWD is more complex than for a single-function CD or CW. A model which is more water-efficient in its washing function may be less so in its drying function (Figure 14); the capacity and the proportion of the wash load that can be dried also varies from model to model.

Figure 13. CWDs – Water consumption on drying



Author analysis of registered models

Figure 14. CWDs – Water consumption on washing and drying



Author analysis of registered models

To make a fully informed choice between purchasing a CWD and a separate CD and CW, and then between alternative CWD models, a prospective buyer would need the following information:

- Washing capacity and washing water use of the CW models under consideration (which appear on the CW WELS label).
- Washing capacity and washing water use of the CWD models under consideration (which appear on the CW WELS label).
- Energy use of the CW models under consideration (which appear on the CW energy label).
- Drying capacity and drying water use of the CWD models under consideration (data which are not readily available to the public).
- Energy use of the CD models under consideration (which appears on the CD energy label).

This may well be more information than most buyers would bother to process, even if it were readily available. However, the purchase decision is likely to be made in two stages, with different information needs.

Information to support a two-stage decision process

As with other products, the means of conveying information on CWDs should be consistent with the purchase decision process, which needs to be better understood through consumer research. It is very likely that the CWD purchase process has two stages, analogous to how water heaters are chosen.¹²

The decision to purchase a CWD rather than a CW only, or a separate CW and CD, is likely to be informed by a number of factors, including the space available (which may make a single unit the only option), the price of separate units and a general appreciation of the relative resource impacts of the alternatives. Some consumers may like the idea of a combined product or because of the convenience it offers (from washing straight through to drying).

However, if the data were readily available, some buyers considering CWDs may be diverted to purchasing CWs alone or to separate CWs and CDs. It is possible that an awareness of the CWD water usage when drying, and/or that the magnitude of water use is comparable to the washing water use, is all that is necessary for this decision to be made. Details of drying water efficiency are not likely to be taken into account until the next stage of the decision process.

The information needs for this first stage may be satisfied by informing buyers that the CWD uses water on the drying cycle, and of the quantity of water used. This could be achieved by including a 'water warning' statement (whether as part of the dryer energy label or a new label) along with the litres of water used – information which is currently available, but very difficult for the public to access.

If after the first stage of the selection process buyers still decide to purchase a CWD, they may wish to compare alternative models on the basis of price, capacity (for both washing and drying) and resource efficiency. At present, it is impossible for buyers to do this due to the absence of information on CWD drying-mode water use.

¹² For water heaters the first stage is a general choice about the energy form (electric, gas or solar) and the second stage is the selection of the model, which in the case of gas water heaters at least, may be informed by energy labelling.

The information offered to support this second stage of the selection process should also be consistent with the way in which buyers are most likely to use the product. In the case of CWDs, the critical difference from conventional front loader CWs is the ability to wash and dry a load from start to finish. Therefore this 'full process' function should logically be the basis for rating the comparative performance of CWDs.

Up to now, CWDs have not been fully recognised as a distinct product, only as sub-classes of CWs and CDs which, it is implicitly assumed in the test standards, would be used in the same way as conventional CWs and conventional CDs. This may be a reasonable assumption for presenting energy and water information during the first stage of the product selection process, but once the process moves to the second stage, the information most likely influence the prospective purchaser is:

- Maximum load that can be processed from start to finish (the 'process load');
- Total energy consumption per kg to wash and dry that load; and
- Total water consumption per kg to wash and dry that load.

This information is not available from present tests. It would be necessary to develop a new test, that would be additional to the full load washing and drying tests, as follows:

- 1) Load the CWD to the 'process load' (e.g. if the CWD is rated for 8 kg washing and 5 kg drying, wash with a 5 kg load).
- 2) Use the cycles and settings nominated by the supplier which will:
 - Clean and rinse the load to the requirements of AS/NZS 2040 *Performance of household electrical appliances- Clothes washing machines Part 1: Energy Consumption and Performance*; and
 - Dry the load to the level of dryness required in AS/NZS 2442 *Performance of household electrical appliances- Rotary clothes dryers Part 1: Energy Consumption and Performance*.
- 3) Measure the total energy and the total water used to process the load to dryness.
- 4) Calculate the total energy and total water use per kg of load processed to dryness. These values would be the ones most useful to prospective buyers comparing the performance of alternative CWDs.

If there are clearly marked part-load settings which users could access to minimise water and energy use for this size load (or an automatic load sensing capability) these should be selected. Models without load-sensing or part-load adjustment capability will obviously be at a disadvantage because their water consumption at the 'process load' will be identical to their water consumption at their full rated wash load, so wash water use per kg load will be much higher. Conversely, drying water use per kg of load may well be lower than under the present AS/NZS 2442 test, because the load may have lower water content at the end of the wash cycle (the limited test data available indicate that this is so). (Access Product Information Consultants, 2008a).

One complication would be to ensure that the CWD meets the soil removal and rinse performance requirements of AS/NZS 2040. While the soil test swatches could be removed for examination at the end of the wash cycle, rinse performance is measured by extracting detergent residues from the entire load. Therefore it may be necessary to do two 'process load' tests – one carried through to

dryness, and the other terminated after the wash cycle, so compliance with the soil removal and rinse performance requirements can be verified.

Of course, disclosure of this information will only affect purchasers who are motivated to select CWDs based on resource efficiency. It is not currently known what proportion of CWDs are purchased by buyers or intermediaries, such as developers, concerned with capital cost or other criteria rather than running cost or resource efficiency.

Comparison with other Clothes Dryers

The drying function of a CWD could be carried out in a conventional CD. Indeed, this is implicit in the CD energy label, which tests CWDs in the same way as conventional condenser dryers and evaporative dryers.

Are CWDs more energy-efficient in their drying than conventional dryers? If so, it could be argued that there is some energy benefit to compensate for their water consumption. The answer would appear to be no: on average, CWDs use only four per cent less energy to dry each kg of load than other condenser dryers (Table 14) and the most energy-intensive CWD uses more energy per kg than the most energy-intensive conventional alternative.

Table 14. Energy use of CWDs and other CDs

Clothes dryers	Number of models	Avg cap kg	Average kWh/kg	Max kWh/kg	Min kWh/kg	Range kWh/kg
CWDs	49	4.4	0.81	1.17	0.65	0.52
Condenser dryers	57	6.2	0.84	0.98	0.38(a)	0.60
Evaporative dryers	122	5.4	0.89	1.14	0.73	0.41

Source: author from energy labelling registrations database, November 2009 (a) Heat pump model

Dishwashers

About 45 per cent of Australian households have a dishwasher (DW), and the share is rising steadily (Figure 4). Most DWs sold are of the 'standard' size: about 600 millimetres (mm) wide and 850mm high, and designed to fit under a kitchen bench top. These are able to wash between 10 and 15 standard place settings, depending on their internal stacking arrangements and baskets. There are also models which are narrower (e.g. 450mm wide), half-height (e.g. the six-place 'dish drawer' which can be installed as a single unit or stacked into the equivalent of a standard unit) or over-bench. Non-standard sizes had relatively low sales per model, except for the 'dish drawer' (Table 15).

Table 15. Dishwashers, model numbers and sales, 2008

Capacity Place settings	Models on register (a)	Share of models	Sales 2008 (b)	Share of sales
4	5	0.4%	613	0.2%
5	0	0.0%	NA	0.0%
6	9	0.8%	8,777	2.9%
7	2	0.2%	NA	0.0%
8	22	1.9%	1,046	0.4%

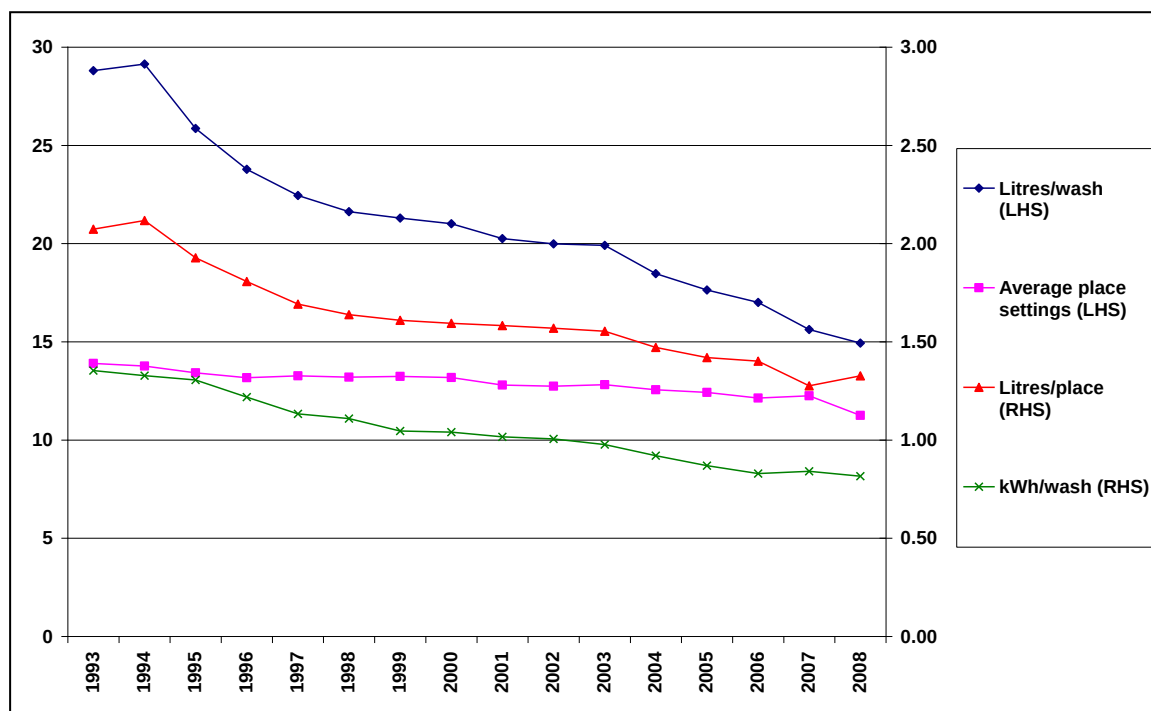
Capacity Place settings	Models on register (a)	Share of models	Sales 2008 (b)	Share of sales
9	24	2.1%	2,286	0.8%
10	15	1.3%	42	0.0%
11	0	0.0%	NA	0.0%
12	718	62.3%	210,961	70.9%
13	41	3.6%	6,057	2.0%
14	298	25.9%	67,533	22.7%
15	18	1.6%	438	0.1%
All	1152	100.0%	297,763	100.0%

(a) At November 2009, including 'grandfathered' models. (b) From GfK. Excludes sales of unidentified models.

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. DW energy and water consumption are closely coupled, unlike CW, where users are able to decouple them by selecting cold wash.

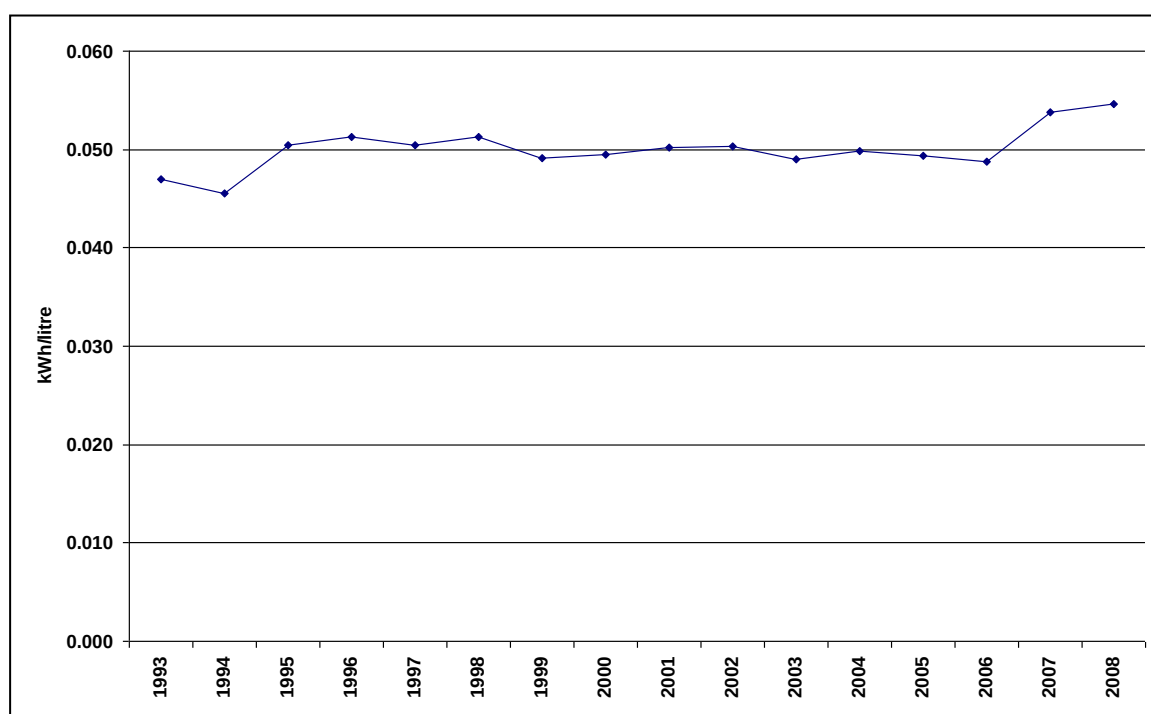
Between 1993 and 2008, sales-weighted average water use of new DWs sold declined by 48 per cent, from about 29 litres per cycle to 15 litres (Figure 15). The rate of improvement slowed in the early 2000s, but then accelerated again from 2004, when awareness of urban water shortages was high and water authorities started to offer incentives for purchase of the more water-efficient models (identified first by AAAAA ratings, and then by WELS ratings). These were genuine technical improvements in water efficiency, not artefacts of changes in average capacity: this declined slightly over the period, and would have *increased* water consumption per place setting, all else being equal. The energy used per litre remained almost constant over the most of the period but increased slightly in 2007 and 2008 (Figure 15). As most DW energy is used to heat water, this indicated that there was virtually no change in average wash temperatures for most of the period, but that as water use declines, it is possible that machines have to heat to higher temperatures to achieve the required wash performance.

Figure 15. Sales-weighted water and energy use, new DWs



Source: EES (2009) LHS =left hand scale; RHS = right hand scale

Figure 16. Sales weighted average kWh/litre, new DWs



Source: EES (2009)

The most water-efficient model on the market now uses about 10 litres (0.78 litres per place setting) but there is still a wide range in water-efficiencies at each capacity level. (Table 16, Figure 17). Although some of the highest water users are 'grandfathered' registrations, which will all run out by

March 2012, there are still a range of water efficiencies among the more recent registrations (Figure 18).

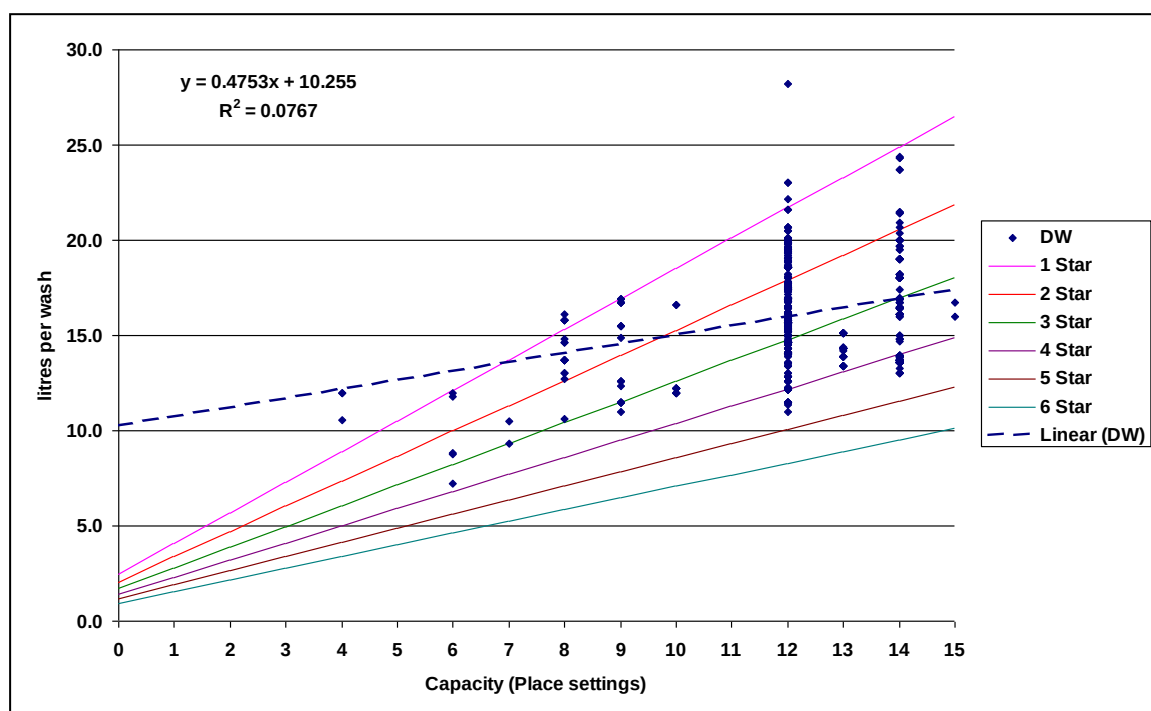
When the WELS star rating bands were devised, a vertical intercept on the Y-axis was included in recognition that smaller capacity units consume more water per place setting than larger units. The dashed trend line on Figure 17 indicates that the relationship may be more pronounced than originally envisaged. This means that minimum WES levels based on WELS star bands may have disproportionate impacts on smaller units.

Table 16. Average, minimum and maximum water consumption rates, DWs

water consumption rates	litres per place setting Standard (11-15 place settings)	litres per place setting Other (10 or less place settings)
Minimum	0.8	1.2
Model average	1.2	1.7
Maximum	2.4	3.0

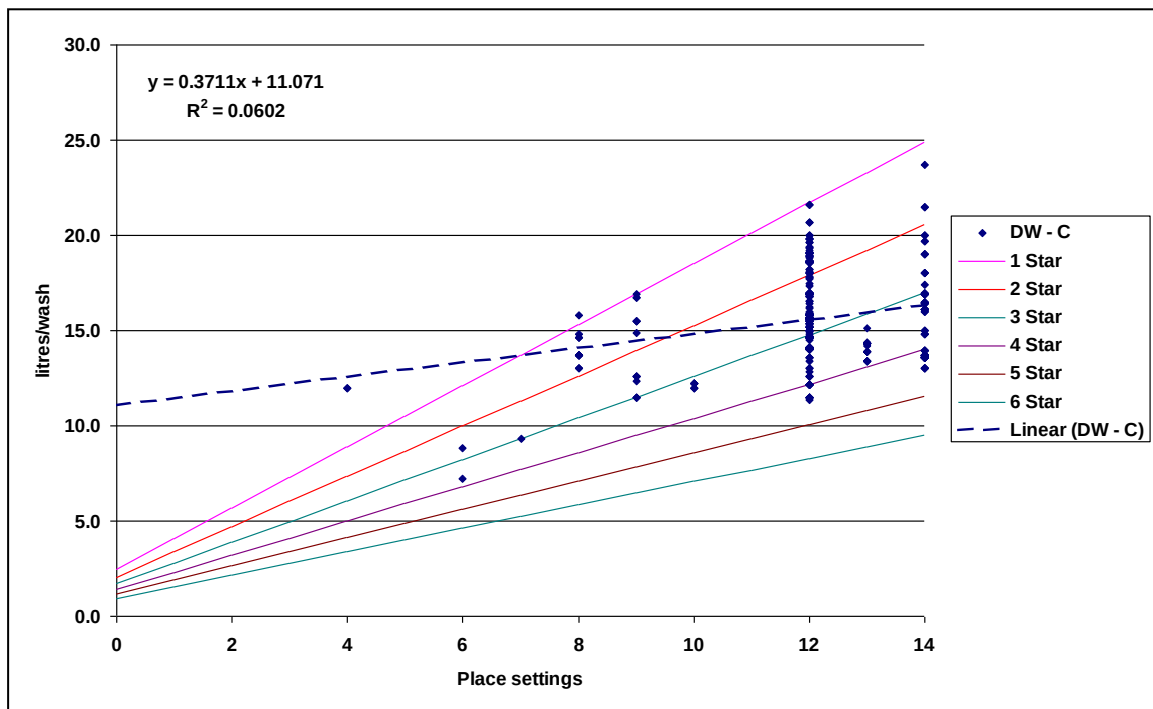
Source: Recent registrations on www.enrgrating.gov.au Rating based on 'normal' program.

Figure 17. WELS ratings of all DW models on the market at January 2008



Author analysis of registered models

Figure 18. WELS ratings of more recently registered dishwasher models on the market at January 2008



Author analysis of registered models

4 Policy options

Options considered

This section considers options for targeting reductions in water use associated with CWDs, CWs and DWs, as a means of contributing to managing Australia's residential water market. It considers the options of:

- Voluntary labelling and minimum WES.
- Mandatory 'Water Warning' labels.
- Rebate schemes.
- Mandatory water efficiency labelling and mandatory minimum WES.

All these options are discussed below. The preferred option is the application of mandatory water efficiency labelling to the water-using dryer-mode of CWDs and mandatory minimum WES to CWs and the washing-mode of CWDs.

Voluntary labelling and minimum WES

The initial rationale for the WELS scheme was the low effectiveness of the pre-existing voluntary AAAAA labelling program run by WSAA. Suppliers of more water-efficient products had a commercial incentive to label, mainly in order for their products to gain access to the purchase rebates offered by the water authorities. However, suppliers of less efficient products did not label (GWA 2004).

There is no commercial reason for suppliers of combined washer-dryers to draw attention to the fact that their products use significant quantities of water to dry clothes. They would not benefit from water authority incentives – in fact the water authorities plan to disqualify combined washer dryers from their rebate schemes, and are waiting for the implementation of drying-mode water use labelling to make this change.

Even the suppliers of CWDs which use less water per kg to dry would put themselves at a disadvantage by labelling, because their less water-efficient competitors would simply avoid labelling altogether, so maintaining the customer perception that their models use no water at all for drying. Rather than a 'first-mover advantage', there would be a 'first-mover disadvantage'. Under these circumstances, a voluntary labelling program would be equivalent to maintaining the status quo. There would be no water savings and consumers would continue to be deprived of important product information.

There is even less commercial incentive for any product supplier to voluntarily adopt minimum performance standards which would impinge on their own products. They would incur costs of removing or replacing models falling below the voluntary standard, for no benefit, unless they can convince customers (at their own expense) that their remaining products are preferable because they meet a self-imposed standard. This strategy is easily subverted by competitors ignoring the standard, or actively questioning it and adopting other standards that better suit their own products.

As Table 6 indicates, the only instances of 'voluntary' standards for CWs and DWs (in the European Union) are backed by the threat of mandatory standards, and by a strong appliance industry

association with broad coverage that is able to gather the data to demonstrate to governments that average targets are being met.

The only other known example of effective 'voluntary' product efficiency standards is Japan, where there is a unique relationship between corporations and government that makes 'voluntary' agreements binding in effect.

As none of these special conditions apply in Australia, there is no reason to expect that voluntary standards would succeed without a clear commitment to mandate the standards in the event of inaction. It is difficult to discern any benefit compared with mandatory standards. It would require a longer lead time, would place the costs of administration and compliance on the industry instead of absorbing them into the existing WELS framework at essentially marginal cost, and would carry the high risk that the standards would ultimately have to be enforced by government in any case.

Voluntary options have been examined in a number of previous RISs for the WELS and energy labelling programs and have not been found viable. This is because no rational supplier would take the risk of constraining their actions without assurance that their competitors would do the same. The only entity capable of giving such an assurance is the Government, through regulation.

Mandatory 'Water Warning' labels

There are in fact two general approaches to minimum standards for product performance, energy or water efficiency:

- A 'low level' or 'defensive' standard which aims to protect consumers by preventing very inefficient products coming on to the market.
- A 'higher level' standard which aims to deliver significant benefits to appliance buyers (and other energy and water users) by reducing their costs of water and energy services, and to meet other policy objectives such as environmental protection.

Mandatory minimum task performance standards as a consumer protection measure are already universal for products which carry water and energy star rating labels. A minimum level of water and energy use is also becoming part of consumer expectations of 'fitness for purpose'. Could the same objective be met by requiring products which do not meet the accepted minimum criteria with a special 'water warning' label, such as those carried by some shower heads?

Shower heads were among the first group of appliances to be subject to WELS labelling. There are two distinct technology types: those with flow controls and those without. Only flow controlled showers can be tested to determine their flow rate under AS/NZS 6400. Non-controlled shower heads cannot be tested because they cannot meet water pressure stability requirements of the test, and hence cannot obtain a star rating.

Non-controlled showers could not be excluded from the market because they are necessary for low-pressure installations which use tank water, but the objective was to restrict their purchase to those installations. This was the reason for the development of the 'water warning' label, with the text: 'Zero star rated; Water Warning; Does not comply with AS/NZS 6400.' The intention was to prompt prospective buyers to investigate the reason for the warning and to select a flow-restricted shower head if they were on mains water. The success of this strategy has yet to be determined. For new

dwellings, the decision is not left to the market – if they are on mains water, it is mandatory under State building codes to install low-flow shower heads.

Even if CWs and DWs carry a ‘water warning’ label (some already do), if they are cheap enough they are likely to be preferred by builders, landlords and other intermediaries who are unconcerned with running costs, and who can remove the label before the ultimate buyer or occupant sees it.

Rebate schemes

The objective of ‘higher-level’ standards is to deliver significant benefits to appliance buyers (and other energy and water users) by reducing their costs of water and energy services, and to meet other policy objectives such as environmental protection. Could rebate payments by the water supply authorities to buyers of highly water-efficient CWs achieve the same outcomes? This would avoid the need for regulation and would leave the full range of products on the market.

It could also motivate buyers who would not otherwise care about running costs (e.g. builders and other intermediaries) to purchase the more efficient products, provided the value of the rebate was high enough and they were able to capture it – some rebate schemes are only available to private buyers of single units, not bulk purchases.

However, surveys have already shown that it is impossible to avoid ‘free riders’ on the rebate (WA Auditor General 2006). To gain enough genuine sales diversions to meet water saving objectives, the rebate would end up being paid for an increasing share qualifying product sales, compared with the 25 per cent or so who now receive it. The effective cost to the water authority per diversion would probably rise from the present \$300 to \$400 (assuming 50 per cent free riders and the current each rebate of \$200 in SA and \$150 elsewhere). Of course, the rebate could be reduced, but the only effect will be to reduce the number of genuine diversions – the free riders will continue to accept any amount, however small. The cost per kl saved may remain much the same with a smaller rebate, but the total volume of water saved will be less because there will be fewer genuine diversions.

In other words, the cost to water authorities per kl saved via rebates for the purchase of higher-efficiency CW probably already exceeds the cost of water supply augmentation, and it is difficult to see how the cost per kl can be reduced. Therefore, although rebates deliver benefits to those appliance buyers who claim them, the cost to those who provide the rebate (i.e. all water users) is probably higher than their benefit. Water users not receiving the rebates would be better off if the water savings foregone were made up through more cost-effective demand side programs (e.g. WELS) or even if sourced from augmented supply.

Mandatory water efficiency labelling and mandatory minimum water efficiency standards: the preferred option

Mandatory energy performance standards are an accepted and proven policy measure. A retrospective analysis of the impact of mandatory minimum energy performance standards (MEPS) combined with labelling for refrigerators in Australia concluded that the benefits in energy savings were higher than initially projected, and the costs were significantly lower than initially projected (EnergyConsult 2006). There was no real increase in average appliance prices and no reduction in the range of models on the market – those excluded were replaced by more energy-efficient models with comparable features, so there was no detectable reduction in customer choice.

A multi-national study sponsored by the International Energy Agency concluded:

This paper provides information on the trends in energy performance and prices of major appliances in the US, Australia, Japan and Europe and examines the impact of national Standards and Labelling (S & L) appliance programs. The results indicate that not only is the average energy consumption of appliances falling, but that they have also become cheaper. This is contrary to many expectations that the introduction of mandatory S & L programs would increase the price that consumers pay for appliances (Ellis et al 2007).

There was debate at the commencement of the WELS scheme about whether mandatory WES should be adopted at the same time. The original RIS concluded that WES could not be justified for any product but toilets at the time:

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 an AA rating or better. (GWA 2004, p44).

Minimum WES for CWs and DWs can now be reassessed, because there is now sufficient information about the market to underpin a stringent analysis (due in part to the WELS scheme). Unlike showers, where the market is divided between two distinct technologies, there is a continuous gradient of water efficiency for CWs, CWDs and DWs. Given the extensive information now available about the markets for these products, it is now possible to set minimum WES levels which reduce water demand cost-effectively and at acceptable impacts on the market.

Mandatory labelling has not been shown to be ineffective – on the contrary. However, if it can be shown with reasonable confidence that the adoption of minimum WES can save significantly more water (and energy) than labelling alone, and do so while making both appliance buyers and other water users better off, then minimum WES should be implemented. There are no practical or policy impediments to the implementation of mandatory minimum WES, provided they meet these criteria.

Assessment of alternative options

Table 17 summarises the assessment of the options considered compared with the status quo, using the criteria in the preceding sections. Environmental benefit is assessed as a separate criterion, because it is more or less proportional to water savings and energy savings.

Table 17. Assessment of options compared with status quo

Measure	Projected water savings	Impact on product purchasers	Impact on specifiers, intermediaries	Risk to choice, competition	Impact on other water users	Consumer protection
Voluntary WELS labelling	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected
Mandatory WELS labelling	Moderate savings	All benefit from higher avg eff; label users benefit more	No impact; no incentive to use label	Can enhance competition by making efficiency a selling point	Benefit from lower water demand; costs borne by purchasers	Moderate; very inefficient products still on the market
Rebates (assuming no WELS)	Moderate savings	Recipients benefit from rebate as well as from lower running costs	Can influence if rebate rules allow	No risk	High; worse off if rebate scheme not cost-effective	No effect
Water warning labels (alone)	Very little savings	Minimal	None	No risk	Benefit from lower water demand; costs borne by purchasers	Moderate; very inefficient products still on the market
Voluntary minimum WES standards	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected	No change from status quo - no take-up expected
Mandatory WES: low level	Some savings	Do not need to be aware; better off if minimum WES level meets criteria	Influences all purchases, including these	Very little risk	Benefit from lower water demand; costs borne by purchasers	High; very inefficient products excluded from market
Mandatory minimum WES: higher level	High savings	Do not need to be aware; better off if minimum WES level meets criteria	Influences all purchases, including these	Some risk; levels need to be set carefully	Benefit from lower water demand; costs borne by purchasers	High; very inefficient products excluded from market

Source: GWA modelling

For the appliances under consideration energy savings are more or less proportional to water savings. For products already subject to water efficiency labelling, there is no benefit in implementing minimum WES and abandoning water efficiency labelling.

The measures which best meet the criteria are a combination of mandatory WELS labelling and minimum WES. However, there are different ways in which WELS labelling can be implemented and many possible minimum WES levels, from low-levels which primarily have consumer protection value to levels so high that no current model could meet them.

Criteria for Consideration of minimum WES levels

Administrative simplicity is one criterion. If minimum WES is to be introduced, it could be based on existing standards and rating scales, or on some new formula which better reflects physical

characteristics such as the relationship between capacity and water efficiency discussed in Chapter 2. On balance, the most logical method is to base minimum WES levels on the Star Rating Index (SRI) calculated in accordance with AS/NZS 6400:2005, and to include the selected minimum WES level in the standard. For example, if a SRI of 3.0 were selected by the Government (after considering the impacts of such a regulation) then AS/NZS 6400 would be revised to the effect that a CW would have to obtain a SRI of 3.0 or greater to comply with the standard. The minimum WES level would be given regulatory force once the WELS regulations invoked the new revision of the standard.

The overriding criterion for adopting a given minimum WES level is that the projected benefits should exceed the projected costs. The quantifiable costs and benefits are covered in the next chapter, but it is possible to get a preliminary indication of non-quantifiable costs from analysing the market impact of various minimum WES levels. At one extreme, a minimum WES level that would prevent 100 per cent of current models from being sold would obviously have a very high market impact – all suppliers would have to change their complete model line-up to continue to supply the market. This does not necessarily exclude this approach from consideration, but there would need to be compelling factors, such as impending water shortages, for setting such a high minimum WES level.¹³

At the other extreme, setting a minimum WES level so low that it has no impact on the current market would have no impact on the average water efficiency of new CWs, although it would still have the value of preventing products of even lower water efficiency from coming on to the market (which still appears to be happening).

The following sections apply this criterion to each product in turn.

Preferred option for clothes washers

CWs have, on average, increased in water efficiency since the introduction of energy labelling and then water efficiency labelling. This has been due to increasing buyer preference for FL models, increasing water efficiency in the models offered (both FL and TL), and buyer preference for the more water-efficient among the models offered.

However, both TL and FL models of low water efficiency continue to be introduced to the market and continue to sell in significant quantities. In fact, some FL models are now less water-efficient than some TLs.

Some CW models on the market are still registered to a superseded method of test, which is less rigorous than the current method of test (AS/NZS 2040:2005). The registrations for these models have been 'grandfathered' in that they can continue to display the WELS ratings obtained under the superseded test, for a period of up to five years from their original dates of registration. For all 'grandfathered' models, this period will have expired by 31 March 2012.

¹³ In the USA in the early 1990s, MEPS were announced for refrigerators which could not be met by any of the models on the market at the time of initial announcement. In Australia, the MEPS levels announced for electric storage water heaters in 1996 required all models to be revised by the time the MEPS took effect in 1999. However, the circumstances of these 'high-level' MEPS introductions were different from those in the clothes washer market: there was no energy labelling (for water heaters) or labelling was ineffective (in the USA), so there were no policy options for driving energy efficiency other than high-level MEPS.

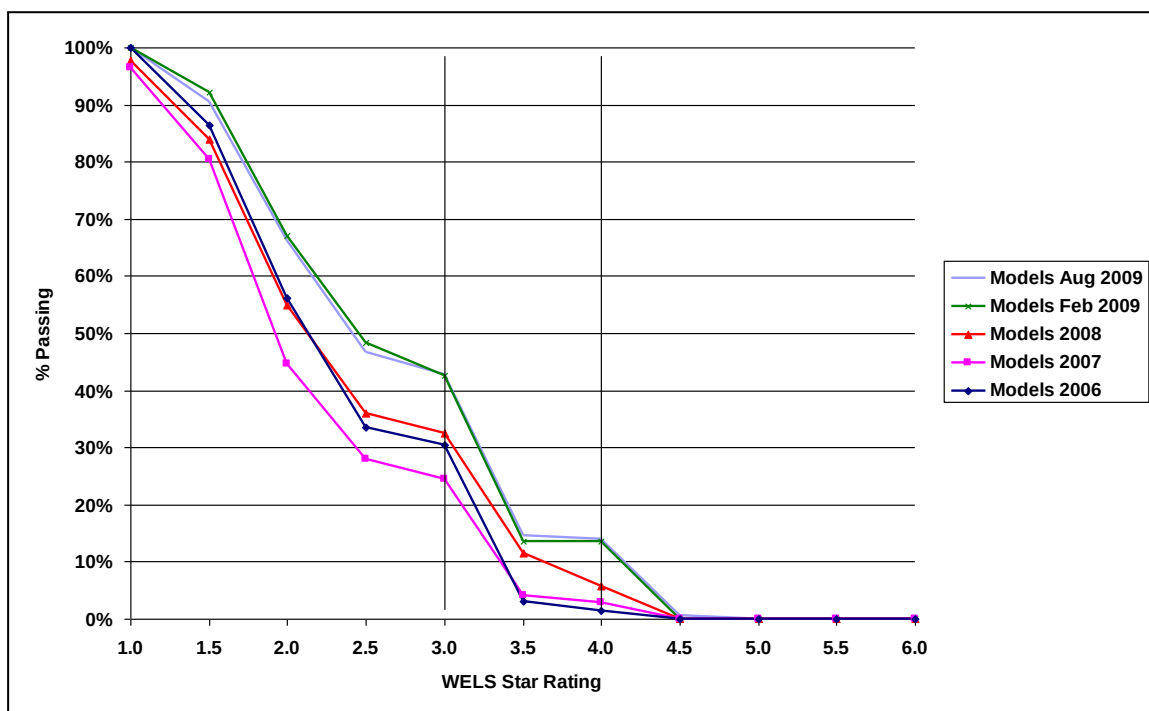
As the models affected come to the end of their 'grandfathered' registration periods, their suppliers will have to decide whether to:

- Allow the registration to lapse, remove the model from the market, and not replace it with another model.
- Remove the model from the market but replace it with another similar model (i.e. targeting the same size and price point), whether of lower, equal or higher water efficiency to the model removed.
- Re-test it to AS/NZS 2040:2005, re-label it (generally with a lower WELS rating, since the new test is more stringent) to keep it on the market.

The earlier suppliers have certainty about future regulatory requirements, the better they will be placed to make the above decisions. Introducing minimum WES in the near future would be timely, in that it would inform the commercial decisions which will have to be made about 'grandfathered' models over the coming years. If minimum WES levels are introduced later, a large number of models yet to be introduced may have to be taken off the market, with attendant costs to both suppliers and buyers. In other words, there is at present a window of opportunity to introduce minimum WES at lower cost.

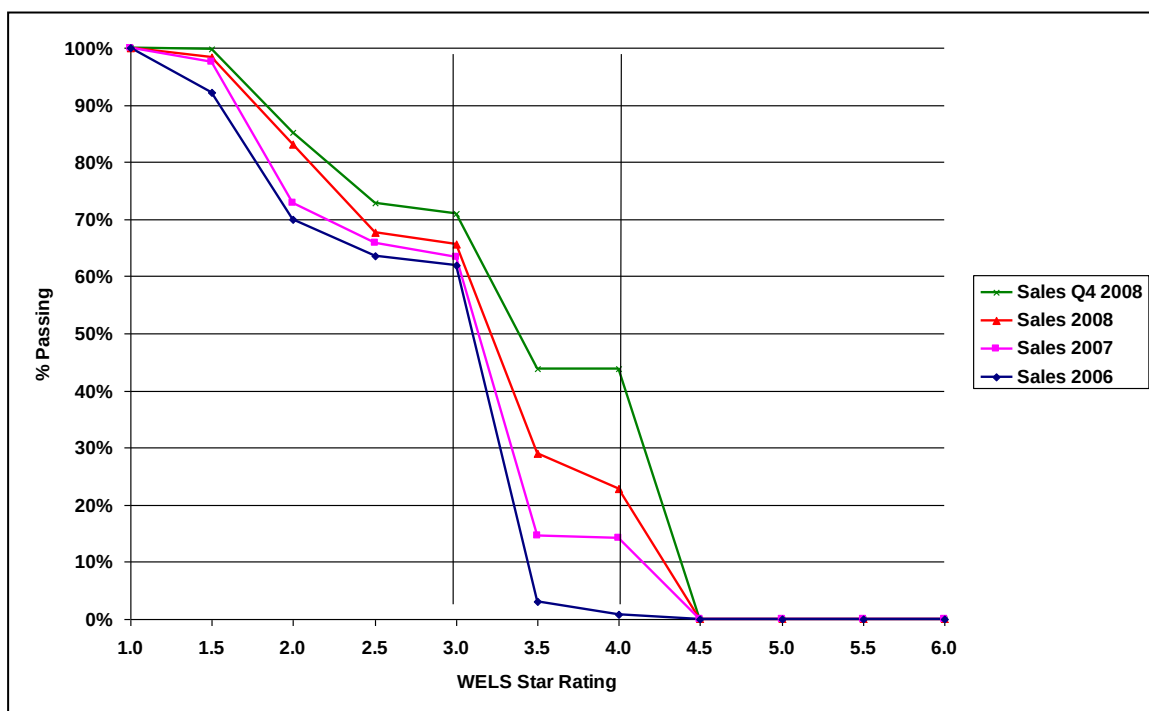
The minimum WES levels most likely to deliver maximum benefits to consumers lie somewhere between having no market impact and excluding all models. Figure 19 illustrates the impacts of successive minimum WES levels on the TL CW market. A minimum WES level of 2.0, for example, would have been met by 70 per cent of the TL CWs sold in 2006, and would be met by about 56 per cent of the models currently on the market. However, as the products on the market tend to increase in average water efficiency over time due to WELS, energy labelling and other factors, the market impact of a given minimum WES level can be expected to be lower by the time it is actually implemented if this trend continues.

Figure 19. TL CWs - percentage of models passing minimum WES levels, 2006-2009



Author analysis of registered models

Figure 20. TL CWs - percentage of sales passing minimum WES levels, 2006-2009



Author analysis of registered models

Over the past two years the CW market has moved towards greater water efficiency, partly in response to water authority rebates, which saw the 4.0 star (or higher) share of the TL market increase from one per cent in 2006 to 44 per cent in the last quarter of 2008. The 4.0 star (or higher) share of the FL market increased from about 73 per cent to nearly 100 per cent.

The rate at which the market is changing is also indicated by comparing the pass rates of the models available on the market in 2009 with those available in 2006 (Figure 19). Only 30 per cent of the TL models on the market in 2006 would have met a minimum WES level of 3.0 stars or higher, but by August 2009 43 per cent would have met a level of 3.0 or higher. At this rate of change in the market, it is likely that by 2011 (the earliest that minimum WES would take effect), between 50 per cent and 60 per cent of TL models would pass a minimum WES level of 3.0.

Figure 20 indicates that 62 per cent of TL sales passed a minimum WES level of 3.0 in 2006, and by the last quarter of 2008 the share had increased to 71 per cent. It is likely that by mid 2011 the share will be 75-80 per cent. By the end of 2008, 100 per cent of FL sales passed a minimum WES level of 3.0 (Figure 21 and Figure 22).

There are currently 39 brands of TL on the market (excluding obsolete brands that only have 'grandfathered' models); 28 brands would have their entire current model range excluded at a minimum WES of 3.0. However, several brands without models at 3.0 stars have at least one model at 2.5 stars, so with minor technical improvements it is likely that more brands will be able to remain on the market.

Table 18 indicates that a minimum WES level of 3.0 would have less impact on the TL market than the Consultation RIS had previously estimated for a minimum WES level of 2.5:

- The Consultation RIS estimated that a minimum WES of 2.5 would have excluded about 67 per cent of TL models; now it would exclude 52 per cent of models. A minimum WES level of 3.0 would exclude 57 per cent of models;
- The Consultation RIS estimated that a minimum WES of 2.5 would have excluded about 36 per cent of TL sales; now it would exclude 27 per cent. A minimum WES level of 3.0 would exclude 29 per cent of sales.

In other words, if a minimum WES level of 2.5 met the criteria of market acceptability proposed in the Consultation RIS, then 3.0 would meet the same criteria now.

Table 18. Percentage of TL and FL CWs passing each minimum WES level

Models	Consultation RIS 2.0	Consultation RIS 2.5	Latest Data (Q4 2008) 2.0	Latest Data (Q4 2008) 2.5	Latest Data (Q4 2008) 3.0	Latest Data (Q4 2008) 3.5	Latest Data (Q4 2008) 4.0
TL models	56%	33%	67%	48%	43%	14%	14%
TL sales	70%	64%	85%	73%	71%	44%	44%
FL models	100%	100%	100%	100%	100%	97%	91%
FL sales	100%	100%	100%	100%	100%	100%	99.9%
All models	80%	69%	86%	77%	75%	62%	58%
All sales	81%	77%	92%	85%	84%	69%	69%

A RIS level of 3.5 would impose significantly greater impacts on the TL market if imposed today (see Figure 19), but the impacts will most likely be much less by the time minimum WES take effect (say by mid 2011). An introduction level of 3.0 followed by an increment to 3.5 after 12 months would be

feasible. In fact, the adoption of 3.5stars would be almost the same as an adoption of 4.0 stars, since there are so few TL models rated 3.5 stars.

If it is accepted that there is no rationale for differentiating between TL and FL with regard to minimum WES, then it could be argued that the metric of acceptable market impacts, which were previously applied to TL and FL separately, should be applied to the total market.

On this basis a starting minimum WES of 4.0 would exclude about 42 per cent of all CW models on the market today and 31 per cent of sales (Table 18).

However, to reduce the risk of disruption, manufacturers could be given an additional 12 to 18 months to conform to a minimum WES level of 4.0, for example;

- A minimum WES level of 3.0 to take effect 1 July 2011; and
- A minimum WES level of 4.0 to take effect 1 July 2012.

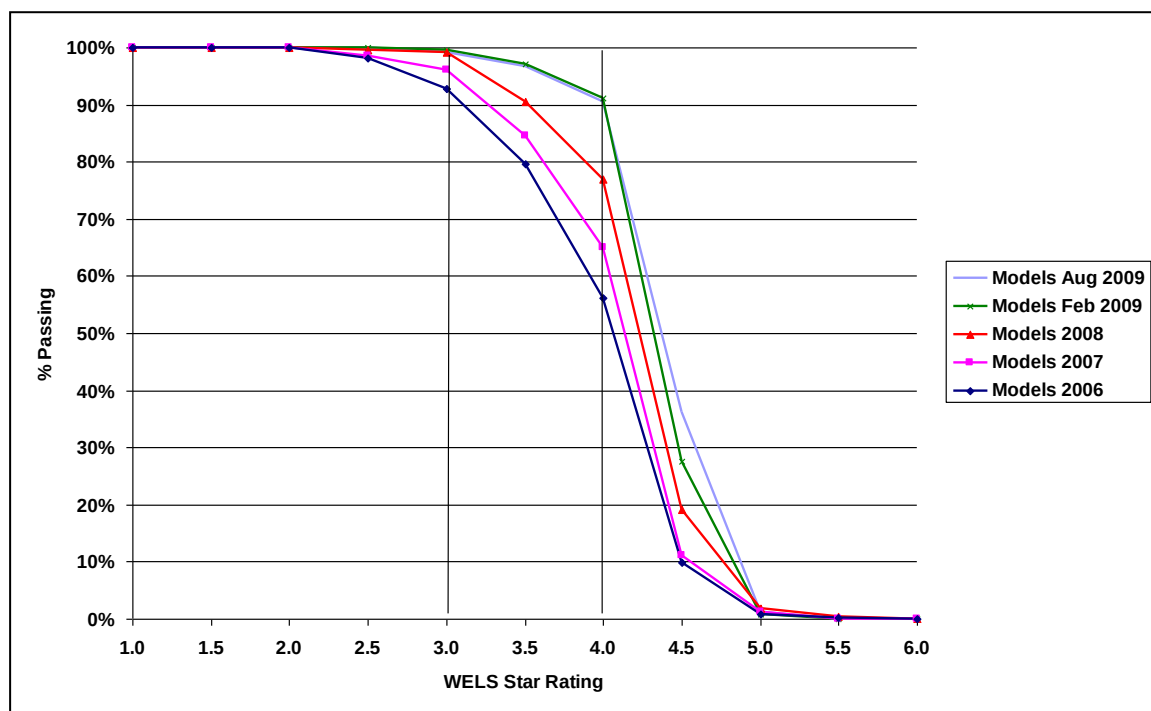
There may have to be special consideration for smaller TL. Figure 23 indicates that there are only 9 models of less than 5.0 litres capacity, and that none would meet a minimum WES level of 3.0 – in fact the highest rating in this group is 2.0. It would not be in consumers' interest to exclude smaller TL models from the market, so to avoid this outcome, the minimum WES levels could be modified as follows:

- A minimum WES level of 3.0 to take effect on 1 July 2011, with the exception of models of less than 5kg capacity, for which the minimum WES level should be at 2.5 stars (to give an incentive for improvement in this class);
- A minimum WES level of 4.0 to take effect 1 July 2012, with the exception of models of 4.5 kg rated capacity or less, for which the minimum WES level should be 3.0 (to give further incentive for improvement in this class).

Special provision for smaller models was not included in the Consultation RIS, because none were affected by the then recommended minimum WES level of 2.0 stars.

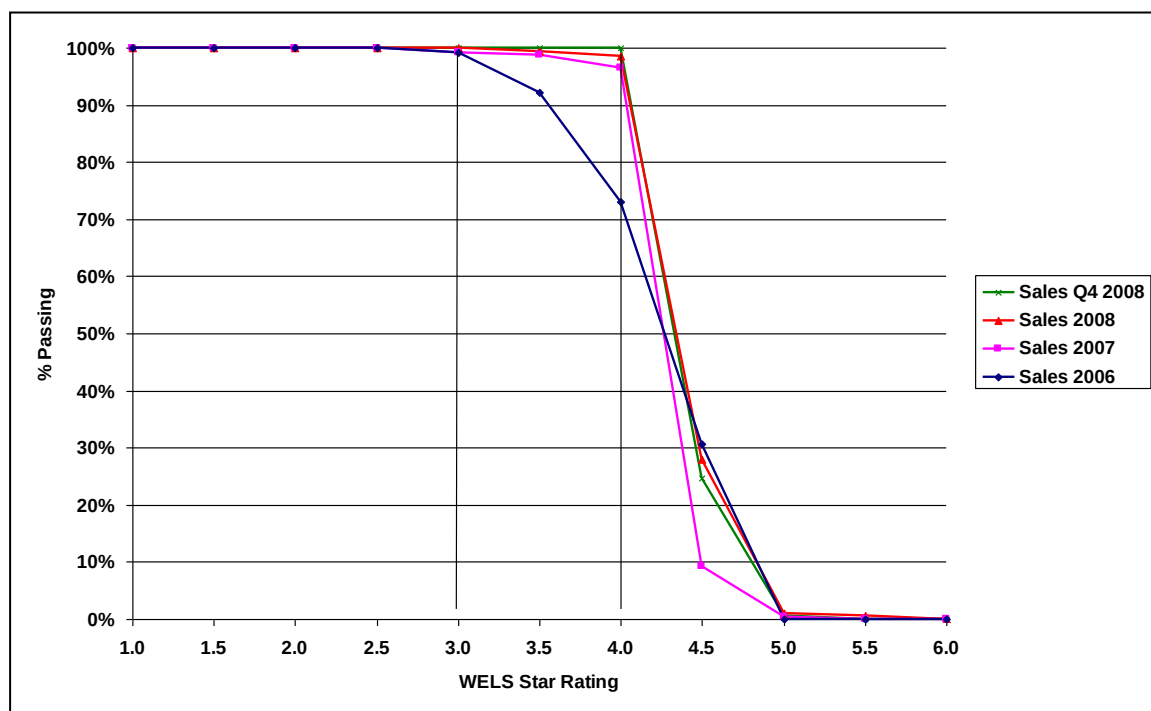
It is not likely that suppliers would understate the volumes of their 5.0 to 5.5 litre products simply to take advantage of a lower minimum WES level, because rated capacity is an important marketing feature. Suppliers have been moving towards larger capacity TL models (see Figure 7), so reversal of this trend simply to take advantage of a minor concession in WELS requirements is not likely.

Figure 21. FL CWs - percentage of models passing minimum WES levels, 2006-2009



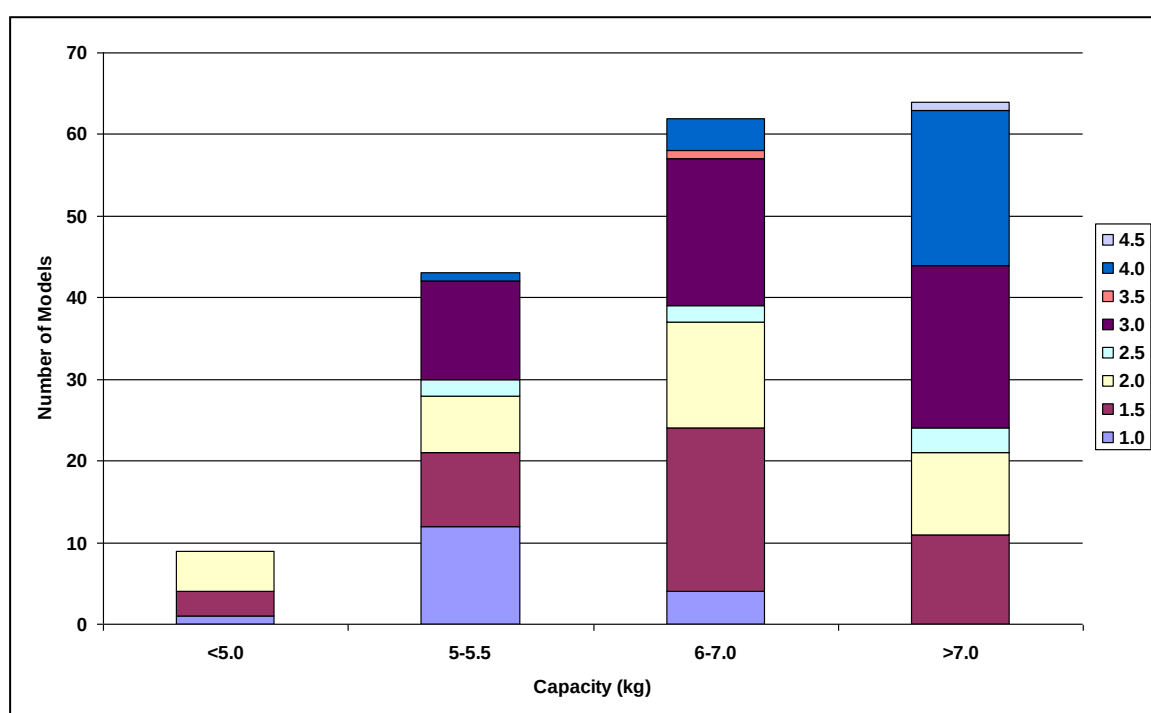
Author analysis of registered models

Figure 22. FL CWs – percentage of sales passing WES levels, 2006-2009



Author analysis of registered models

Figure 23. TL CWs – number of models by WELS ratings, February 2009



Author analysis of registered models

Preferred option for combined washer dryers

Combined washer dryers already carry three labels – separate energy labels for energy use in washing and drying mode, and a WELS label for water use in the washing mode. The Consultation RIS analysed four labelling proposals for addressing water use in drying modes – from no separate drying-mode water label (Proposal 1 in Table 19) to labelling of water use in a combined wash and dry cycle (Proposal 4 in Table 19).

Responses to the proposals during the consultation process are summarised in Chapter 7. In general:

- the water authorities supported the recommendations in the Consultation RIS: for Proposal 3 followed in due course by Proposal 4 as soon as practicable (Table 19); and
- The industry and the Australian Consumers' Association supported a water warning (either on the energy label or as a WELS-style water warning label) and a total litre value, but no star rating value until a new CWD test, based on further usage research, is devised.

Table 19. Proposals for water and energy labelling of CWDs

Proposals	Clothes washing function	Clothes drying function	Combined function
0. Present situation (3 labels)	Water Efficiency Label – litres/wash & stars based on litres/kg washed	No Water Efficiency Label	No label

Proposals	Clothes washing function	Clothes drying function	Combined function
0. Present situation (3 labels)	Energy label – kWh/year & stars based on kWh/kg	Energy label – kWh/year & stars based on kWh/kg	No label
1. EL-015 proposal (3 labels)	Water Efficiency Label – litres/wash & stars based on litres/kg washed	No Water Efficiency Label	No label
1. EL-015 proposal (3 labels)	Energy – kWh/year & stars based on kWh/kg	Energy label – kWh/year & stars based on kWh/kg + Water use message & litres for drying	No label
2. WS-032 proposal (3 labels)	No Water Efficiency Label	No Water Efficiency Label	Water Efficiency Label – litres/wash & dry ‘hybrid’ load & stars based on ‘hybrid’ load (full load washed + drying load dried)
2. WS-032 proposal (3 labels)	Energy label – kWh/year & stars based on kWh/kg	Energy label – kWh/year & stars based on kWh/kg	Water Efficiency Label – litres/wash & dry ‘hybrid’ load & stars based on ‘hybrid’ load (full load washed + drying load dried)
3. Access (2008) proposal (4 labels)(a)	Water Efficiency Label – litres/wash & stars based on litres/kg washed	Water Efficiency Label – litres/dry & stars based on litres/kg dried	No label
3. Access (2008) proposal (4 labels)(a)	Energy – kWh/year & stars based on kWh/kg	Energy label – kWh/year & stars based on kWh/kg	No label
3A. Modified	Water Efficiency Label – litres/wash & stars based on litres/kg washed	Water Warning Label – litres used in drying mode	No label

Proposals	Clothes washing function	Clothes drying function	Combined function
3A. Modified	Energy – kWh/year & stars based on kWh/kg	Energy label – kWh/year & stars based on kWh/kg	No label
4. Long term proposal (4 labels)	Water Efficiency Label – litres/wash & stars based on litres/kg washed	No Water Efficiency Label	Water Efficiency Label – litres/wash & dry ‘process’ load & stars based on ‘process’ load (drying load washed + drying load dried)
4. Long term proposal (4 labels)	Energy label – kWh/year & stars based on kWh/kg	Energy label – kWh/year & stars based on kWh/kg	Water Efficiency Label – litres/wash & dry ‘process’ load & stars based on ‘process’ load (drying load washed + drying load dried)

(a) This proposal was been endorsed by Australian Standards committee WS-032 at its meeting on 12 March 2008

Consequently, the following steps are now proposed:

- 1) A mandatory WELS label for the drying function of CWDs, to take effect in mid 2011, with a ‘Water Warning’ heading and indicating the total litres of water used during the drying cycle by that model (3A Modified in Table 19) and
- 2) Consideration of a star rating WELS label for the drying function of CWDs , to take effect 12-18 month later. This could be either based solely on drying-mode water consumption per kg dried (i.e. Proposal 3 in Table 19) or on combined washing and drying performance (i.e. Proposal 4 in Table 19).

Figure 24 illustrates the range in total water use in drying-mode that CWD WELS labels would show in Step 1 – the range is from 11.4 litres to 76 litres.

Buyer awareness of water use in drying-modes and the removal of water authority rebates incentive should lead a proportion of purchasers who would otherwise select a CWD to purchase a conventional FL instead. Buyers who are so sensitised to water use that they will forgo a CWD purchase because of water use on drying, and those who are seeking models which carry rebates, are unlikely to prefer TLs, so the risk of purchase diversions from FL to TL is negligible.

Where the labelling regime prompts the purchase of a FL instead of a CWD, the buyer will need to provide for the clothes drying function that would have been met by the CWD, in one of the following ways:

- Purchasing a stand-alone condenser dryer at the same time or later.
- Purchasing an evaporative dryer at the same time or later.
- Using a dryer already installed.

- Foregoing a dryer and relying on line drying.

There will be a spectrum of buyer motivations. Those who need a CWD because their space can only accommodate a single product and they have no access to outside drying (typical of many apartment situations), and those who place a high value on the convenience of the combined function, will continue to buy CWDs in any case. At the other end of the spectrum, those who have more space in the laundry and outside, and those may have a stand-alone dryer already but are attracted to CWDs because of the possibility of straight-through operation, would not need a new dryer at all. In between are households who would buy separate CWs and CDs if they were deflected from a CWD purchase.

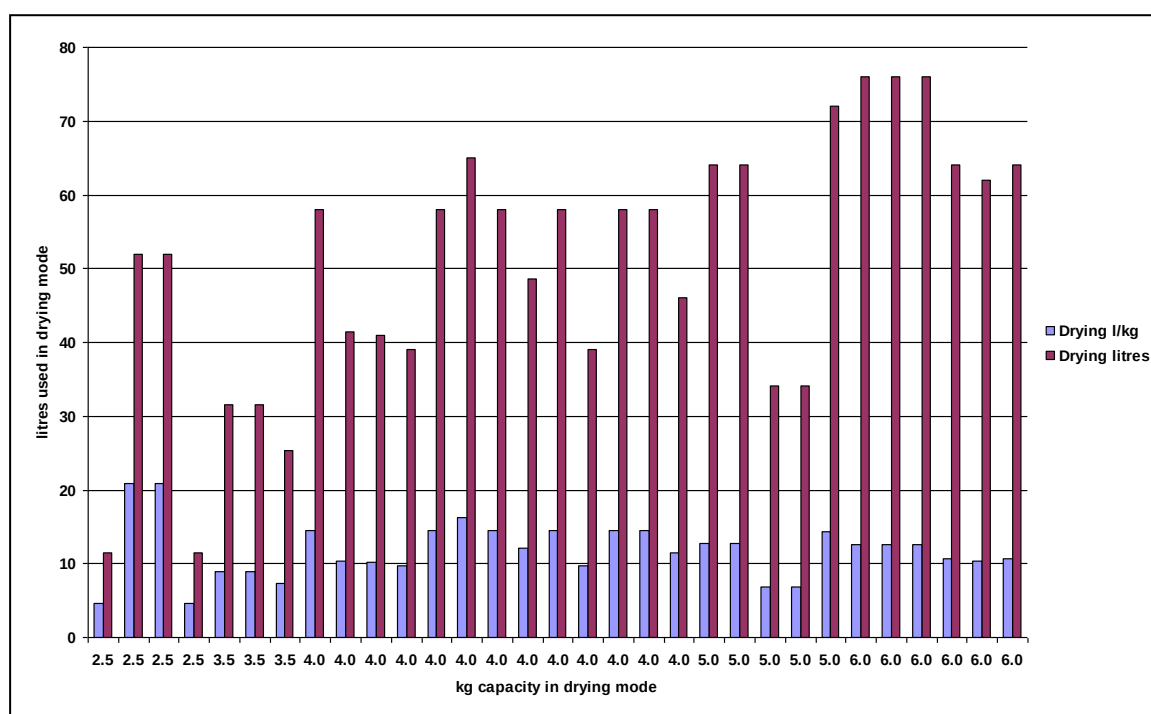
The overall effect of the Stage 1 label will be to reduce CWD sales compared with the no-label BAU case, increase FL sales and possibly also increase stand-alone dryer sales. Many of these additional dryers would be air-cooled condenser dryers, because some of the factors favouring CWDs, such as interior laundries without access to external venting, would also favour condenser dryers over evaporative types.

The most effective strategy for labelling CWDs is a two stage approach. The first stage should be capable of rapid implementation, so that the information failure about the product's water use can be corrected without delay. Proposal 3A is the best option for this.

The second stage could be either Proposals 3 or Proposal 4. Proposal 3 would not on its own help those who still wish to buy CWDs to identify the models that are the most water-efficient overall, taking into account both washing *and* drying water use in the most likely mode of operation. The most useful metric for comparison would be the total water use for combined washing and drying per kg of load processed. It is likely to lead to further water savings in water use, beyond those available from Proposal 3. Without a combined label, buyers may end up preferring models which have high apparent water efficiency in full load washing and in drying, but may be less water-efficient under part-load washing.

Proposal 3 could be implemented using data from current tests. Proposal 4 requires the development of a new part load washing test for using the drying limit load, and a new drying test which starts with the moisture content as it is at the end of the wash cycle, rather than the standard moisture content in AS/NZS 2442. Such a test would take some time and cost to develop, and then every CWD model would have to be retested.

Figure 24 CWD water use in drying mode – total and per kg



Author analysis of registered models

Preferred option for dishwashers

DWs have increased markedly in average water efficiency since the introduction of energy labelling and then water efficiency labelling (Figure 15). While models of lower water efficiency continue to be introduced to the market and continue to sell in significant quantities, these tend to be specialised models for niche markets (e.g. narrower configuration or countertop models). Therefore, no mandatory minimum WES is considered necessary for DWs at this point in time.

5 Cost-benefit analysis

Price and cost projections

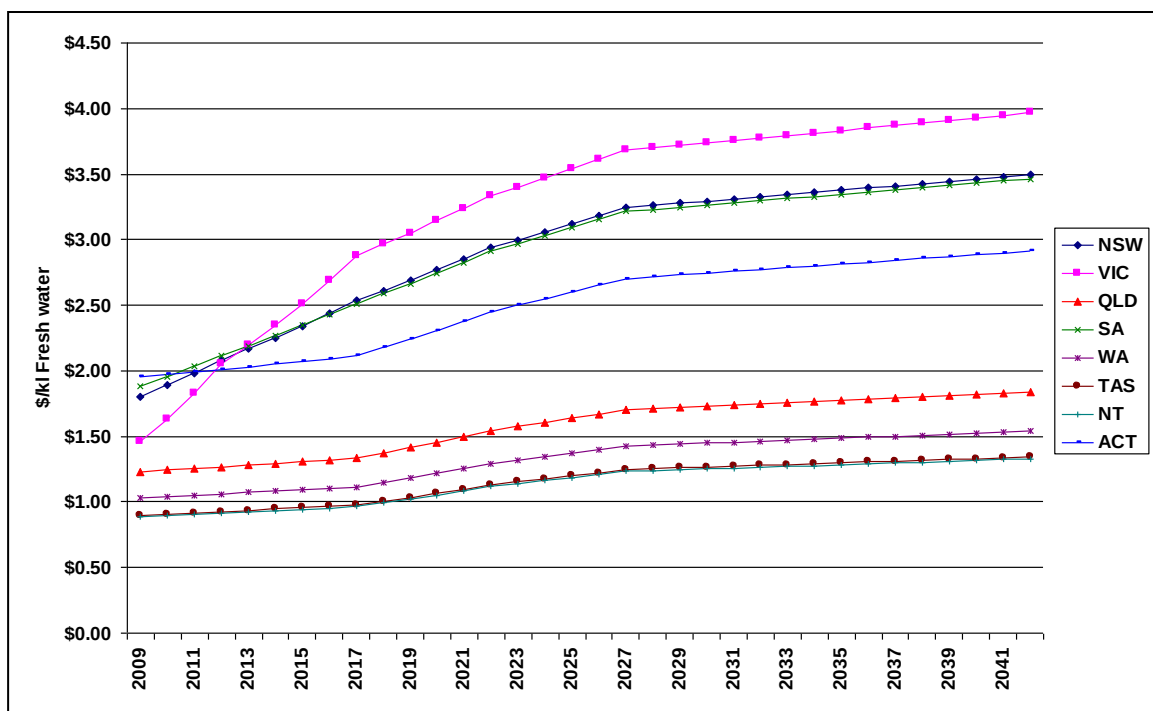
Water and wastewater prices

Volume-based marginal prices determine the monetary value to users of water saved or used at the margin. The marginal \$/kl tariffs for metered freshwater supply for the major water utilities in 2009 was taken from WSAA (2009). Melbourne water suppliers also have consumption-related wastewater charges for residential consumers, so increasing the value of water savings, but the others have fixed or property-rateable charges.

Up to 2012, the projected rates of price increase for NSW are taken from the Independent Pricing and Regulatory Tribunal or IPART (2008a) and those for Victoria are based on WSAA (2007a). Beyond 2012 three sets of projected changes in these prices have been modelled:

- No real increase in charges (i.e. prices rise at the rate of inflation).
- A medium rate of real increase, taking into account current price determinations and current investment in supply sources, including desalination plant (Figure 25).
- A higher rate of real increase, to reflect the possible need for additional future supply expansion.

Figure 25. Projected marginal water charges, medium price increase scenario



GWA modelling

Energy price and greenhouse gas-intensity

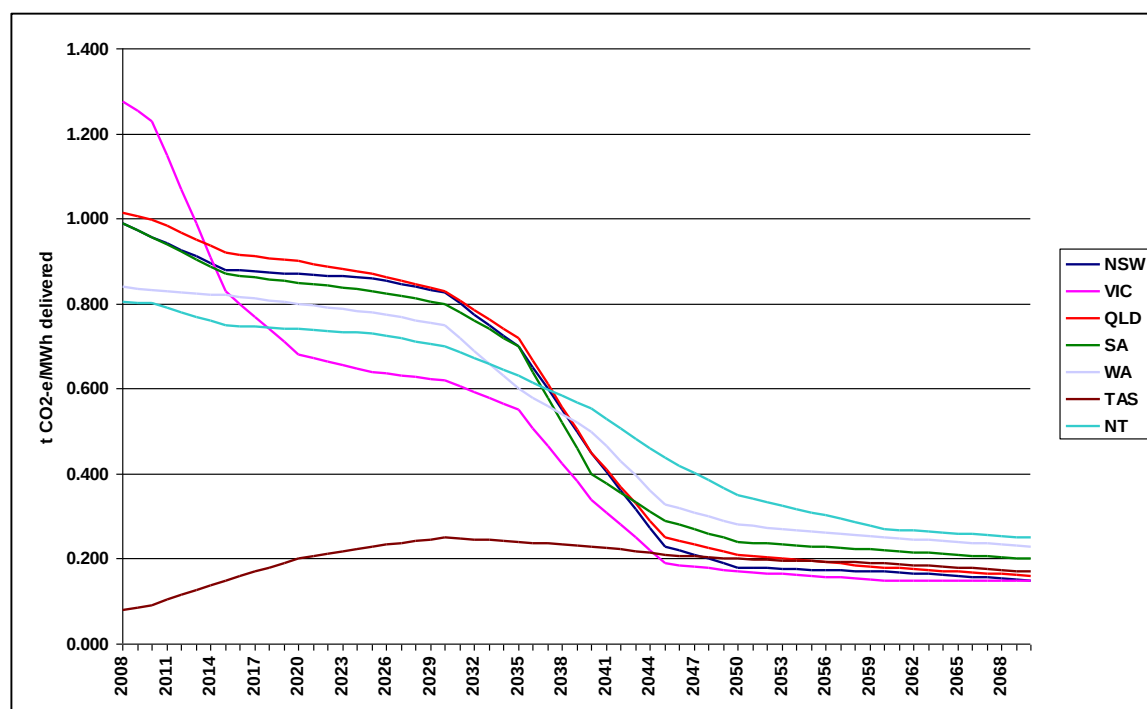
When the cost-benefit modelling was carried out, it was assumed that the CPRS would be implemented in mid-2010, and that energy prices and the greenhouse intensity of electricity supply

would follow the profiles projected by the Australian Government Treasury (Treasury) in *Australia's low pollution future: the economics of climate change mitigation* (2008).

The Treasury modelling includes projections of the greenhouse gas intensity of electricity generation developed by McLennan Magasanik Associates (MMA 2008). These were used to develop emissions intensity trends for electricity delivered in each State, which are illustrated at Figure 26. The greenhouse-intensity of electricity delivered is higher than the intensity of electricity generated, to allow for energy lost in generation site use, transmission and distribution. It is projected that the national average emissions intensity of electricity supply would decline by about 22 per cent by 2020 under the 'CPRS-5 scenario'.¹⁴

Just before the completion of this RIS, the Government announced that the start of the CPRS would be delayed until mid-2011 and that 'permits will cost \$10 per tonne of carbon in 2011-12, with the transition to full market trading from 1 July 2012.' The Government also announced 'a commitment to reduce carbon pollution by 25 per cent of 2000 levels by 2020 if the world agrees to an ambitious global deal to stabilise levels of CO₂ equivalent in the atmosphere at 450 parts per million or less by 2050.' As there is no present commitment to this target, the 'CPRS-25' scenario has not been modelled.

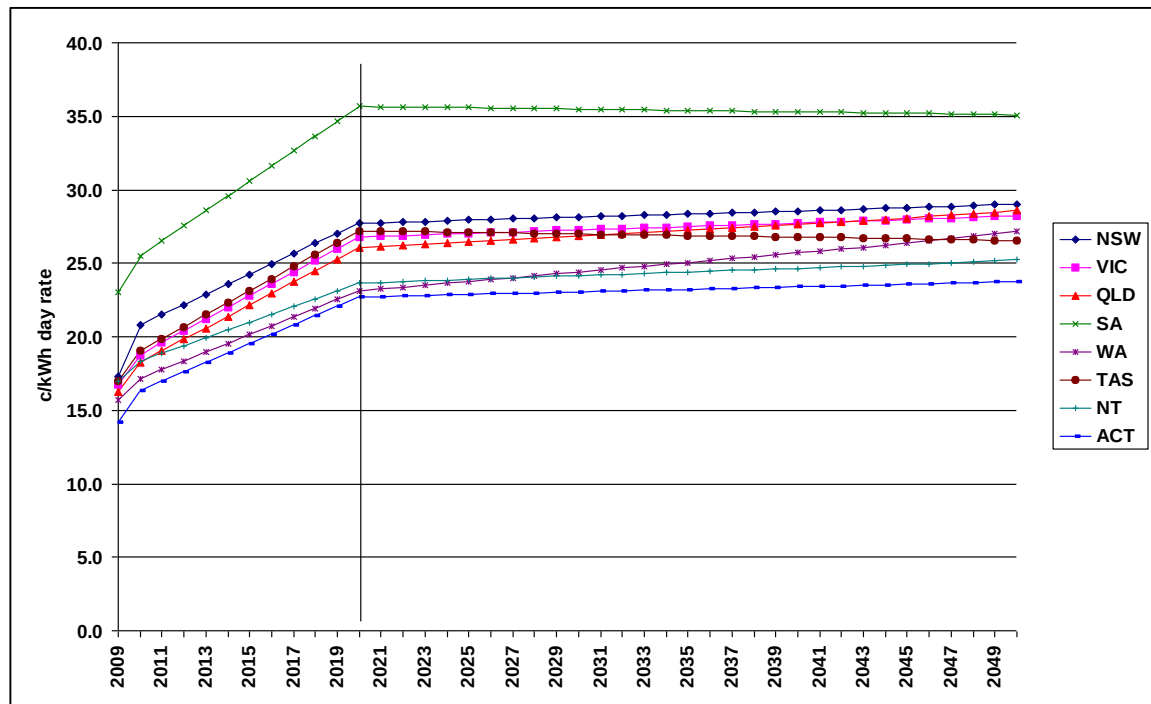
Figure 26 Projected emissions-intensity of electricity supplied



Derived by GWA from The Treasury (2008)

¹⁴ The CPRS-5 scenario is one in which Australia's total greenhouse gas emissions are held to five percent below the 2000 level in 2020. The CPRS-25 scenario is one in which Australia's total greenhouse gas emissions are held to 25 percent below the 2000 level in 2020.

Figure 27 Projected day rate electricity prices, CPRS-5 (\$2008, real prices; includes CPRS effects)



Derived by GWA from The Treasury (2008)

The general residential household electricity energy prices for each State in Figure 27 were developed by Syneca Consulting from the Treasury 'CPRS-5' projections (2008).¹⁵ Off-peak electricity prices consistent with Treasury projections were also developed for the States which offer Off Peak (OP) tariffs (both restricted hours and extended hours tariff were projected). Syneca Consulting also developed natural gas and LPG price projections consistent with Treasury modelling.

Water Heating

The energy mix and efficiency of water heating for CWs is a key factor. FL CWs and CWDs have the ability to heat their own water when required, so they use day-rate electricity at a high conversion efficiency (nominally 95 per cent – some energy is lost as heat from the cabinet). Many FLs also heat water to a preset level even when the user selects a 'cold' wash.

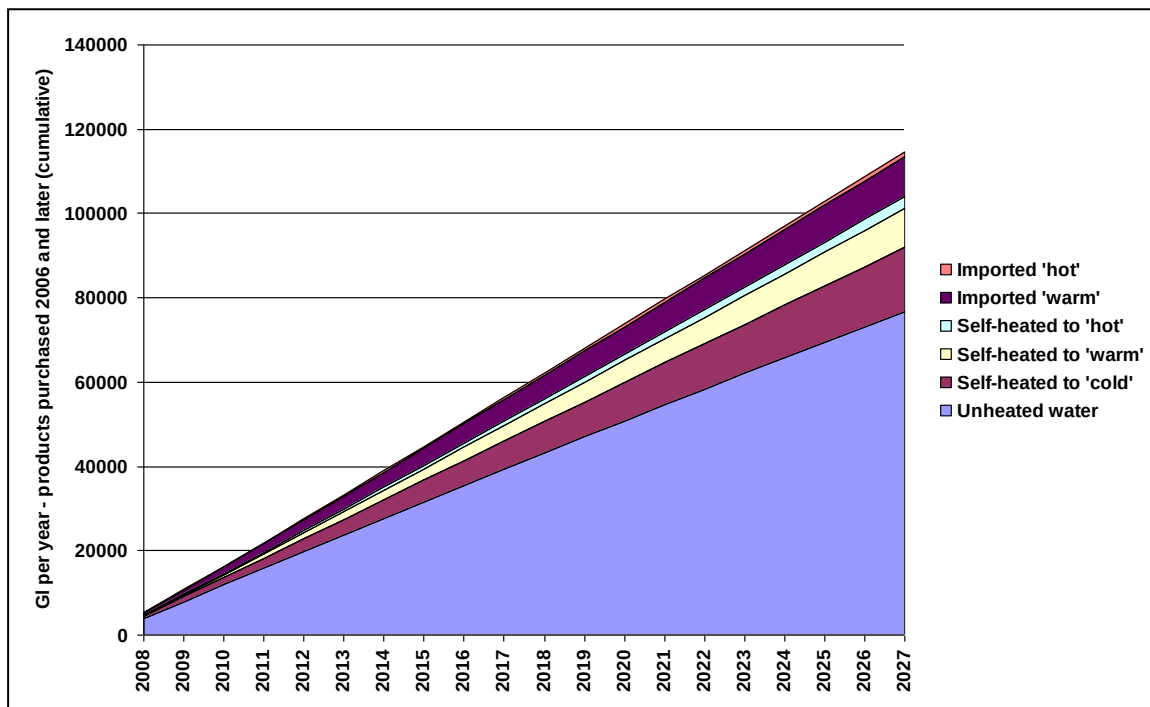
Very few TLs have heating elements, so they take their hot water requirements from the house supply. Therefore, to estimate the energy saved from a given reduction in water demand, it is necessary to calculate:

- The share of imported water that is unheated, heated to 'cold' (nominally 25 degrees centigrade (°C) – this is common in FL CWs), 'warm' (45°C) and 'hot' (60°C). This is estimated from published data on preferred wash temperatures (ABS 4602.0). Figure 28 illustrates (for NSW) the volume of water used by all CWs and CWDs in 2008 and later, by the category of heating. The great majority of water is used unheated, and most of the water heating is carried out in FL CWs and DWs, rather than imported.

¹⁵ Syneca contacted The Treasury and MMA to clarify treatment of both energy costs and network charges.

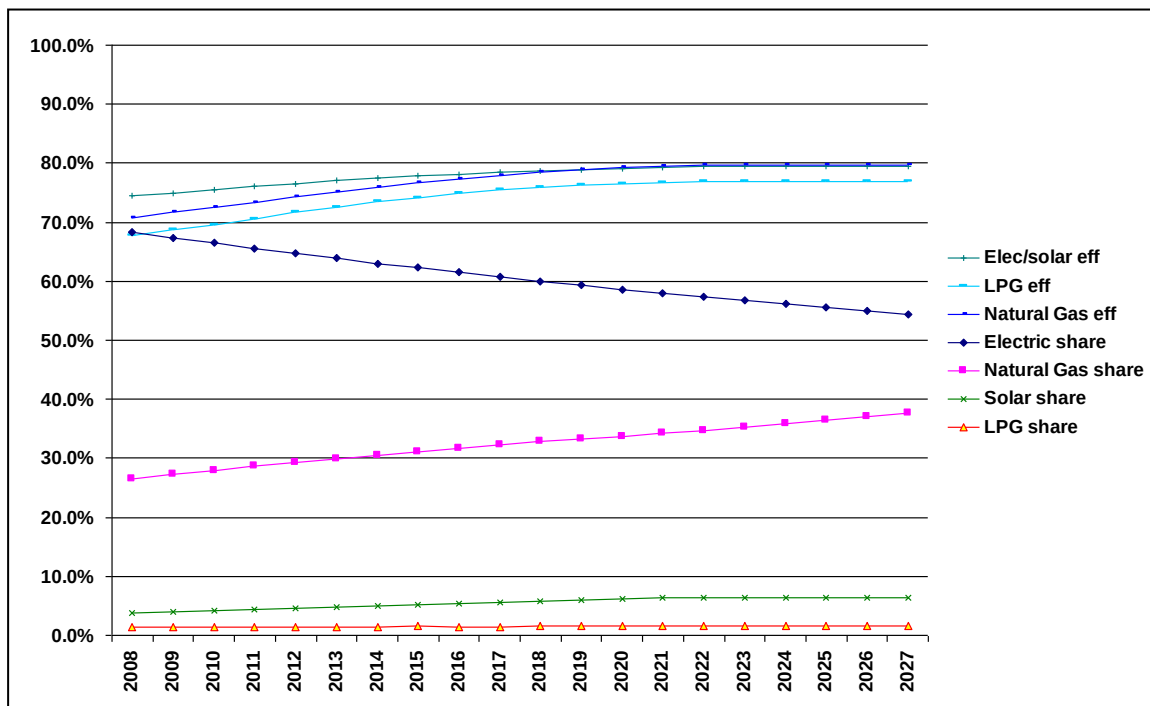
- The energy type mix and the projected conversion efficiency of water heaters in each state, taken from EES (2008). Figure 29 illustrates these projections for NSW.

Figure 28. Projected annual water use by mode of heating, all Clothes Washers and Combined Washer Dryers purchased 2008–2027, NSW



Source: GWA Modelling

Figure 29. Projected water heater shares and efficiencies, NSW



GWA Modelling

Program benefits and costs

The private benefit of the proposed WES for CWs and DWs, and of drying-mode WELS labelling for CWDs, is the value to appliance users of the projected reductions in freshwater use, wastewater discharges and energy use.

There are four categories of costs:

- 1) Water efficiency testing costs, which are borne by product suppliers and then recovered from product purchasers. The WES for CWs and the Stage 1 labelling of CWDs would be based on existing test data, and new models would have to be tested for WELS in any case, so there are no additional testing costs. However, if a new test for Stage 2 labelling of CWDs is developed, existing CWD models would have to be re-tested, and new CWDs would have to be subject to the new test in addition to the tests in AS/NZS 2040:2005, *Performance of household electrical appliances—Clothes washing machines* and AS/NZS 2442 *Performance of household electrical appliances- Rotary clothes dryers Part 1: Energy Consumption and Performance* tests. The costs are calculated by multiplying estimated testing costs by the number of models affected.
- 2) Physical labelling costs, estimated at about \$0.20 per product sold (GWA 2004; confirmed by industry sources). WES do not require any additional labelling, but drying-mode labelling for CWDs would require an additional label. The cost is calculated by multiplying the costs per label by projected CWD sales.
- 3) Administrative costs to suppliers and to government. These would not be significantly affected by the proposed regulatory changes, although the progressive deregistration of products not meeting WES levels and verifying their removal from the market, and the registration of CWD drying-mode labels are additional activities that would require some additional resources. It is also expected that check testing activity will need to be increased somewhat, because the risk of non-compliance will be higher for WES than for labelling alone. Whether these additional administrative costs are met entirely by suppliers/ product buyers (via higher WELS registration charges), by governments/ taxpayers (via WELS program funding) or allocated between them does not affect the cost-benefit analysis.
- 4) The *additional* increase in the average purchase price of products (beyond the passing on of the costs above) due to buyer preference for more water-efficient models or different types of products prompted by WELS labelling, and the additional costs of enforced purchase of more water-efficient products due to WES.

Cost category 4 dominates the cost-benefit analysis, so it is necessary to understand the relationship between water efficiency and product prices.

CWD Cost Impacts

The introduction of drying-mode labelling for CWDs will prompt some buyers who would otherwise have purchased a CWD to purchase a FL instead, because of their awareness of and aversion to water use on drying.

It is also expected that the water authorities who currently offer incentive payments for the purchase of FL CWs will exclude CWDs. At present about a third of all CWD sales receive rebates of at least \$150 each so removal of the rebates would increase the average CWD price by about \$50. This would

reinforce the effect of the label in diverting purchases from CWDs to FL CWs, whether or not the latter continue to qualify for rebates.

Even apart from the incentive payments, each diversion will result in an average \$518 saving to users, because the average price of a (new standard) FL in 2008 was \$779 compared with \$1,297 for a CWD (Table 10). However, the \$518 represents the price of the clothes drying capability, which some diverted purchasers will value highly enough to buy a separate CD. It is assumed that the tendency to purchase a separate dryer in each State will be the same as the general CD ownership rate in that State (Table 20).

Table 20. CD ownership and usage factors by State

State/Territory	Actual Ownership 2006	Projected Ownership 2020	Uses/yr	kWh/yr
NSW	59.2%	60.0%	57	144
Victoria	54.1%	55.0%	82	208
QLD	55.0%	58.0%	47	119
SA	51.5%	51.5%	65	165
WA	48.3%	48.3%	65	165
Tasmania	56.0%	57.0%	90	228
Northern Territory	35.9%	36.0%	25	63
ACT	58.8%	57.0%	50	127

Source: EES (2008)

For example, it is projected that 60 per cent of buyers diverted from a CWD in NSW in 2020 will buy a CD. It is assumed that the CD will generally be a condenser dryer (costing on average \$550), rather than an evaporative dryer (\$440), because the physical circumstances that would have favoured a CWD purchase in the first place will also favour a condenser dryer. Therefore the probable expenditure on a dryer will be \$330 (60 per cent of \$550), bringing the total 'diverted' purchase price in this example to \$1,120 (i.e. \$779 + \$330), compared to \$1,297 for a CWD.

In households with a CWD, it is assumed that drying-mode is used more frequently than in households with a stand-alone dryer, because of the convenience of selecting a straight-through wash and dry cycle compared with physically moving the load from the washer to the dryer.¹⁶ For example, stand-alone CWDs in NSW perform 57 drying cycles a year on average (Table 20), so it is assumed that CWDs in NSW perform 1.5 times that number – therefore, 86 drying cycles per year. This is a quarter of the average number of annual washing cycles, so it implies that only a quarter of CWD loads are dried. Whenever a FL CW plus CD is purchased instead of a CWD, drying frequency reverts from 1.5 times the average value to the average value, so the energy saved on drying is

¹⁶ A survey of 50 CWD users made available by a manufacturer indicated that the average number of wash cycles in the week of the survey was 4.8 and the average number of dry cycles was 1.0 (52 if extrapolated to a full year). The location of survey respondents and the time of year were not indicated. As dryer use is highly seasonal, the survey is considered inconclusive.

equivalent to a half of the average annual energy use for drying in that State (72 kWh/yr for NSW). All the water that the CWD would have used in drying will also be saved.

There are no water- or energy-efficiency penalties from diverting wash cycles from CWDs to FLs, since both use the same horizontal-axis technology. Similarly, there are no energy-efficiency penalties in diverting drying cycle from CWDs to stand-alone CDs.

WELS for CWDs should also increase buyer preference for those CWD models which are more water-efficient in their drying performance. This will lead to further water savings, but no further energy savings, since the water saved will be unheated. Stage 2 labelling would have the added benefit of reducing CWD water use for washing as well as drying, because the combined function label would enable buyers to identify models which perform well on both functions, not just one function or the other.

Price-Efficiency Relationships

Historically, the purchase price of CWs has declined steadily since 1993, despite the introduction of energy labelling, WELS labelling and rising water efficiency (Figure 8). In fact, the price reduction is even greater if inflation is taken into account. This suggests that there is no direct relationship between water efficiency or energy-efficiency and product price, and indeed this has been the finding of other analyses carried out in Australia and elsewhere (Energy Consult 2006, Ellis et al 2007).

However, it would be prudent to assume that if product suppliers are required to focus research and development effort on energy-efficiency and water efficiency in response to greater consumer demand for those attributes (brought about by WELS and WES), this would to some extent displace other attributes which purchasers may also value, such as shorter wash cycles or greater product durability.

The only way to assess the relationship between product price and efficiency is by 'cross-sectional' analysis of the market. At any given time, there is a vast range of product attributes on the market. If it is assumed that these attributes are independent (e.g. a stainless-steel finish is as likely to be available on a water efficient CW as a water inefficient CW) then given sufficient data, it should be possible to determine whether there is a statistical link between product price and the key attribute of water efficiency.

Table 21 illustrates the relationship between water efficiency and price (per kg capacity) for TL CWs registered to the latest version of the test standard. It indicates a weak positive relationship (i.e. with a very low R^2 value). There is also a weak positive relationship for current FL models. Table 21 also indicates that for the CWD subset of FLs, the relationship appears to be identical to that for other current FLs.

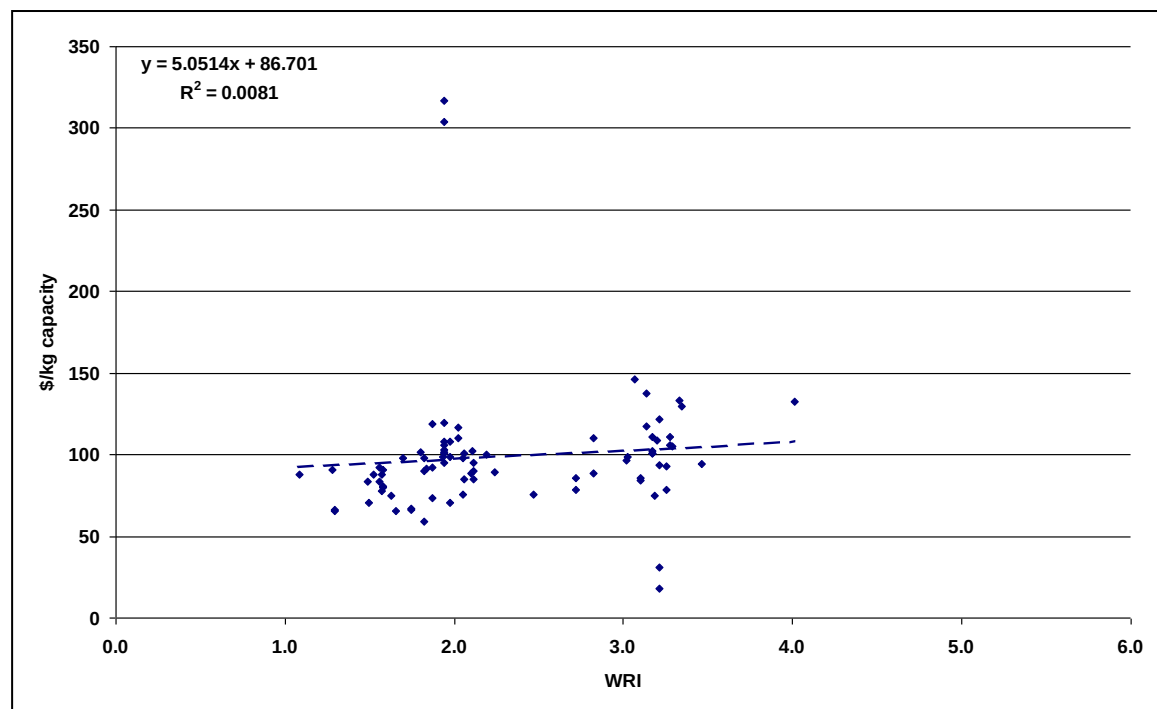
These relationships are expressed as a set of price-efficiency factors in Table 21. A factor of 1.0 would mean that for an average one per cent increase in water efficiency there would be a one per cent increase average purchase price. The TL CW factor of 0.17, derived from Figure 30, means that for every one per cent increase in washing water efficiency there would be a 0.17 per cent increase in price. The observed factors for CW range from – 0.40 to 0.23. The factor adopted for modelling is 0.20.

There are no data on the relationship between drying water efficiency and price, because it is not possible to disaggregate the price contributions from the washing function from those of the drying function. Therefore a price over efficiency (P/E) ratio of 0.2 has been adopted, on the assumption that the technological factors in improving water efficiency in the drying-mode are of equal complexity to those for the washing mode. As the proposed WES levels for front-loaders would have negligible impact on current CWD models (all of which have higher washing SRI levels), the only one of the proposals which will impact on CWD costs is CWD labelling. This means there is no double counting of P/E effects from the drying and the washing function.

Table 21. Estimated price-efficiency relationships, CWs on market in 2008

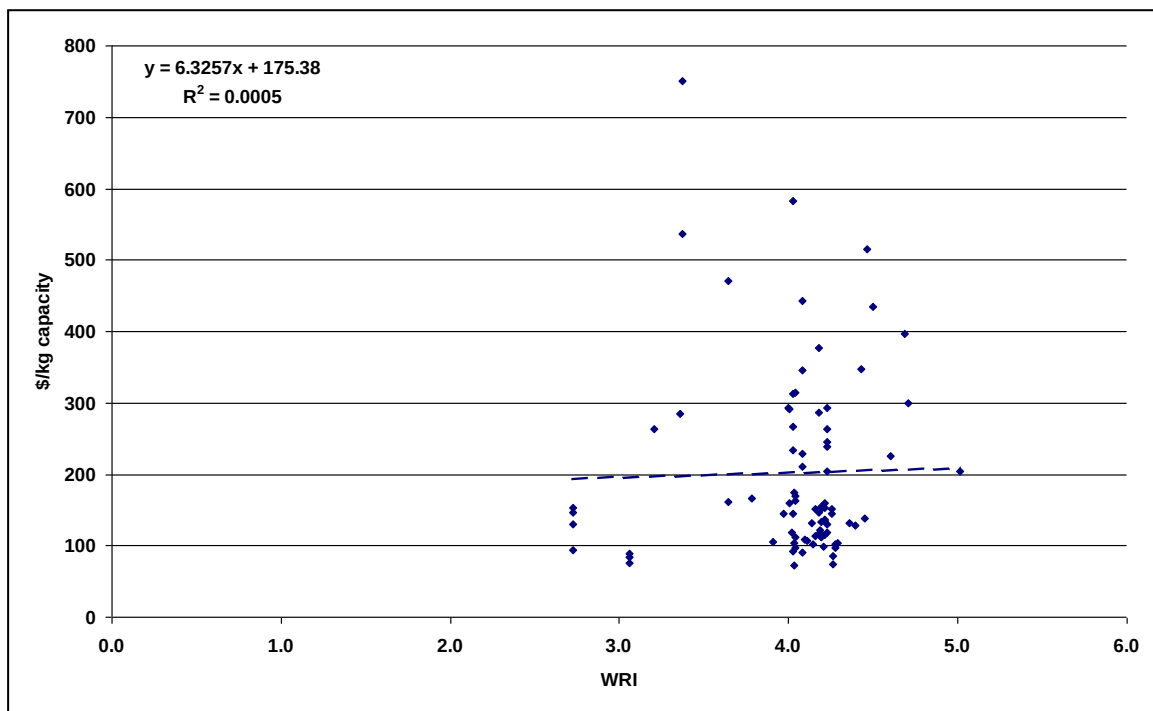
Product	Models	\$/kg at average SRI	\$/SRI at average SRI	% price change/SRI	% price change/% eff change	Default value used
TL CW	Current	\$ 100	\$5.1	5%/30%	0.17	0.20
TL CW	Grandfathered	\$ 110	\$7.7	7%/30%	0.23	0.20
FL CW	Current	\$ 200	\$6.3	3%/30%	0.10	0.20
FL CW	Grandfathered	\$180	-\$21.2	-12%/30%	-0.40	0.20
CWD (all FL)	All (washing)	\$180	\$12.3	7%/30%	0.23	0.20
CWD (all FL)	All (drying)	NA	NA	NA	NA	0.20

Figure 30. Top load CWs (current models): price–efficiency relationships



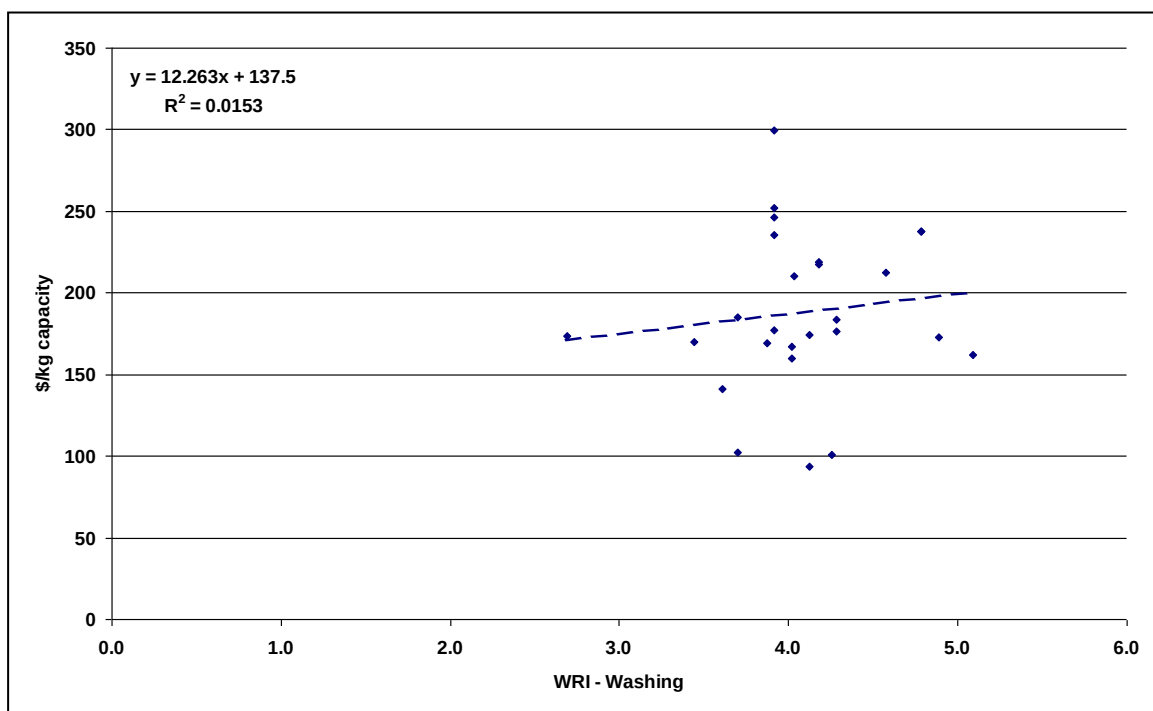
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Figure 31. Front load CWs (current models): price–efficiency relationships



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Figure 32. Clothes washer-dryers: price–efficiency relationships (washing mode)



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Impacts

Weighted average water efficiency

The projected average water efficiency of new CWs to be sold between 2008 and 2027 has been taken from EES (2009). It is expected that the average water efficiency would continue to increase (i.e. litres per kg will continue to decline) even without WES, due to the continuing impact of WELS and energy labelling. The BAU projections are indicated by the upper lines in Figure 33.

Once a WES level is established, no product with a SRI below that level can be legally sold. Logically, the sales-weighted litres/kg can be no higher than the WES level, but in fact will be well below it, because many models on the market today are already more water-efficient than the proposed WES levels.

The extent to which the post-WES average water use falls below the WES level depends on the responses of CW suppliers:

- 1) If suppliers replace the models which fail WES with models which are on average as water-efficient as the existing models which pass WES, the average increase in water efficiency will be high.
- 2) If suppliers do not replace the models which fail WES at all, the average increase in water efficiency will be identical to case 1 above, but with fewer models on the market. However, no previous implementation of appliance MEPS or WES in Australia has led to a decline in model range.
- 3) If suppliers replace models which fail WES with models that just meet WES (but no better), then the average increase in water efficiency will be lower.

Therefore, the possible increase in average water efficiency compared with BAU is defined by two extreme values, one corresponding to cases 1 or 2 and the other corresponding to case 3. These values have been modelled using the GfK data on CW sales in 2008. Table 22 shows for a WES SRI of 3.0, the maximum reduction in sales-weighted average water use for top loaders would be 2.9 litres/kg (if suppliers respond as in Case 1 or 2 above) and the minimum reduction would be 2.0 litres/kg (if suppliers respond as in Case 3). As it is not possible to know how suppliers will respond, an intermediate value of 2.5 is used to model the effects of this WES level.

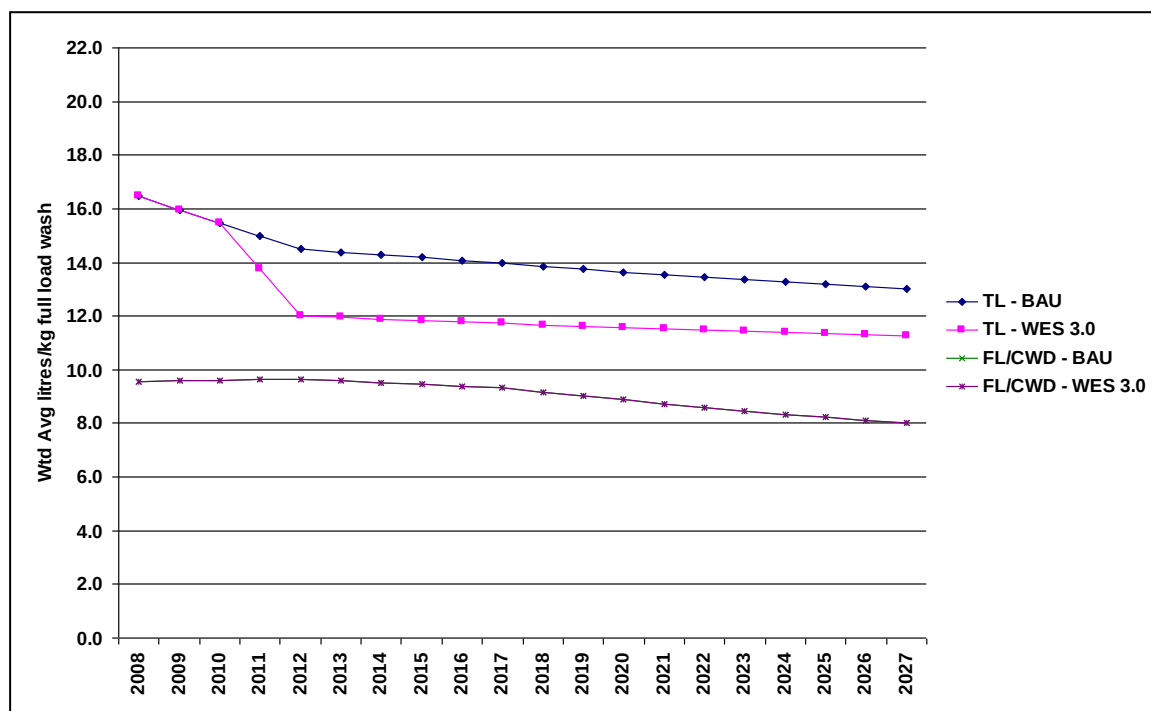
A WES of 3.0 would have no impact on TL or CWD models.

Table 22. Estimated impact of WES on average CW water use, based on 2008 sales

Models	Products	Un-restricted	Case 1/2	Case 3	Max reduction	Min reduction	Adopted reduction
TL CW	BAU	14.9	-	-	-	-	-
TL CW	WES 3.0	-	12.0	12.9	-2.9	-2.0	-2.5
FL CW	BAU	9.3	-	-	-	-	-
FL CW	WES 3.0	-	9.3	9.3	0.0	0.0	0.0

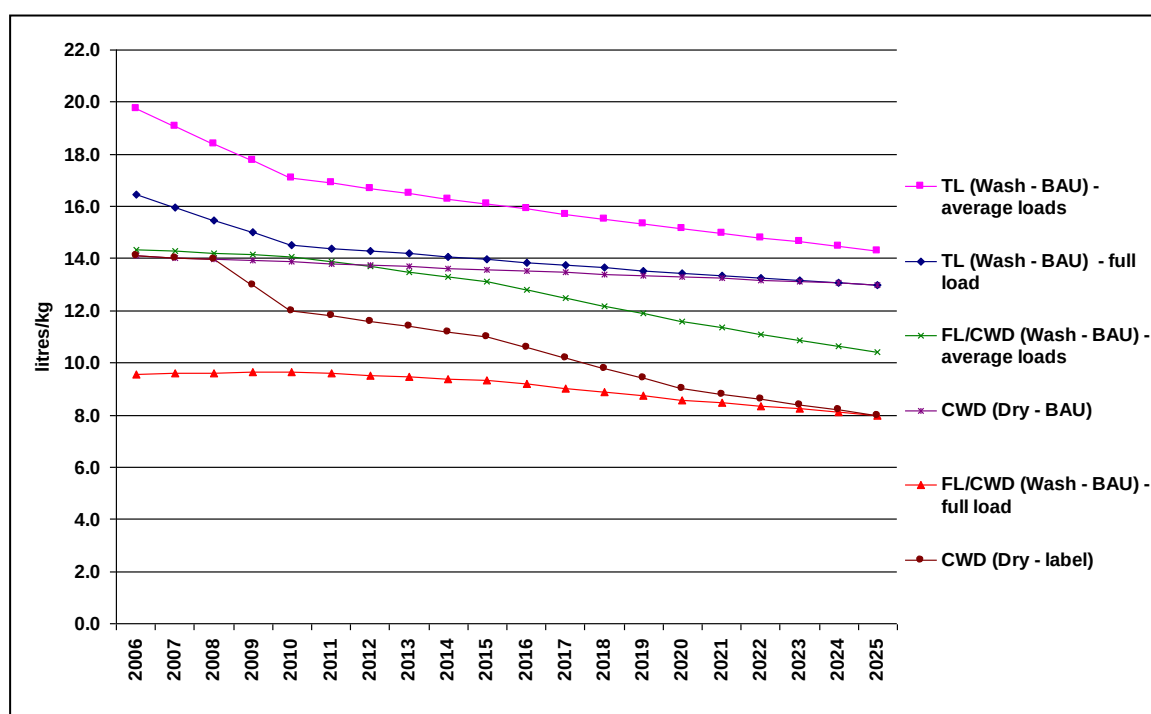
CW values weighted average litres/kg washing water. DW values weighted average litres/place setting.

Figure 33. Projected sales-weighted average litres/kg, full loads, new CWs



GWA Modelling. Note: for FL/CWD, the trend lines for BAU and WES of 3.0 overlap exactly

Figure 34. Projected sales-weighted average litres/kg, actual loads, new CWs & CWDs



GWA Modelling

Figure 33 illustrates the projected effect of WES on BAU water-efficiency, based on the following assumptions:

- All models of CW and DW sold from October 2011 must meet the WES levels.

- The sales weighted average water use for new products sold in FY 2010 is lower than the BAU level by the 'applied reduction' value in Table 22.
- Suppliers begin to change over their models as soon as the WES levels are announced (say mid-2010), so that average water use reductions in the year preceding the introduction of WES (FY 2011) are half the reduction in the first full year of WES (FY 2012).
- Following the introduction of WES, there are further improvement in water efficiency due to WELS labelling, but these are less rapid because buyers only have the more water-efficient models to choose from in any case (the least efficient having been excluded). This is shown by the fact that the WES trend lines do not decline as rapidly as the BAU trend line.

All litres/kg values up to this point have been at full capacity loads, because this is the basis for testing and rating. However, it is known that the average load is about half the rated capacity, but this does not mean that average water is also halved. In fact, water use per kg at partial loads is substantially higher than water use per kg at full loads, so if this were not taken into account, the water savings from a given WES level would be significantly over-estimated.

Figure 34 illustrates the assumed litres/kg for washing actual loads compared with the litres/kg for washing full loads. Figure 34 also shows the projected impact of WES labelling on the average litres/kg used by CWDs in drying-mode. There are two phases of reductions – the first from Stage 1 labelling and the second from Stage 2 labelling. It is assumed that the maximum drying load capacity (which represents a partial washing load) is always used.

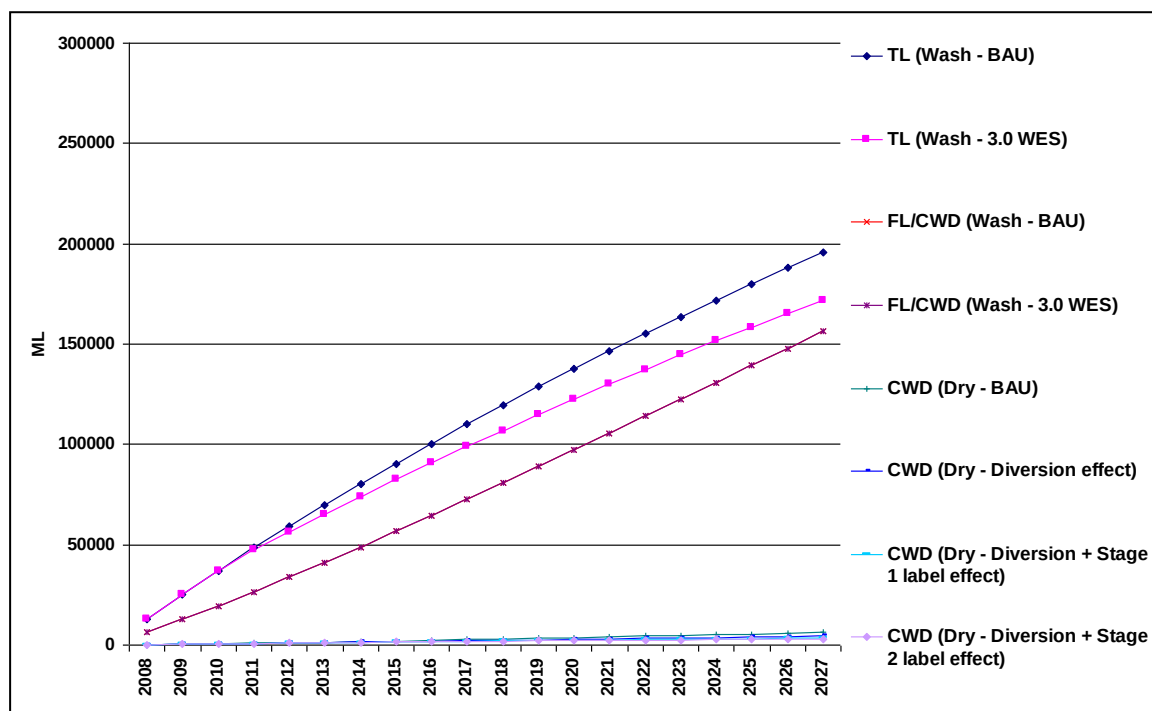
Reductions in total water use

The projected annual water consumption of the CWs and CWDs to be sold in the period 2008 to 2027 is illustrated in Figure 35. This should not be confused with the water consumption of the entire stock of these appliances, because the water use of the products already in use is not affected by future changes in WELS or WES, and need not be modelled. By 2027, nearly the entire stock will be post-2008 units.

The top pair of lines in Figure 35 indicates a significant reduction in TL CW water use under a minimum WES of 3.0 stars. The next pair is so close as to be indistinguishable, indicating that there will be no impact of a minimum WES of 3.0 for FL CWs (including the washing water use of CWDs). At the bottom of the graph, are the projections of the drying-mode water use of CWDs.

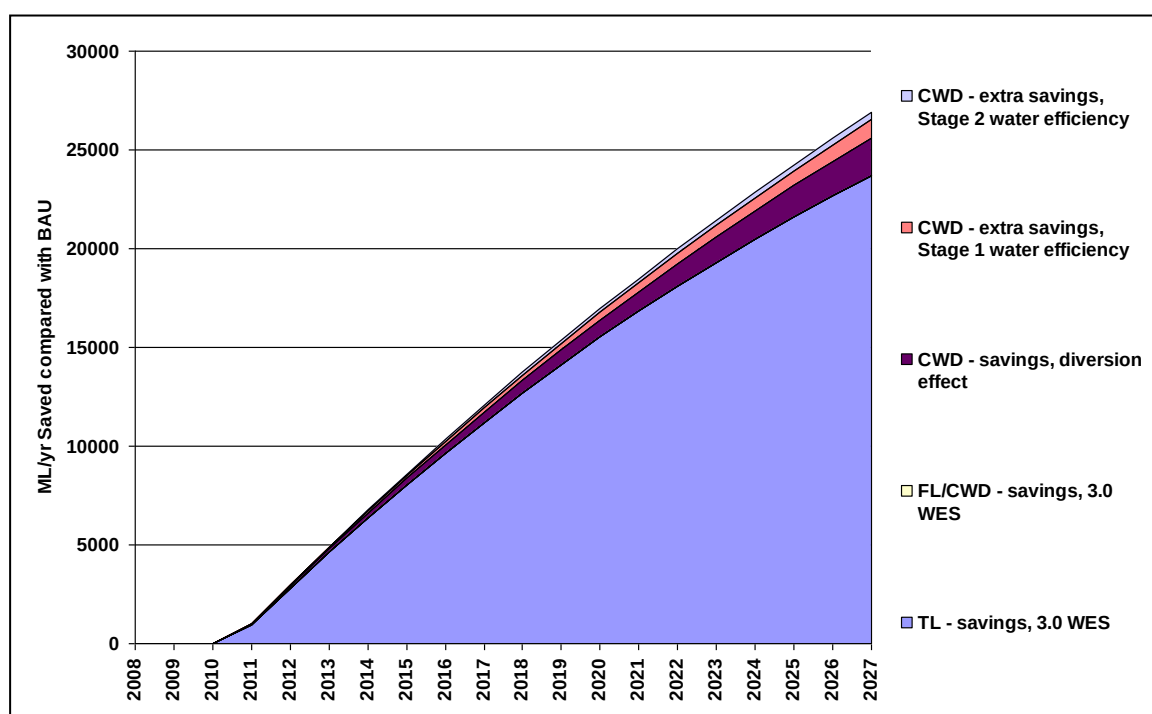
Figure 36 shows the savings from BAU implied by the differences between the trend in Figure 35: a reduction in the water use of all CWs and CWDs in Australia of about 26,900 ML/yr (7.1 per cent) below the BAU level. About 88 per cent of this would come from WES for CWs, and the rest from labelling CWD drying-mode water use.

Figure 35. Projected annual water use of appliances purchased 2008–2027, Australia



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Figure 36. Projected water savings due to WES and CWD labels, 2007–2028, Australia



GWA Modelling

Reductions in energy and greenhouse

End Use Energy

From the projected water savings (Figure 36) and the ratio of water that is heated to various temperatures (Figure 28), it is possible to calculate the reduction in water heating energy associated with the water saved. Figure 37 shows the projected energy savings from reduction in the hot water imported from the house hot water supply system by TL CWs, which have no facilities for heating their own water. There are no hot water savings from CWD labelling because the dryer-mode water use saved is unheated.

The energy saved by the lower demand for hot water can be calculated by applying the water heater type shares and conversion efficiencies illustrated, for NSW, in Figure 29 (these values are different for each State and Territory). Figure 38 indicates that about half the energy saved from a reduced demand for hot water from the house supply ('import HW') is electricity, and the other half is natural gas, with a small amount of LPG. Only a small amount of electricity is saved by a reduced demand for self-heated water, because only FL CWs heat their own water, and the proposed WES levels will have negligible impact on FL CWs.

Figure 39 also illustrates the additional electrical energy saved by reducing the number of annual drying cycles through the diversion of a proportion of CWD purchases to FLs. This comes about in two ways: a fall in the number of 'dryer-units' (i.e. the sum of CWDs and stand-alone dryers), and a reduction in the frequency of drying.

Water Supply Energy

Electricity is used to pump water from dams and storages to the points of end use, and then to pump and treat wastewater. On average, significantly more electricity is used to desalinate a kilolitre of seawater than to pump a kilolitre of freshwater from dams, but desalination plant can be built closer to the point of use. Therefore it is assumed that where desalination plants are used, pumping energy is halved (Table 23). The projected reduction in water supply electricity use from WES and WELS is shown in Figure 37

Table 23. Estimated electricity consumption (kWh) per kl of water delivered

State/Territory	Pumping (a)	Desalination (b)	Total(c)
NSW	0.65	4.93	5.26
Vic	0.88	5.27	5.70
Qld	0.95	4.38	4.86
SA	1.58	NA	1.58
WA	0.72	4.10	4.46
Tas	1.30	NA	1.30
NT	0.47	NA	0.47
ACT	0.67	NA	0.67

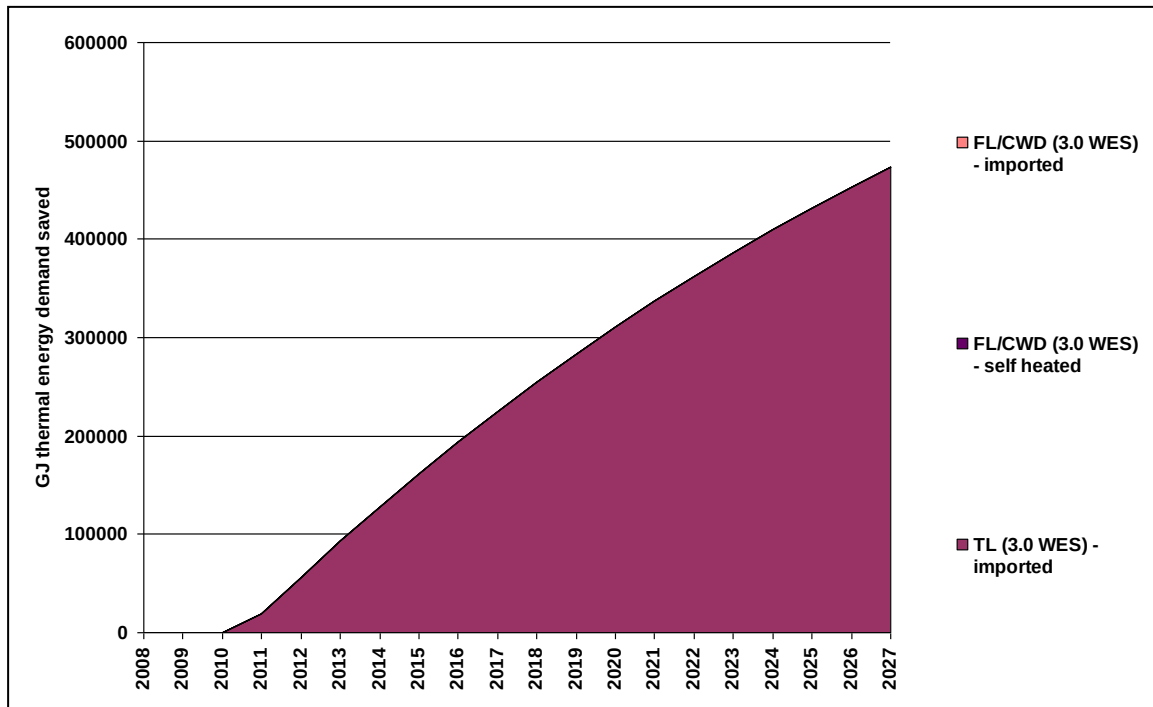
(a) From GWA (2004) (b) From Table 22 (c) Assumes pumping energy halved where desalination used.

Greenhouse

Figure 40 illustrates the projected reduction in greenhouse gas emissions due to the energy savings, compared with 'business as usual'. In 2027, electricity would account for 82 per cent of the energy

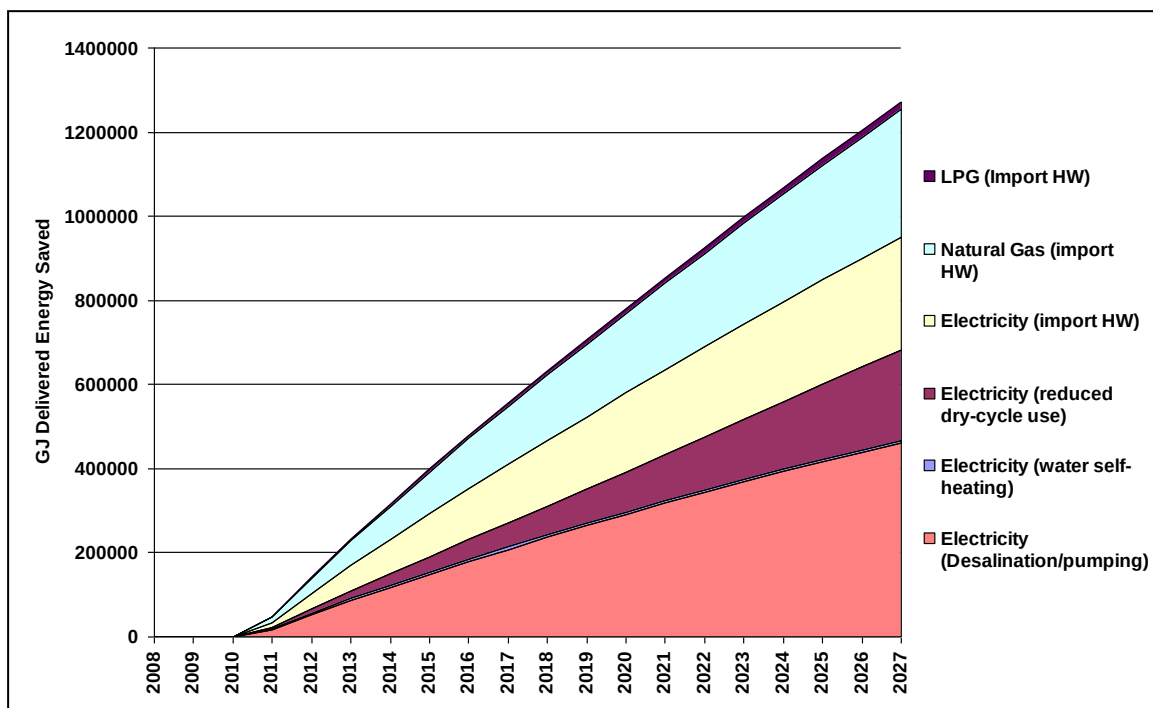
saved and 91 per cent of the 240 kt CO₂-e/yr saved, because of the high greenhouse-intensity of electricity compared with natural gas and LPG. The greenhouse impact of water-saving and energy-saving programs is usually calculated using marginal greenhouse emissions factors rather than average factors (GWA 2005c), but Figure 40 also illustrates the impact using the slightly higher average emission factors.

Figure 37. Projected reductions in thermal energy demand due to WES, 2008–2027



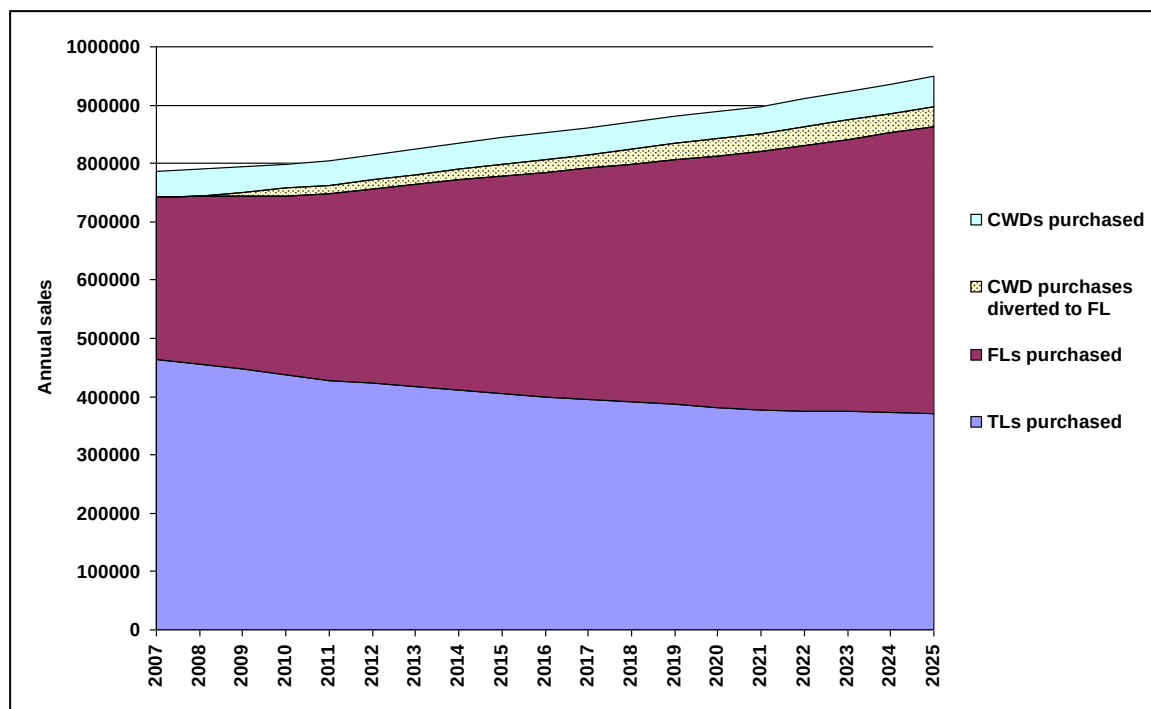
GWA modelling

Figure 38. Projected reductions in delivered energy due to WES, 2008–2027



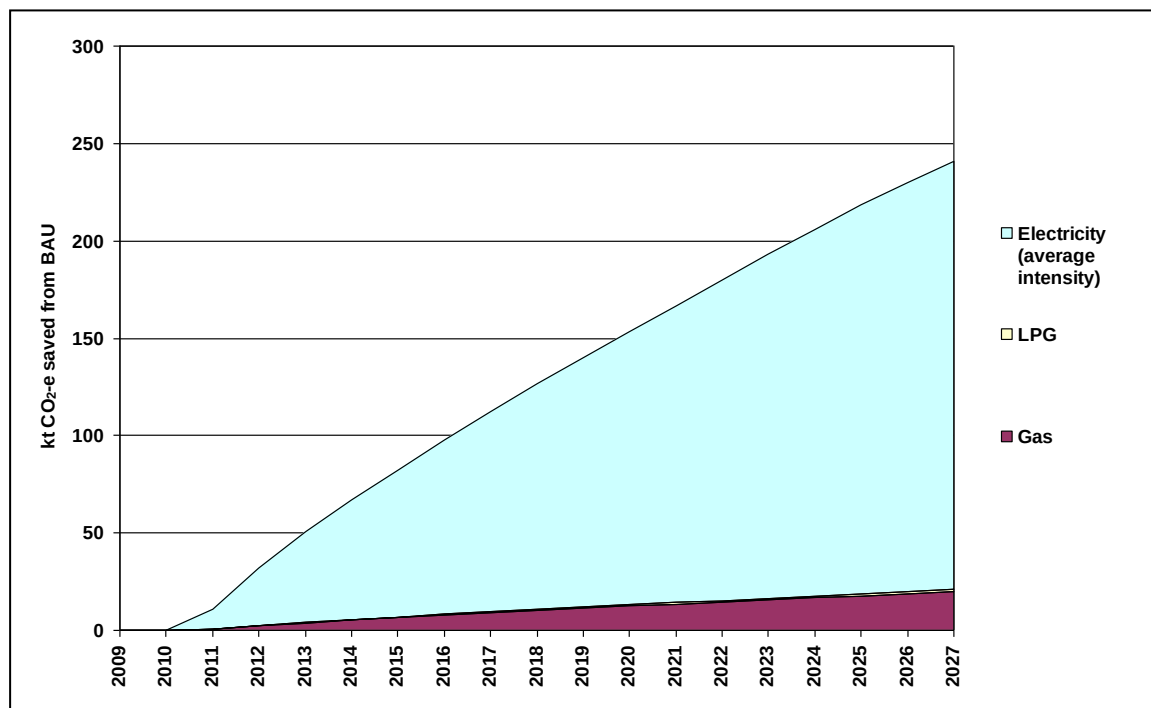
GWA modelling

Figure 39. Clothes washer market with diverted purchases



GWA modelling

Figure 40. Projected reductions in greenhouse gas emissions from energy saved



GWA Modelling

Value of costs and benefits

Whole of Australia

Benefits

As a result of WES, purchasers will buy more water-efficient clothes washers than under BAU, without even necessarily being aware that the measure has been implemented. Labelling of CWDs, together with expected changes in water authority incentive regimes, will alert buyers to drying-mode water use, reduce the market share of CWDs and motivate buyers to prefer the more water-efficient CWDs.

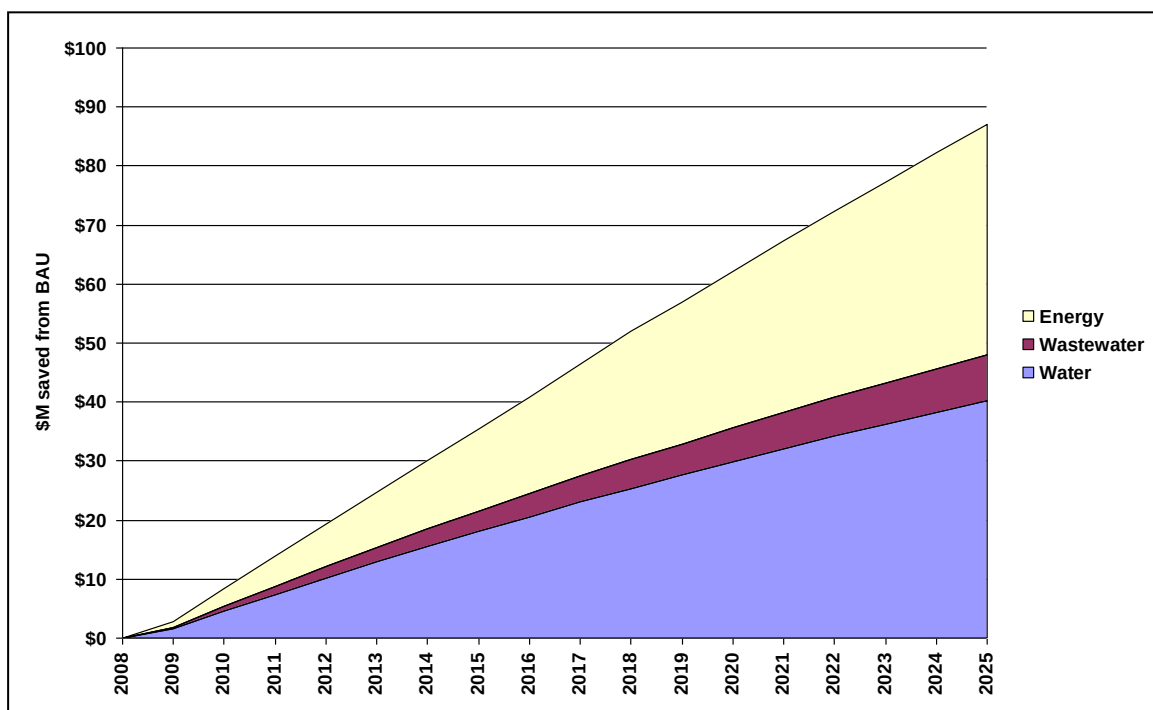
The value of benefits from the end users' perspective is calculated from the projected trends in water, wastewater and energy prices indicated in Figure 25 and Figure 27. These assumptions are varied in sensitivity testing in a later section.

It is projected that the combined effect of WES for CWs and dryer-mode labelling for CWDs could reduce national household expenditure on water, wastewater and energy as indicated in Figure 41. It is projected that by 2027 annual savings will exceed \$87 million per year, and that about 48 per cent of the savings will come from water, eight per cent from wastewater and 42 per cent from energy.

The relatively small wastewater share of savings is due to the fact that at present only Victorian households face a volume charge for wastewater. If the analysis is carried out on a supply cost basis rather than a consumer price basis, wastewater savings are a larger proportion of the overall savings.

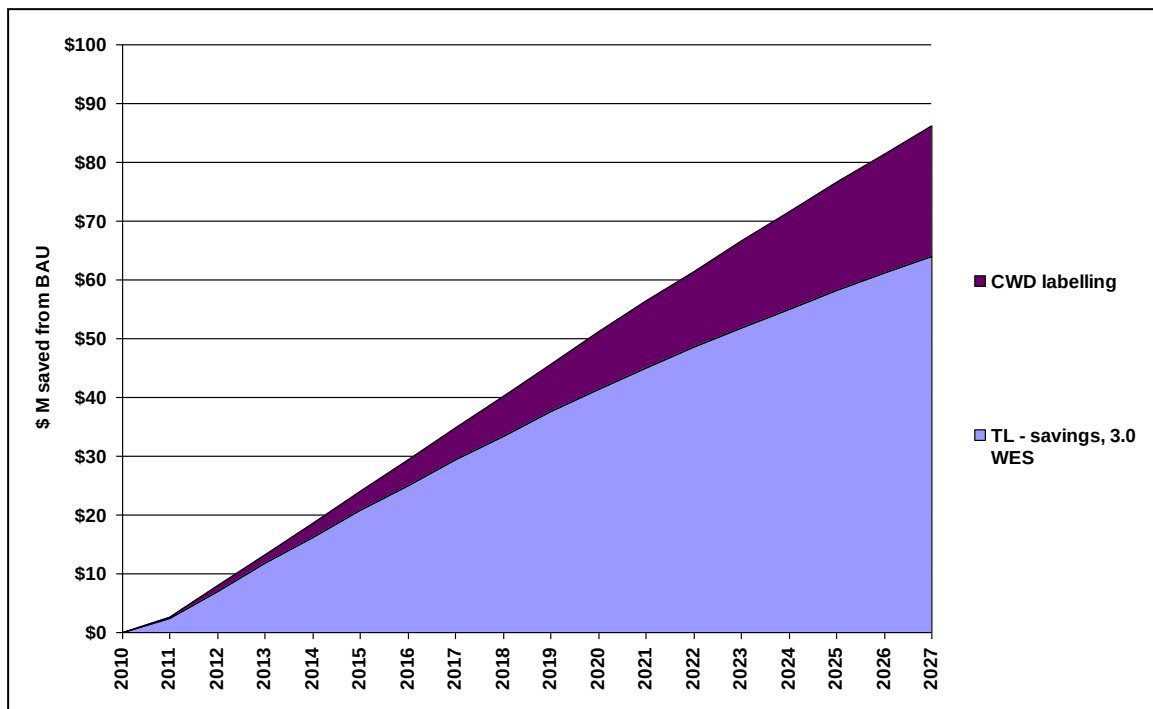
Figure 42 breaks the projected savings down by measure. About 80 per cent of the total projected savings over the period 2010–2027 come from WES for top loader CWs and 20 per cent from CWD labelling. Figure 43 breaks the savings under each measure into water/wastewater and energy components.

Figure 41. Projected costs savings, 2008–2025 (end user perspective)



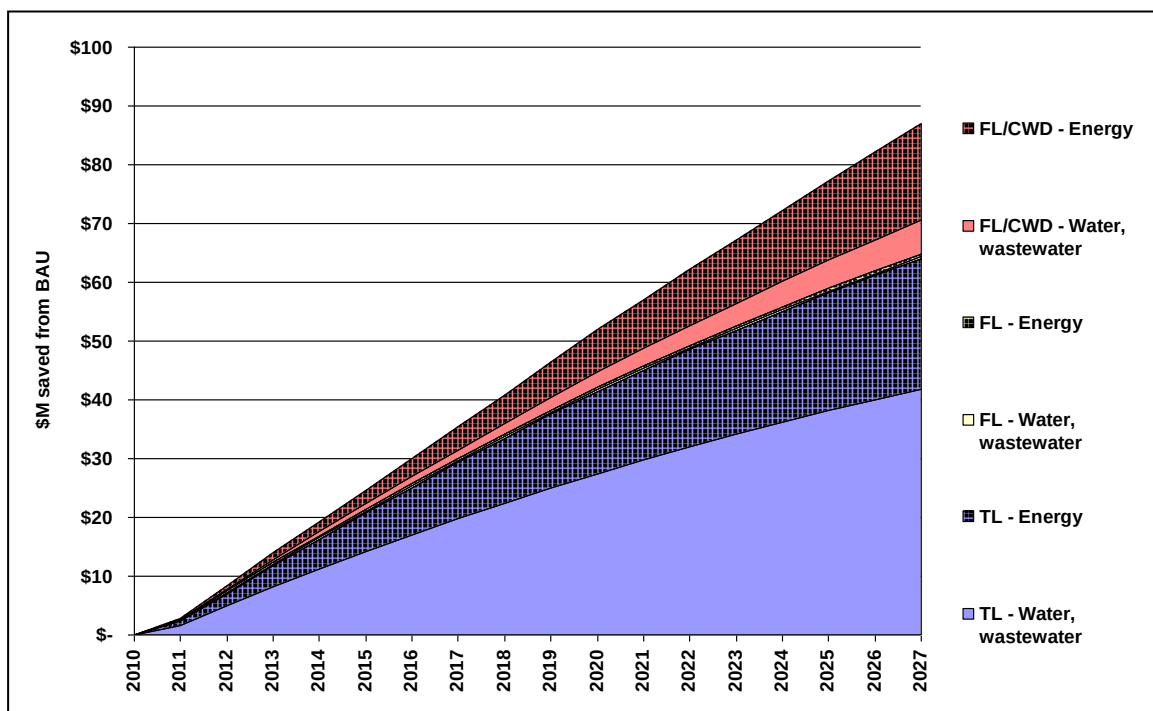
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Figure 42. Projected costs savings, 2008–2025, by measure (end user perspective)



GWA modelling

Figure 43. Projected water and energy costs savings, 2010–2027, by measure (end user perspective)



GWA modelling

Costs and Net Benefits

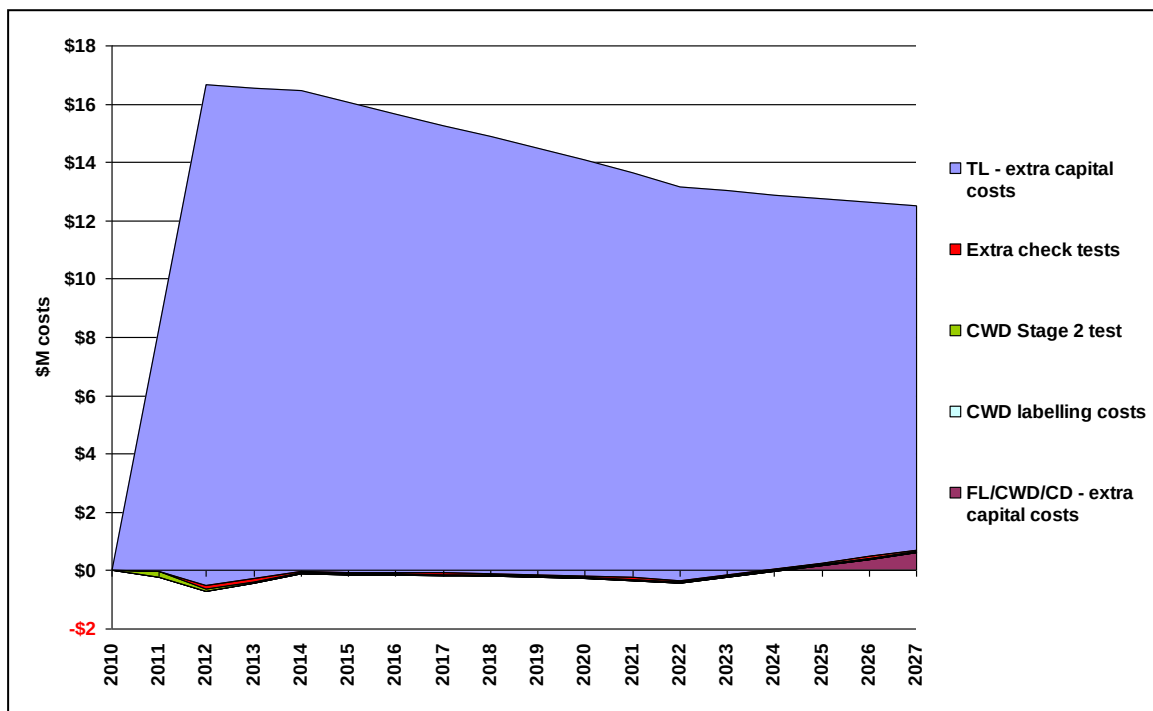
The annual costs associated with the proposals in the first years are summarised in Table 24, and Figure 44 illustrates annual costs for the period 2008–2027. The small reduction in some capital costs (illustrated by the fact that the area coloured blue falls below the axis in some years) is due to the fact that CWD buyers diverted to purchasing a separate FL CW and CD instead will spend less in total than if they had bought a CWD.

Table 24. Projected costs of WES for CWs and CWDs, 2011–2014 (\$M)

Projected costs	2011	2012	2013	2014
TL - extra capital costs (a)	8.35	17.18	16.84	16.48
FL/CWD/CD - extra capital costs (a)(b)	-\$0.2	-\$0.7	-\$0.4	-\$0.1
CWD labelling costs (c)	0.01	0.01	0.01	0.01
CWD Stage 2 test (d)	0.20	0.10	0.04	0.04(e)
Extra check tests (d)	0.0	0.10	0.10	0.05(e)
Total	8.32	16.67	16.56	16.46

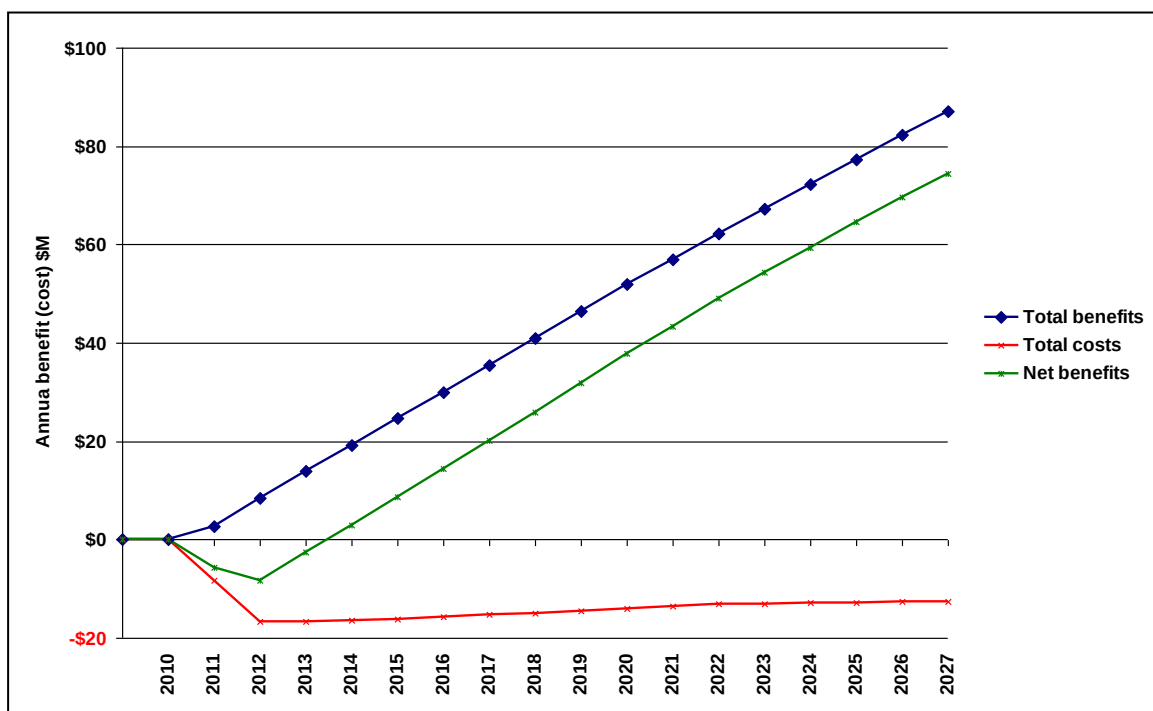
(a) Borne directly by product buyers. (b) Average price of a FL CW plus a CD is lower than average price of a CWD. (c) Borne by product suppliers/ buyers. (d) Borne by WELS administration – part or all may be recovered from product suppliers/buyers via registration charges. (e) Constant in subsequent years

Figure 44. Projected costs of WES for CWs and CWDs, 2010–2027



GWA modelling

Figure 45. Comparison of costs and benefits of WES for CWs and CWDs, 2010–2027



GWA modelling

It is estimated that the development of a Stage 2 water and energy consumption test will cost \$ 200,000 to develop and \$ 2000 per test to undertake. If 50 current CWD models need to be tested during 2012, the total test cost will be \$100,000 (\$0.1 M). After that, CWDs only need to be tested at the rate at which new models come on the market. This is assumed to be 20 new models a year,

giving an annual test cost of \$0.04 M. It is also estimated that *additional* check testing to verify compliance with WES will cost \$100,000 in the first two years following implementation, and then drop to \$50,000 per year.

It is also estimated that the cost of additional WELS staff to implement the WES requirements for CWs and the labelling requirements for CWDs, administer the increased testing effort and develop the recommended combined water consumption test for CWDs will be \$100,000 per year, recurrent (on-costs included).

Although all direct costs and benefits of the proposed measures have been included, there are other impacts which are more difficult to quantify. The substitution of a CW only, or a CW plus stand-alone CD, for a CWD purchase leads to a reduction in 'utility' (i.e. usefulness and convenience) for the buyer.

Instead of a having clothes washed and dried as a single operation, the user will have to carry out at least one extra operation: at the very least transferring the load from the washer to a dryer or – if there is no CD – perhaps carrying the clothes to an outside line and then retrieving them later. The line dry option may incur added risks, delays and inconvenience, especially in wet weather. Some buyers obviously place a value on mechanical drying, because they are willing to pay extra for a CWD (or CW plus CD) compared with a CW only. Therefore the assumption that diverting buyers from CWDs will result in a reduction in mechanical drying implies a loss of utility. However, this is not an enforced loss, since buyers who place a high value on mechanical drying are still free to buy a CWD if they wish, or a CW plus CD.

Net Present Values and Sensitivities

The net present value (NPV) of any projected stream of costs and benefits can be calculated using any discount rate. A discount rate of 0 per cent implies that a monetary cost or benefit incurred in some future year is as valuable as in the current year. The higher the discount rate, the less value placed on future costs and benefits. The following analyses present a range of discount rates, from 0 per cent to 10.0 per cent. The Office of Best Practice Regulation advises that a discount rate of seven per cent should be used for analyses of efficiency programs, with testing of sensitivity at higher and lower discount rates (CIE 2008).

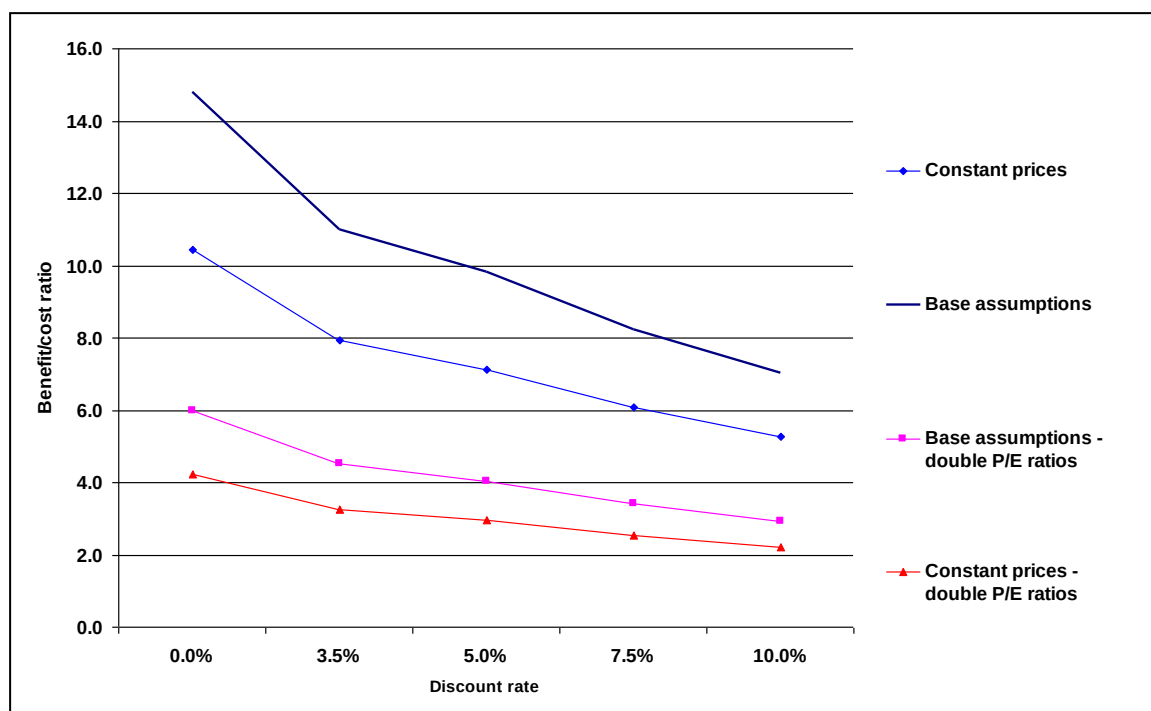
Figure 46 illustrates the benefit/cost ratio of all measures combined across a range of discount rates, taking into account:

- NPV of all administrative costs incurred up to 2027;
- NPV of all additional capital costs for appliances purchased up to 2027; and
- NPV of lifetime water, wastewater and energy costs associated with the operation of appliances purchased up to 2027; this means that the operating costs for an appliance purchased in 2027 are projected as far forward as 2042, and taken into account in the NPV calculations. This ensures consistency in the assessment, because costs are incurred at the time of purchase of an appliance whereas benefits accumulate over the operating life.

With medium price increase projections, the estimated benefit/cost ratio is about 10.6 at a discount rate of four per cent, ranging to 6.6 at a discount rate of 11 per cent. With no growth in real prices, the combined benefit/cost ratio is about 7.7 at four per cent ranging to 5.0 at 11 per cent.

A number of sensitivity tests were carried out to identify the assumptions under which the benefit over cost (B/C) ratio falls below 1 and the measures cease to be cost-effective.¹⁷ Even with a doubling of the Price/Efficiency ratios in Table 21 to 0.4 (to simulate a higher than expected capital cost impact from more water-efficient appliances, with no projected increase in energy and water prices), the lowest benefit/cost ratio is 2.1 at a discount rate of 11 per cent. This indicates that the program is robust, and is highly likely to be cost-effective.

Figure 46. Benefit/Cost ratios of proposed CW minimum WES and CWD labelling under various assumptions and discount rates



GWA Modelling

Table 25. Cost-benefit ratios of proposed CW minimum WES and CWD labelling under various assumptions and discount rates

Cost-benefit ratios	Discount rates 4%	Discount rates 7%	Discount rates 11%
Medium price increase assumptions	10.6	8.5	6.6
Constant prices	7.7	6.3	5.0
Base assumptions - double P/E ratios	4.3	3.5	2.8
Constant prices - double P/E ratios	3.2	2.6	2.1

Source: Figure 46. Interpolated and extrapolated values

¹⁷ The benefit to users is the net present value of the future water, wastewater and energy costs saved by the proposed measure (discounted at a rate of seven per cent). The cost to users is the net present value of the future increases in product costs imposed on users by the proposed measure, also discounted at seven per cent (on the assumption that all cost incurred by product manufacturers, importers and retailers will be passed on to buyers).

Distributional effects

Provided the B/C ratio is greater than 1, end users as a group are made better off by the implementation of the proposed measures. It is possible that some end users will be worse off, if they are denied access to the cheapest and least efficient CWs, and are such infrequent users that they derive little benefit from the enforced gain in water efficiency. However, the number of such users is likely to be small, because previous experience has shown that average appliance prices tend to be unaffected by the introduction of MEPS or WES. It is also likely to be balanced by the number of higher-frequency users who use (and save) more water and energy, and hence derive more benefit than the average.

Figures released by the NSW government showed that with the introduction of state-wide rebates on washing-machines that carried a WELS rating of 4.5 star or higher, demand surged by 14 000 per cent and the average price of the appliance drop from \$1800 to \$600 (Sydney Water 2009). This price of an average 4.5 star washing machine is similar to the purchasing price for an average 3.0 star washing machine (prices provided to DEWHA upon request by a large retailer in Mar 2010), and only marginally more expensive than the \$500 purchasing price quoted for an average 2 star washing-machine by the same large retailer. As such, while there may be a weak correlation between a washing-machine's water efficiency and its purchasing price, the difference is not clear and past experience suggests that average prices of washing machines with water efficiency rating 3 stars and above may continue to fall if the proposed minimum WES is established due to increased demand at those efficiency levels.

In addition to considering the marginal impact on consumers in relation to the purchasing price of washing machines under the minimum WES proposal, consideration must also be given to the longer-term impact on consumers derived from having purchased a more-efficient machine than they otherwise may have under the status quo. Table 26 indicates the average change the real purchase price of appliances over the period 2012-2027 that would result from the proposed measures: a 3.1 per cent increase for top loader CW and a 12.3 per cent reduction for combined washer-dryers. Most households will buy a CW only once every 15 years or so, when spread over those long intervals, the NPV of extra appliance purchase costs is about \$9 per household. At the same time the NPV of the water and energy savings is about \$72 per household. This demonstrates that over the operating life of the product, energy and water savings are highly likely to outweigh any potential marginal capital increases relating to purchases made in accordance with the proposed minimum WES.

Table 26. Projected impacts of proposed measures on average appliance prices

Projected impacts	BAU Price (a)	With measures (a)	Price premium	% price premium
CW (TL)	\$702	\$723	\$22	3.1%
CWD + CD(b)	\$ 1,290	\$1,132	-\$158	-12.3%
NPV of average extra cost/HH (c)	-	-	\$9	1.0%
NPV of average saving /HH (d)	-	-	\$72	-

(a) Average appliance purchase price over period 2012-2027 (undiscounted). (b) Average price of FL+stand-alone CD purchase that replaces CWD purchase is estimated to be lower. (c) NPV (seven per cent discount rate) of average future appliance purchase price premiums incurred by households for period 2012-2027. (d) NPV (seven per cent discount rate) of average water, wastewater and energy price savings incurred by household for period 2012-2027.

Supply cost analysis

The cost and benefits to this point have been assessed from the perspective of the appliance buyers who pay retail prices, and the users who face retail water and energy prices.

If supply/production costs were substituted for water, energy and appliance costs, both costs and benefits would decline in absolute terms, but not symmetrically. The inclusion of the real costs of wastewater disposal in all jurisdictions (which are only reflected in retail prices in Victoria at present) means that for most measures the cost reduction from the societal point of view would be somewhat higher than from the end user perspective. In other words, there would be a benefit in reduced wastewater management costs which would increase the B/C ratio from the societal perspective.

Measures which reduce the demand for water are directly substitutable for measures which augment the supply of water, and their costs can be compared. The levelised cost per kl is the NPV of all costs required to make the saving or supply the water divided by the water saved or supplied. It is projected that the preferred set of measures covered in this RIS will reduce water demand by 252,000,000 kl over the period 2010-2027. However, the total water saving by 2042, when the last of the appliance sold in 2027 retires from the stock, will be about 1.7 times as great or about 468,000,000 kl. Table 27 indicates the levelised \$/kl saved at various discount rates.

Table 27. Approximate levelised costs of supply from proposed measures

Discount rate	\$M costs (a)	\$/kl saved
3.5%	\$74	\$ 0.17
10.0%	\$52	\$ 0.12
4.0%	\$72	\$ 0.17
7.0%	\$61	\$ 0.14
11.0%	\$49	\$ 0.11

(a) Includes testing, labelling, administration and higher capital costs

Table 28 compares the levelised costs in Table 27 with the estimates of the cost-effectiveness of the WELS program as a whole by the Institute of Sustainable Futures (ISF 2008). The comparison is approximate only, because there is no way of knowing what time periods, discount rates or costs have been included in each estimate. However, ISF's levelised cost estimates for the original WELS program (\$0.13 - \$0.21 per kl) cover the discount rates from 3.5 per cent to 10.0 per cent. The same range of discount rates applied to the costs in the present RIS yield levelised costs of \$0.12 to \$0.17 per kl.

This levelised cost is well below all the supply side options, and lower than all the demand side options other than the 'outdoor water efficiency' measures. The costs of achieving water savings though CW minimum WES and CWD drying-mode labelling are less than a fifteenth of the costs of saving water through water authority rebates, which is estimated to be \$2.10 to \$2.60 per kl.

Table 28. Summary of water demand and supply side option costs

Water demand and supply side option	Options	Approx. levelised unit cost (\$/kl)
Demand Reduction Options	Outdoor water efficiency (a)	\$0.10 – \$0.20
Demand Reduction Options	WELS measures covered in this RIS (c)(b)	\$0.12 - \$0.17
Demand Reduction Options	WELS (programs implemented to date) (a)(b)	\$0.13 - \$ 0.21
Demand Reduction Options	Shower head programs (shower head exchanges, rebates, and retrofits) (a)	\$0.50 – \$0.60
Demand Reduction Options	Building regulations (5 Star in Victoria, BASIX NSW) (a)	\$0.30 – \$4.00
Demand Reduction Options	Clothes washer rebates (c)	\$2.10 – \$2.60
Supply augmentation	Desalination (a)	\$1.19 – \$2.55
Supply augmentation	New storage (a)	\$1.26 – \$3.58
Supply augmentation	New recycling schemes in Sydney (a)	\$1.00 – \$5.50
Supply augmentation	Residential Rain tank (a)	\$3.00 - \$4.00

Source: (a) ISF (2008). (b) 3.5 per cent to 10.0 per cent discount rates; upper cost estimates. (c) Calculated in this RIS. same range of discount rates used here to maintain comparability with other studies

By state and territory

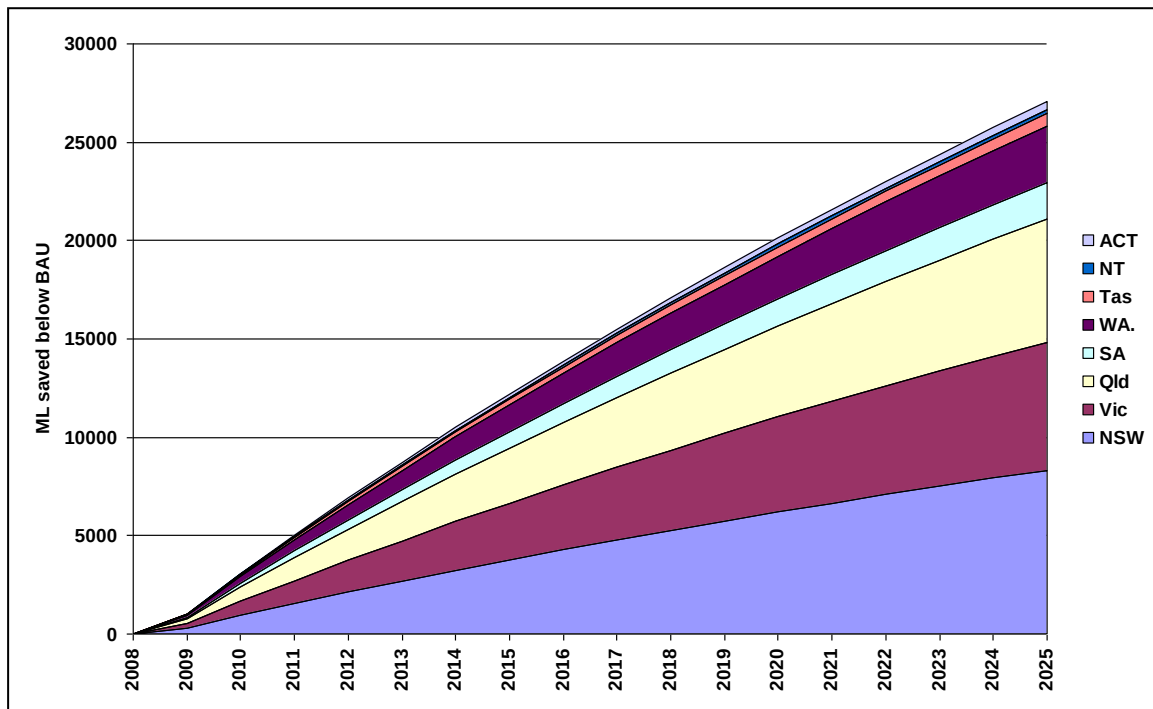
The proposed WES and labelling measures are cost-effective for end users in every jurisdiction, with B/C ratios ranging from 12.5 (Victoria) to 5.0 (Northern Territory), with Victoria having the highest net benefit (\$224.7 M). Table 29 breaks down the projected water savings by State and Territory. NSW accounts for nearly 31 per cent of the aggregated water savings to 2027, and Victoria and QLD for over 23 per cent each.

Table 29. Impacts and cost-effectiveness by jurisdiction

State/Territory	ML saved 2010-27	Cost \$M	Benefit \$M	Net benefit \$M	B/C ratio
NSW	78375	25.3	189.5	164.2	7.5
Vic	60805	18.0	224.7	206.8	12.5
Qld	58652	18.4	83.7	65.2	4.5
SA	17465	4.7	44.9	40.2	9.5
WA.	27571	6.6	44.4	37.8	6.7
Tas	6059	1.8	16.7	14.9	9.3
NT	1777	0.4	1.9	1.5	5.0
ACT	3833	0.9	8.9	7.9	9.6
Total	254537	76.2	614.7	538.5	8.2
Admin cost (national)	-	2.0	NA	NA	NA
Total with admin cost	-	78.2	614.7	536.5	7.9

Discount rate of seven per cent

Figure 47. Projected water savings by jurisdiction



GWA Modelling

6 Other impacts

Product suppliers

Manufacturers and importers

There is no manufacturing of CWs in Australia or New Zealand. Electrolux closed its Adelaide CW plant in 2006 and Fisher & Paykel moved its laundry product manufacturing facilities from New Zealand to Thailand in 2008.¹⁸

The main top loader brands are Electrolux (including Simpson and Westinghouse brands), Fisher & Paykel and LG, which have over 70 per cent of the market between them. The main front loader brands are LG, Bosch, Electrolux, Samsung and Whirlpool, which have over 80 per cent of the market between them. LG, Samsung and Electrolux have over 90 per cent of the CWD market.

There are currently 37 brands of TL on the market; 15 brands (41%) have at least one models meeting a MEPS level of 3.0. Two further brands have at least one model at 2.5 stars which may be able to remain on the market with minor technical improvements.

The sales weighted SRI of TLs has been increasing at over 0.2 per year since 2002, so it is likely that even more companies will have acquired or developed complying models during the proposed 12 to 18 month notice period for WES implementation. This is similar to the lead times used to introduce or raise minimum energy performance standards in the energy rating program.

Suppliers of CWDs already affix two energy labels and a CW WELS label to every unit sold, so the administrative systems to handle a new dryer-mode WELS label are already in place. It would be reasonable for AS/NZS6400 to allow the drying-mode WELS label to be printed on the same template as the dryer energy label, in the same way as the CW energy and WELS labels may be printed on the same template.

There are very few twin tub CWs still sold in Australia, but there is at least one model which meets the proposed WES level of 3.0.

There are no stand-alone water-using condenser dryers on the Australian market at present; therefore the WELS labelling would not apply.

Retailers

WES should have little impact on retailers, since it will not add a new label or affect the appearance of existing labels. Retail staff may notice that there are no more TL CWs rated at less than 3.0 WELS stars once the measure takes effect.

The introduction of a drying-mode WELS label for CWDs will however need to be understood and supported at the retail level. Some retail staff may not be aware that CWDs use water for drying, and all will need to understand the drying-mode label to be able to explain it to customers (or at least not

¹⁸ <http://news.smh.com.au/business/fisher--paykel-joins-the-offshore-rush-20080417-26po.html>

offer conflicting explanations). In the event that water authorities change the eligibility criteria for rebates for CWD purchases, retail staff may be required to explain why this has occurred.

The introduction of drying-mode labelling would be considerably smoothed by a campaign to inform retailers. Whether this is funded by the WELS program or the water authorities (perhaps out of funds saved from CWD rebate payments avoided) is immaterial. If the initial funding is via the WELS program, it may be combined with other information programs targeting retailers. As it is not known whether a new communications campaign would be undertaken or whether it could be incorporated into other communications at marginal cost, no additional budget has been estimated.

Water supply authorities

Many of the water supply authorities that are members of WSAA 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.

The proposed measures would gradually contain the growth in water demand for washing appliances, rather than bring about immediate reductions in water use. In this respect, the effects will be no harder to plan for than normal changes in household numbers or greater water efficiency in other end uses. The projected savings from these measures alone are not likely to be sufficiently large to impact on the need for additional sources of freshwater supply but could, if combined with other water efficiency programs, affect their timing. Similarly, the impacts on the pricing consequences of water supply options already committed, such as a desalination plant, is likely to be minimal.

However, if current water restrictions are lifted, and water charges increase no more than the doubling already envisaged, the projected growth in household demand alone will create a need for either further supply augmentation or water efficiency measures beyond those already in train.

Water supply authorities would be advantaged if they abandoned their rebate schemes in favour of more cost-effective efficiency options, such as the WES and labelling measures proposed in this RIS. In fact, there would be little point in continuing rebates for 4 star or even 4.5 star CW purchases once the proposed measures were implemented. If buyers want a front loader, they could no longer purchase one of less than 3.0 stars, so the additional water saving from diverting them to a 4 or 4.5 star model would be as little as 4.4 kl per year. In fact, so many more buyers would purchase models higher than 4.0 or 4.5 that rebate costs to water authorities would rise even as the water savings per rebate fell.

If rebates could somehow be targeted to those who would otherwise have bought a top loader then they could be justified, even if a TL WES level of 3.0 were introduced, but this is not possible.

The introduction of dryer-mode labelling of CWDs would allow the water authorities to immediately exclude this class of products from rebate schemes. This would immediately save about a third of the rebate cost for CW.¹⁹

¹⁹ Author calculations based on confidential advice from Sydney Water.

Trade and competition

Trade

The World Trade Organisation's *Agreement on Technical Barriers to Trade*:

'seeks to ensure that technical negotiations and standards, as well as testing and certification procedures, do not create unnecessary obstacles to trade. However, it recognizes that countries have the right to establish protection, at levels they consider appropriate, for example for human, animal or plant life or health or the environment, and should not be prevented from taking measures necessary to ensure those levels of protection are met. The agreement therefore encourages countries to use international standards where these are appropriate, but it does not require them to change their levels of protection as a result of standardization.'²⁰

Australia is an active participant in the development and harmonisation of international standards for the energy and water testing of products, and where appropriate these are reflected in Australian and New Zealand Standards. There are no accepted international test standards for product water consumption, so the use of AS/NZS 6400 as the basis for testing for WES and WELS does not create a conflict.

The results of water consumption tests conducted in other countries are already accepted by the WELS scheme, provided that AS/NZS 6400 were used as the basis of testing and the laboratory does not have a history of unreliable results. Check tests can 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).

The Trans-Tasman Mutual Recognition Agreement

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 minimum WES or 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 WELS program. 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 proposed WES and CWD labelling at the same time as Australia, there will be scope for non-WES-compliant and unlabelled products imported from New Zealand to be sold in Australia unless the Australian Government obtains an exemption under the provisions of the TTMRA until such time as the measures takes effect in New Zealand. However, the risk of this occurring is minor even without a TTMRA exemption, because no CWs are

²⁰ http://www.wto.org/english/docs_e/legal_e/ursum_e.htm#dAgreement

manufactured in New Zealand, and it is unlikely that products would be imported to New Zealand first before trans-shipment to the Australian market.

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

Impacts on competition

The adoption of WES for CWs will further reinforce the competitive advantage for suppliers of more water-efficient products, beyond the advantage already conferred by WELS labelling.

The largest impact will be on the TL CW market, since this is where the proposed WES levels will impact on the greatest number of current models. Those suppliers with the greatest number of non-complying models in their range will be the most affected. It is possible that some may withdraw from the market (or at least withdraw from the TL market) because they are unable or unwilling to source complying products. At worst, up to 28 of 39 suppliers of TL product may be in this situation, but some of those have complying FL and/or CWD models, and most would be in a position to introduce complying TL product within the proposed 18 month notice period. If however an increase in average TL prices diverted more TL purchasers to FL models, there would be additional water savings.

The ability of the remaining suppliers of TL products to capitalise on withdrawals from the TL market by increasing prices will be severely limited by the fact that TL models are now in direct market competition with FL models. The competitive position of FLs may actually increase if the FL market gains extra support from water authorities through the redeployment rebate payments to products of higher water efficiency (say 4.5 or higher).

As the purpose of dryer-mode WELS labelling 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 measures on supplier competition is likely to be so small as to be effectively competition-neutral.

Consultations

The appliance industry has been aware of the Government's intention to implement WES for clothes washers and dishwashers, and WELS labelling for clothes washer-dryers, since at least 24 November 2006, when the EPHC issued its communiqué.

In February 2007, the DEWHA WELS team and the Australian Greenhouse Office (AGO) held an industry workshop in Sydney to discuss options for minimum energy performance standards and WES for CWs, and drying-mode labelling for CWDs.

At the workshop, industry associations were invited to submit formal comments. Submissions were received from the Australian Electrical and Electronics Manufacturers Association (AEEMA) and the Consumer Electronic Suppliers Association (CESA), which generally represents imported brands (although local manufacturers also import some of their models).

The WELS team held a further industry forum in March 2008.

The Consultation RIS was released for public comment in October 2008. A public forum was held in Sydney in December 2008 and 16 submissions were received when the process ended at the end of January 2009.

Industry submissions

Submissions were received from:

- The Australian Industry Group (AiG), incorporating the former Australian Electrical and Electronics Manufacturers Association
- Consumer Electronics Association of Australia (CESA)
- Electrolux
- Fisher & Paykel

The main points were:

- General support for WES for CWs;
- No support for WES for DWs (as proposed in the Consultation RIS) because the water and energy savings would be negligible;
- There was a concern that the analysis was based on old sales data;
- There was no support for different WES levels for TL and FL (as proposed in the Consultation RIS);
- There was general agreement that a WES level of 2.0 is too conservative and manufacturers supported either a 2.5 or 3.0 level WES;
- There was support for some form of water labelling for the drying-mode for CWD, but not for a star rating (as proposed in the Consultation RIS); and
- There was support for labelling the total litres used per drying cycle (and possibly the total kg load per drying cycle) and then reconsideration of the label (to examine introducing possible star ratings) once a new CWD test, based on further usage research, is devised.

Water authority submissions

Submissions were received from:

- The Water Services Association of Australia (WSAA)
- Victorian Water Industry Association
- Sydney Water
- Hunter Water (NSW)
- South-East Water (Melbourne)
- Western Water (Melbourne)

The main points were:

- General support for WES for CW;
- Support for WES for DW (as proposed in the Consultation RIS);
- There was a concern that the analysis was based on old sales data;
- There was a concern that the analysis undervalued water savings and did not take into account the monetary value which the CPRS will give to CO₂ emission reductions from reduced water heating demand;
- There was no support for different WES levels for TLs and FLs (as proposed in the Consultation RIS);
- There was a general agreement that a WES level of 2.0 was too conservative; water authorities supported a higher initial WES level of at least 2.5, to be raised to at least 3.5 after a year; and
- The water authorities supported the recommendations in the Consultation RIS for star-rating the drying-mode water use of CWDs under the present CD drying test, with a new CWD test to be developed as soon as practicable.

Other submissions

The Australian Consumers' Association supported differentiated WES levels (2.0 for TL and 3.0 for FL CWs). It supported the manufacturer position on CWD labelling (i.e. water warning with litres indicated) pending research on a more reliable usage test. It also supported WES for DWs.

Lanfax Laboratories raised a number of issues with the test standard (AS/NZS 2040:2005, *Performance of household electrical appliances—Clothes washing machines*.) It argued that FL models have a higher environmental impact because the majority of front loaders have a higher wastewater salinity than top loaders, so FLs should have a lower WES level to compensate.

Two private individuals made submissions. One advocated high WES levels and support for low-income households to buy more water-efficient CW. The other proposed that the capability to 'suds-save' i.e. storing clean rinse water in the laundry tub for use in the next wash load) be made a factor in CW labelling and also in laundry tub labelling.

Response to submissions

The analysis and recommendations in the Consultation RIS were revised to take account of stakeholder submissions, especially with respect to higher WES levels and harmonised WES levels for TL and FL CWs.

The following changes were made to this Decision RIS in response to the submissions:

- The analysis was repeated with more recent market information. While the Consultation RIS relied on data on product sales in calendar 2006, this Decision RIS uses sales data for 2007 and 2008 as well;
- Water price projections were updated (and significantly increased) to take account of later regulator price determinations;
- Energy price projections were updated (and significantly increased) to take account of the projected impacts of the CPRS;

- Greenhouse gas intensity projections were revised (slightly lowered) to take account of the projected impacts of the CPRS;
- The proposal for different WES levels for TL and FL CW (2.0 or 2.5 stars for TL and 3.0 or 3.5 stars for FL) has been omitted in favour of a single WES level of 3.0 stars.
- The proposal for dishwasher WES has been omitted;
- The proposal for a star rating WELS label and a WES for drying-mode water use of CWD has been omitted in favour of a WELS Water Warning label with the total water use and kg of drying capacity (but no star rating at this stage); and
- The proposal to cover stand-alone condenser CDs using mains water has been omitted, since there are no such models on the market.

7 Conclusions and recommendations

Conclusions

The problem

The increasing variability, and in some areas scarcity, of water supplies within Australia, has focused attention to a greater degree on water management issues. In particular, for urban areas:

- there is a need to balance supply and demand for potable water; and
- there is a need to incorporate into individual purchase decisions for household appliances the full social costs and benefits.

The urban water market is liable to a number of market failures due to the nature of the product and the market itself. Urban water pricing is based on long-term costs for supply investments, rather than adjusting for short term variations in inflows, and the demand for household indoor water is relatively inelastic.

To address the problem, governments have focused on a range of supply augmentation and demand management policies in addition to improving pricing signals. In general demand management responses are considered more cost-effective than investments in supply augmentation. However, demand management responses also have limitations to what can be achieved, particularly in relation to reducing household indoor water consumption, which has been shown to be relatively inelastic.

The WELS scheme falls within the range of demand management measures that have been introduced by governments. The WELS scheme currently provides information about the water consumption and relative water efficiency of household water-using products. In this way, the WELS scheme assists demand management by providing better information on the choices available.

The WELS scheme has been found to be one of the most cost-effective water management options available to governments, and its predicted water savings are used by water utilities in developing their water usage forecasts and supply plans. In this way, the WELS scheme plays a role for governments in their efforts to balance the supply and demand for potable water, as water savings achieved by the WELS scheme can potentially delay decisions on making additional investments in supply augmentation. This results in a more efficient outcome for the whole of society in balancing the supply and demand for potable water, as the WELS scheme is more cost-effective than supply augmentation options.

As a means of addressing the problem, this RIS has considered the case for establishing minimum WES for CWs and DWs, as well as the inclusion into the WELS scheme of the water-using dryer-mode of CWDs for labelling and minimum WES.

The preferred option

The measures considered in this RIS aim to address the problem by enhancing the effectiveness of the WELS scheme and increasing the net benefits to purchasers of the appliances under consideration and to other users of water.

The measures which best meet these criteria, while providing a positive benefits to costs ratio, are a combination of continued mandatory WELS labelling and new minimum WES requirements.

For CWs, the option which best meets the criteria is a minimum WES level of 3.0 (corresponding to a maximum water use of 14.7 litres per kg washed at full capacity, using the test method in AS/NZS 2040).

CWDs had only just been introduced to Australia in 2004, when the original investigations for the WELS scheme were carried out. Their market share grew rapidly to 2006 but has since plateaued.

The absence of readily accessible information on drying-mode water use means that most consumers are unaware that CWDs use water for this purpose, and those who are aware are not able to compare the performance of alternative models. The effectiveness of water supply authority rebate schemes has been compromised because many payments for the purchase of 'water-efficient' CWs (generally those with a SRI of 4.0 or more) have been made for CWD purchases, which in fact *increase* water user compared with the alternatives.

There is therefore some urgency in implementing a labelling scheme to identify CWD as water users in drying mode, and to allow buyers who will still prefer CWD (despite the likely withdrawal of rebates) to select the more water-efficient models. A two-stage approach is recommended:

- 1) In the short term, implement WELS labelling for drying-mode water use, by indicating the litres used per dry cycle and the kg drying capacity (but no star rating), based on test data already available.
- 2) In the longer term, implement a WELS labelling for the combined washing-drying function that corresponds to the way in which buyers actually use CWDs. This will require the development of a separate CWD performance test (rather than distinct washing and drying tests, as is the case at present). This is consistent with the trend in international standards to treat CWDs as a distinct product class.

DWs use much less water per wash than CWs, so the water savings available from any feasible minimum WES level are small. There is therefore no case for minimum WES for DWs at this point in time.

Recommendations

It is recommended that:

- 1) A minimum water efficiency standard for the washing function of clothes washers and combined washer dryers should be adopted, with the same minimum WES level to apply to all product types, including top loading and front loading.
- 2) The initial minimum WES level for clothes washers of 5.0 kg capacity or greater should be a Star Rating Index of 3.0, as calculated in accordance with AS/NZS 6400, *Water Efficient Products – Rating and Labelling*.
- 3) In order to maintain consumer choice in smaller capacity clothes washers, the initial minimum WES level for clothes washers of less than 5.0 kg capacity should be a Star Rating Index of 2.5, as calculated in accordance with AS/NZS 6400, *Water Efficient Products – Rating and Labelling*.

- 4) The above measures should apply to all CW models manufactured or imported following a notice period of at least 12 months, but not more than 18 months from EPHC decision (i.e. they would take effect between the second half of 2011 and the beginning of 2012).
- 5) Once the market impacts of the initial minimum WES levels become clear, consideration should be given to further raising the WES levels to 4.0 (and 3.0 for CWs of less than 5.0 kg), following a further notice period.
- 6) There should be no minimum water efficiency standard for dishwashers for the time being.
- 7) A method of rating and labelling the water consumption of the drying mode of combined washer dryers (CWDs) should be required by the WELS scheme, most likely through inclusion in AS/NZS 6400.
- 8) The CWD drying mode label should have the following elements:
 - a 'Water Warning' or similar heading (as provided for in AS/NZS 6400);
 - the total litres of water consumed during drying, as recorded in existing tests; and
 - the maximum drying load capacity (in kg), as recorded in existing tests.
- 9) The display of the CWD drying label at the point of sale should be mandatory for all CWDs manufactured or imported following a notice period of not more than 12 months from EPHC decision.
- 10) Work should commence on a new 'combined function' test for CWDs, which would measure the energy and water used to wash and dry a complete load of the maximum capacity for which the unit can perform those functions without removal or disturbance of the load.
- 11) When developed, the test should become the basis for a 'combined function' rating which could initially be included on the water rating and energy rating websites, and could eventually replace the drying-mode WELS label.

8 Review

It is recommended that the new measures proposed in this RIS (minimum WES of 3.0 for CW and labelling of CWD dryer-mode) be reviewed by the WELS Advisory Committee (WELSAC, the committee of Commonwealth, State and Territory officials overseeing the WELS program), two to three years following the introduction of the regulation.

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Annexes

Annex A: Demand for household water services

The growing demand for urban water supplies continues to be a major policy challenge for all Australian jurisdictions. This is still driven by households, which increased their share of the water supplied by the urban water authorities from about 52 per cent in 1995-96 to 62 per cent in 2007-08, despite widespread water restrictions which mainly targeted household use (Figure 48 and Figure 49).

The number of households increased at an average rate of about 2.4 per cent per year in the decade to 2008: about twice the rate of annual increase in population (1.2 per cent), because mean household sizes declined. At constant water demand per capita or per household, it would be expected that total residential water use would increase at an underlying rate of 1.2 per cent to 2.4 per cent per annum.

Total household water use increased at an average rate of 4.3 per cent per annum between 1995-96 and the peak, which was in 2000-01. The year 2001-02 was the first of a series of drought years, during which all capital city water authorities imposed restrictions on outdoor water use which are still in force today (see below). Since that year *total* urban residential water use has fallen at 3.3 per cent per annum, even though the number of households supplied has continued to grow at 2.1 per cent per annum. Consequently the *average* annual delivered water use per household has fallen by a third, from a peak of about 272 kl in 1997-98 to about 180 kl in 2007-08.²¹

Most of the fall in household water use appears to have been due to restrictions on outdoor water use, and garden watering in particular. Wastewater collections, which are linked to indoor uses, remained relatively steady, while outdoor uses fell sharply.²² As this effect is due to mandatory restrictions rather than pricing or other influences, it may reverse to some extent if restrictions are

²¹ These averages are for the urban water authorities for which there are consistent data series since 1995-96 (in WSAA 2001, 2006, 2007, 2008), which cover about two thirds of the total water supplied to households in Australia. Deliveries include recycled water.

²² 'Outdoor' use is calculated as the difference between total water supplied to residential and non-residential users, less total wastewater collections (excluding trade waste).

lifted. The effects of restrictions on indoor uses, which are less discretionary, have been far more muted.

Annex B: Pricing

The price elasticity of the demand for urban water is a matter of considerable uncertainty.²³ The uncertainty arises from the wide range of community specific influences that can influence the demand response to price changes and the lack of consistent, recognised methods to calculate the price elasticity of demand for urban water. Elasticities have been found to vary widely with price structures, between cities, and in the same city over time (Worthington and Hoffmann, 2007).

Demand for urban water could be expected to be relatively inelastic to a certain point (meeting basic household water needs) and then increasingly elastic for additional or discretionary uses.

Even within Australia, estimates of elasticity vary widely (Table 30). A recent study of water use in 11 south-east QLD local government areas (Worthington et al 2006) covered the period 1994 to 2004, during which 10 Local Government Areas introduced volume-based pricing with various marginal tariff levels and structures. Mean marginal prices increased from \$0.12 to \$0.64 (433 per cent) a kilolitre over the period studied, while average prices (including access charges) increased from \$0.60 to \$1.05 (75 per cent).

Table 30. Estimated price elasticities of water demand, Australian cities and towns

City or area	Period covered	Estimated price elasticity	Source
Perth	1982	-0.18	Thomas & Syme (a)
Sydney	1990-1994	-0.21	Barkatullah (a)
Adelaide	1978-1992	-0.28 (short run), -0.77 (long run)	Dandy, Nguyen & Davies (a)
Brisbane	1998-2003	-0.51 (short run), -1.16 (long run)	Hoffmann, Worthington & Higgs (a)
11 Qld LGAs	1994-2004	-0.13	Worthington et al (2007)
Sydney	2004-05	-0.17	Grafton & Ward (2007)

Source: (a) Summarised in Worthington & Hoffmann (2007).

Given that metering and volume-based pricing were a novelty in many of the areas, and given the steep rise in the mean marginal price, customer sensitivity to pricing signals would be expected to be high. However, the study concluded:

‘...in inclining multi-part tariff structures, consumption rates are so low, and the limits so high, there is almost no meaningful price signal. Moreover, the reliance on high access charges in two-part tariffs structures means there is likely to be much misperception of the marginal price of water and this further distorts outcomes.

²³ A price elasticity of water demand of -1.0 implies a 10 per cent reduction in demand for every 10 per cent increase in price. Income-elasticity is the change in demand for a given change in income.

Second, the price elasticity of demand is relatively inelastic at -0.126 . This implies that the price mechanism, at present, is not an effective tool for managing the demand and consumption of residential water.' (Worthington et al 2007).

A separate study of the effects of mandatory water restriction on household water consumption in Sydney found a similarly low price elasticity of -0.17 (Grafton & Ward 2007).

There are many reasons why residential customers in particular are and will probably remain relatively insensitive to water prices, including:

- The low proportion of household income required to meet water bills, relative to other utility services;
- the relative infrequency of water price signals, which are often on a quarterly billing cycle, compared with, say, car fuel costs, which are typically incurred weekly;
- Water consumption occurs before water bills are presented to consumers;
- in multi-person households, the indirect linkage between the water-using behaviour of some household members and the payment of a bill which they may never see;
- some dwellings, especially those in older apartment buildings, still lack individual water meters;
- around 30 per cent of Australians rent their accommodation and do not receive water bills, which are sent instead to their landlords (Marsden Jacob 2006). This is consistent with the finding that the price and income-elasticity of water demand in Brisbane is higher in owner-occupied than in rental households (Worthington & Hoffmann 2007).

This suggests that urban households are less sensitive to water prices than other urban water users. Both groups were subject to rising prices over the period, and mandatory restrictions covered a greater share of household water use than non-residential use. Nevertheless, total urban residential water consumption was one per cent lower in 2007-08 than in 1995-96, while non-residential use was 34 per cent lower.

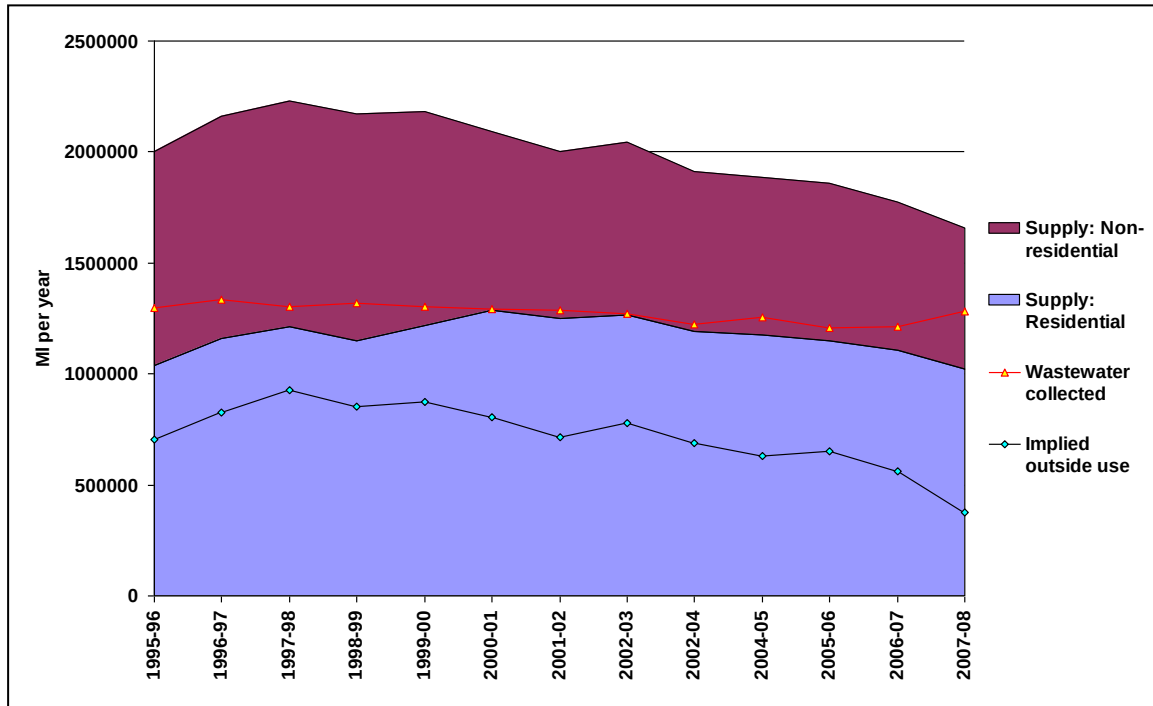
Annex C: Impact of water restrictions and alternative water supplies on households

As of March 2008, at least 75 per cent of Australians were living with mandatory water restrictions (Grafton & Ward 2007). Restrictions have been in place, in one form or another, in Canberra since December 2002, in Sydney since October 2003, in Melbourne since November 2002, in Brisbane since May 2005, in Adelaide since 2002 and Perth since the late 1990s.

Restrictions generally target outdoor water use through measures such as limiting the times when gardens may be watered, limiting the mode of watering or car-washing (e.g. to hand-held hoses or trigger nozzles) or prohibiting the hosing of hard surfaces. Some consumers seek out alternative means of water supply, mainly for outdoor uses. These include bores (popular in Perth), rainwater tanks, greywater diverters or temporary collection of greywater in buckets for garden use. There has been a small increase in the share of households with rainwater tanks since 2001 (Figure 49 and Figure 50). However, only 6.0 per cent of households (less than a third of those with rainwater tanks) use the water for an indoor purpose, and 0.5 per cent use greywater for this purpose (ABS 4602.0

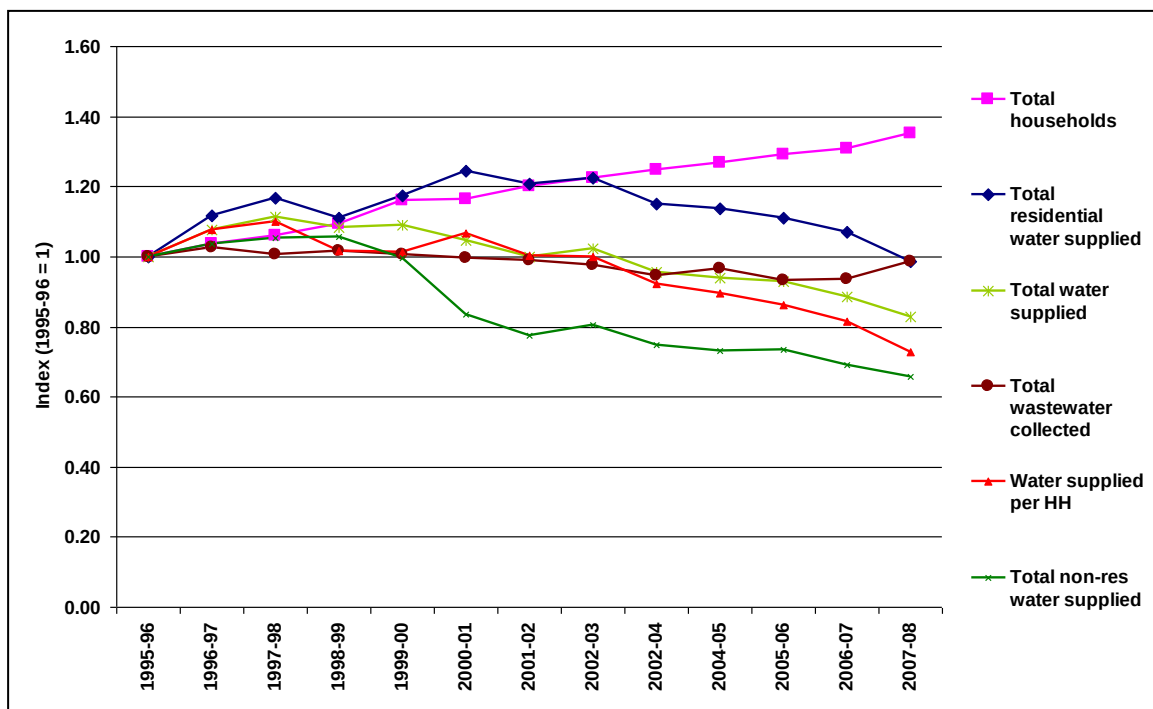
2007). Therefore the impact of alternative supplies on constraining indoor water demand has been minor.

Figure 48. Water supplies and wastewater collections by major urban water authorities, 1995-96 to 2007-08



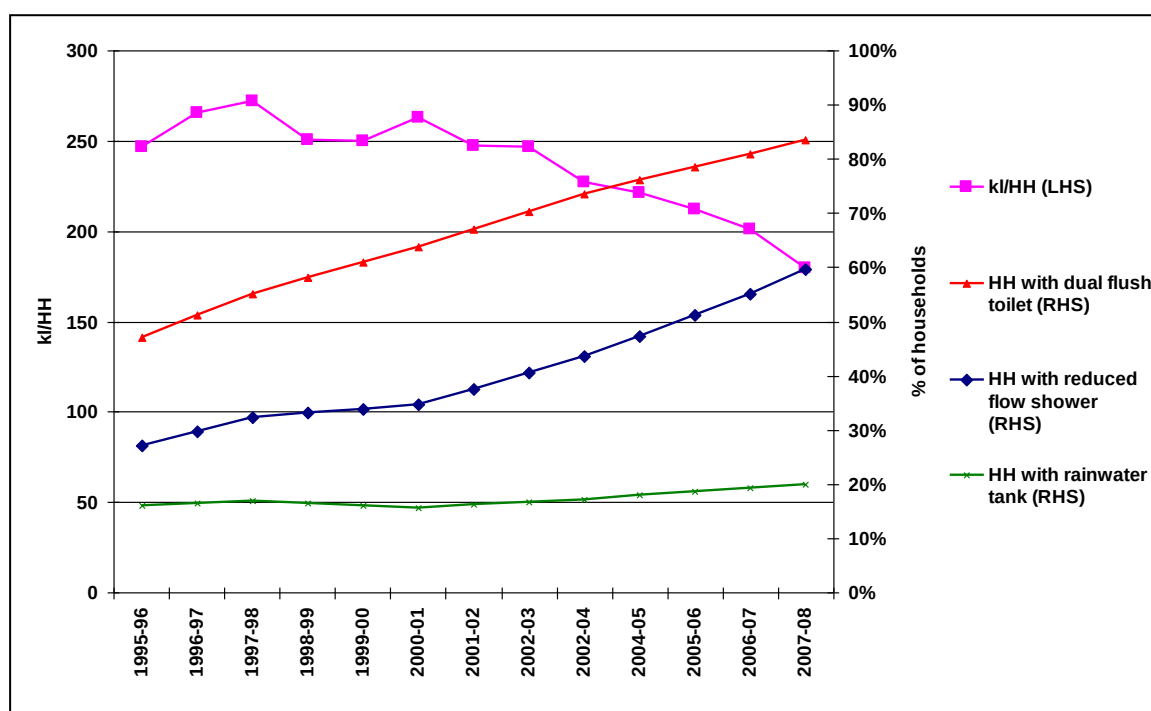
Source: Derived by author from WSAA (2001,2006,2007,2009). Covers all capital cities except Hobart, which does not have water metering

Figure 49. Change in key urban water supply parameters compared with 1995-96



Source: Derived by author from WSAA (2001,2006,2007,2009). Covers all capital cities except Hobart.

Figure 50. Mean household water use and presence of water-saving devices



Source: Mean household water use derived by author from WSAA (2001,2006,2007,2009). Presence of water-devices from ABS 4602.0 (2007)