E3 Equipment Energy Efficiency

Consultation Regulation Impact Statement – Electric Storage Water Heaters

Simplifying regulatory arrangements and improving energy efficiency

December 2013

A joint initiative of Australian, State and Territory and New Zealand Governments

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Overview

This paper presents policy options for consultation to streamline regulations and reduce the operating costs of electric storage hot water heaters to consumers. Water heating accounts for about 25% of an average Australian households energy use and about 30% in New Zealand. The potential net benefits of the options presented, over ten years, approach half a billion dollars with benefit to cost ratios of 8.2 for Australia and 3.9 for New Zealand and a co-benefit of saving almost 1 million tons of CO_2-e.

Policy options examined are:

- Moving from five 'standards' allowed for assessing tank heat loss to one standard and consolidating the testing methods used. This will ensure that information for consumers can be consistent and comparable;
- Lowering the levels of heat wastage that are allowed from hot water storage tanks;
- Removing loopholes to current requirements that exclude the storage tanks of solar and heat pump water heaters;
- Allowing testing of solar booster tanks to ensure that heat wastage levels and associated claims are accurate;
- Removing regulations which restrict the flexibility of water heater sizing;
- Exploring full alignment of Australian and New Zealand tank heat wastage requirements; and
- Labelling to allow consumers to compare the energy efficiency of different types of hot water technologies on a 'level-playing field'.

These options may impact consumers, manufacturers and importers of conventional electric water heaters, electric-boosted solar systems and heat pump water heaters.

Electric storage water heaters have had to meet government requirements on allowable levels of heat wastage from stored hot water since 1999 in Australia and 2002 in New Zealand. These heat losses impose a substantial 'hidden' cost on consumers which will occur regardless of their hot water usage. Over a 10-year appliance lifetime, these losses may cost around $1,774 or $1,697 to Australian or New Zealand consumers respectively[1] - typically more than the upfront purchase and installation cost of appliance. There has been no change to these heat loss requirements since 2005.

Marketing claims from different hot water heaters are often not comparable, making it very difficult for a consumer to make an informed choice. In many situations the purchaser of the hot water system (builders, plumbers or landlords) will not be responsible for the ongoing running costs of the systems. The continued lack of consistent information since the last government review in 2004 and a disincentive for some purchasers to appropriately consider running costs means that many hot water systems may be sub-optimal for consumers, especially when the total lifetime costs of systems are considered.

Some producers may also have an incentive to provide products and services that are aligned with the direction provided by consumers based on their preferences.

Electric storage water heaters are a prominent technology, constituting the bulk of installed water heaters in Australia and New Zealand with high, but declining sales. The significance of this technology may or may not increase in the future with the ability to allow increased levels of renewable generation in the electricity grid via the storage of excess grid energy and can provide a peak electricity demand management option through 'load shifting' measures. Such measures of outside the direct scope of this review, but are complemented by the policy options presented.

A number of policy options could improve the outcomes in the electric storage water heater market.

Feedback on these proposals, and the findings underpinning them, is now sought from stakeholders.

[1] Australia: Based on 2.43kWh heat loss per day and an average $0.20 electricity tariff over 10 years. New Zealand: Based on 1.86kWh heat loss per day and an average $0.25 electricity tariff over 10 years. Based on 200L delivery (Australia) and 200L nominal capacity (New Zealand) systems meeting minimum requirements in test conditions. Actual financial impact for a particular appliance will depend of installation location, tariff and the operational lifespan.

Purpose and feedback

This consultation Regulation Impact Statement document examines the potential impacts, costs and benefits of various policy options to alter the electric storage water heater (ESWH) market. These policy options have been developed to inform discussions on opportunities for consumers to save money by improving the energy efficiency of ESWHs and to streamline existing regulations, including rationalising five standards to one. Comments are sought on the policy options proposed for achieving the objectives of improving the energy efficiency of water heaters by addressing market failures and ensuring that ongoing regulation is efficient and effective. Questions which interested parties may wish to consider include:

Consumer matters

- How important is a reduction in running costs? While any new requirements may lower lifetime appliances costs, what payback period would be sought (how many years until any additional purchase costs are recouped and savings start to occur)?
- Are you concerned that conventional electric storage systems which have the ability to be upgraded (to solar or heat pump systems) are permitted to have poor thermal performance? Is a warning label on these products useful or needed? Are there alternative actions that should be considered?
- Would a label applied to all water heaters providing comparable information such as energy usage, hot water supply, climatic suitability and/or other information be useful?
- Is other information required to enable consumers to compare and choose appropriate water heaters?
- What is you view on the potential increase in consumer choice that could be created by the removal of government size restrictions or the potential reduction in consumer choice that could be caused by removing the water heaters with the poorest heat loss levels?

Standards and testing

- Do you value the removal of duplicate standards? Do you value consistent and comparable testing requirements and the related information being available to consumers? Should there be grandfathering provisions for all models currently registered to the older standards provided that they meet MEPS requirements?
- Do you support standardising the heat loss requirements to use a nominal capacity basis? If so, should hot water delivery information be provided on a storage tank?
- Do you support the removal of sizing limitations for electric storage water heaters?
- Would you like to see international requirements reproduced in Australia and New Zealand such as removing large conventional electric systems from the market (USA) or full labelling across all water heaters (Europe)?

Strengthening heat loss limits

- Is the magnitude of the proposed strengthening of heat loss limits for electric water heaters reasonable?
- Is the 'shaping' of the proposed strengthening of heat loss limits for Australian electric water heaters reasonable?
- If you manufacture or import an electric water heater that may be impacted by revised heat loss requirements, would you seek to re-introduce a new/revised system that complied or would you reduce your range?
- Is the proposal to delay any harmonisation of heat loss levels between Australia and New Zealand, until comparable data is available, a reasonable approach?

Solar and heat pump exclusion changes

- Is it important to be able to conduct 'off-the-shelf', consistent testing of heat loss requirements for all electric storage water heaters?
- Is it important to be able to subject electric storage water heaters to government random testing (check-testing) to ensure claims being made to consumers and governments (for building code requirements and rebate calculations/thresholds) are accurate?
- Should the storage tanks of all electric storage water heaters be subject to the same heat loss requirements as conventional electric systems?

General

- Do you have any suggestions about how to change or improve the policy options in this paper? If so, please provide a full explanation and support your suggestion. Are there other market failures or opportunities to streamline regulatory arrangements?
- Are there other policy options that should be considered? If so, please provide detail.
- Are there any additional categories of direct benefits or costs that have not been noted in this document?
- Is there additional data/information that is likely to improve the assumptions or findings of this document such as sales, pricing or related market trends?

Written comments should be sent via e-mail and received by close of business on **Monday 10 February 2014**. Comments can be sent to:

Email: energyrating@ret.gov.au **Subject:** Electric storage water heater RIS

Where data is provided as evidence for a claim (or to complement the data presented in this document), please ensure that this data can be verified (and provided to other stakeholders) to ensure that all data used is robust. All submissions may be published to ensure transparency.

Glossary

This glossary is designed for individuals not familiar with current hot water energy efficiency requirements. Any regulatory proposals would be based on technical definitions currently in use.

Conventional electric storage water heater – A water heater that heats water with one or more electric resistive elements and stores the water for later use.

CO2-e – Greenhouse gas emission impacts are commonly expressed in a standardised form as the 'carbon dioxide equivalent' (CO_2-e) of the greenhouse emissions (DCCEE 2012). This standardisation approach allows for the different global warming potential of the different greenhouse gases released by an activity, such as producing electricity.

Electric storage water heater (ESWH) – This term is used to cover three main types of water heaters: conventional electric storage water heaters, heat pump water heaters and electric-boosted solar water heaters. Additionally, the term ESWH relates to unvented water heaters unless otherwise specified.

Equipment Energy Efficiency (E3) Committee – A collaborative initiative involving representatives drawn from all jurisdictions in Australia and New Zealand that uses Minimum Energy Performance Standards and Energy Rating Labels to achieve reductions in energy use.

Heat pump water heater (HPWH) – A form of water heater that makes use of renewable energy via the ambient heat in the atmosphere. This type of water heater uses a refrigeration cycle to transfer heat energy from the air into the water.

Low pressure storage water heaters – These systems use an elevated 'header' tank which allows the system to supply water pressure to the user via gravity.

Mains pressure water heaters – An unvented displacement water heater that is intended to be connected directly to the 'main' town/city water supply. When water enters the inlet of the storage tank, it displaces water already stored which provides the water pressure for the user.

Ministerial Council on Energy (MCE) – The former national and policy governance body implementing the Council of Australian Governments national energy policy framework.

Solar water heater (SWH) – Solar collectors are used to convert and transfer heat from solar radiation into water. Common types of system include thermosiphon systems where a roof-mounted storage tank is located immediately above the collectors and split systems where the storage tank is located on the ground and water or another heat transfer medium is pumped to the collectors.

Small-scale Technology Certificates (STCs) – Certificates issued under the Commonwealth Small-scale Renewable Energy Scheme with the number of certificates issued based on the level of renewable energy the systems produces or displaces.

Unvented water heater – As water expands when heated, pressure may need to be released from a storage water heater for safety reasons. In unvented water heaters the pressure venting is controlled by a relief valve which may open periodically. This is the most common type of domestic water heater in Australia and constitutes most sales New Zealand.

Vented water heater – As water expands when heated, pressure may need to be released from a storage water heater for safety reasons. Vented water heaters have an opening to the atmosphere preventing the build-up of pressure and under no conditions of use can the pressure at the surface of the water be other than atmospheric.

Executive summary

Background

This consultation Regulatory Impact Statement (RIS) document examines the potential impacts, costs and benefits of various policy options to alter the electric storage water heater (ESWH) market. These policy options have been developed to inform discussions on opportunities for consumers to save money by improving the energy efficiency of ESWHs and to streamline existing regulations. The options considered include changes to the current tank heat loss requirements (including changes to exclusions, levels and testing consistency), improved product information and education activities. In examining these options, consideration has been given to the effect of consumer behaviour and implications to the wider water heater market.

The term 'electric storage water heater' covers three main types of water heaters: conventional electric storage water heaters, heat pump water heaters (HPWHs) and electric-boosted solar water heaters (SWHs). Conventional ESWHs, also known as electric resistive water heaters, heat water through one or more electric resistive elements and store the hot water for later use. ESWHs are also used as a key component of SWHs and HPWHs where the electric element typically provides limited heating (usually for 'boosting' low water temperature).

In Australia and New Zealand homes where electric storage water heaters are used, water heaters are a major contributor to the consumption of electricity and to greenhouse gas emissions (except when the electricity is from renewable sources). Water heating accounts for about 25% of the energy used in Australia's 8 million homes. About half of these homes have electric hot water heaters, producing up to 3 times the greenhouse gasses of low emission alternatives.

In New Zealand, water heating uses about 6% of the nation's total energy. In New Zealand homes, conventional ESWH are the predominant form of water heating, and electric water heating makes up about one-third of residential electricity consumption, substantially contributing to household energy costs.

Water heaters can have life-spans in excess of 10 years – the choice of a water heater can have large and long lasting implications to a consumer's energy bills.

Market characteristics

In Australia - based on 2011 Australian Bureau of Statistics data, conventional ESWHs constituted 52% of residential water heater stock in 2011, SWHs (both gas and electric) composing 9% and HPWHs responsible for around 2%. For SWHs, only part of the total number of SWH installations are electric boosted. Data suggests that around 65% of such installations in recent years are electrically boosted[2] – with the remaining systems using gas to supplement solar heating.

In New Zealand - conventional ESWHs dominate the New Zealand market. The majority of New Zealand houses still use low pressure water heating systems but low pressure systems are gradually being replaced by main pressure systems. Conventional ESWHs have a much greater share of the installed water heater market than Australia, estimated at 77% based on 1996 Census data (Statistics New Zealand 1996) and a 2005 survey (BRANZ 2005).

Regulatory arrangements

Conventional ESWHs have had to comply with Minimum Energy Performance Standards (MEPS) in the form of maximum tank heat loss requirements since 1999 in Australia and since 2002 in New Zealand. However, the ESWHs included as part of SWHs or HPWHs are currently excluded from these MEPS limits provided that they meet certain energy performance criteria.

These MEPS standards were last revised in 2005 but transitional arrangements agreed to in 2005 have resulted in the continued use of legacy standards. There are now a complex mix of test standards used across Australia and New Zealand (five standards covering three key methods of heat loss tests – see Appendix A, page 71). Further

[2] Provided by the former Department of Climate Change and Energy Efficiency (DCCEE).

confusion is caused by the various MEPS requirements that apply depending on the test method used and country of sale (Australia or New Zealand)– all of which reduces the clarity of MEPS standards for conventional ESWHs.

MEPS are typically revised every few years by the E3 Committee; however, MEPS requirements for ESWHs have not been updated for eight years.

International regulatory arrangements are also changing. In the USA, conventional ESWH larger than 55 gallons (200L) will be banned from 2015 while in the European Union a labelling framework will require standard energy efficiency and sizing information on all water heaters from 2015 to ensure consumers can make informed decisions. The EU requirements also include three scheduled energy efficiency MEPS increases and additional heat loss MEPS requirements.

The problem

When a consumer wants to purchase a water heater, the ability of a system to provide adequate hot water is generally the primary concern. The cost of a water heater is also a major consideration. The full financial cost of a system covers the purchase price, installation price and the running costs of the appliance. However, for consumers seeking to purchase a more efficient water heater, identifying the likely running costs of a water heater may be difficult and is time consuming. As water heaters can be responsible for around 25% of household energy bills, and as water heaters have lifespans in excess of 10 years, the implications of a consumer not finding a suitable system can be large.

Despite the availability of increasingly efficient water heater technologies and components, improvements in the average heat loss levels of ESWH since 2005 have been marginal (if any). This can be attributed to a number of factors such as heat loss levels not being an issue consumers are familiar with and the difficulty for manufactures or retailers in communicating the likely financial benefits to consumers. This could also be because current arrangements are efficient.

An additional outcome that can be observed in the market is that sales of highly efficient water heating technologies, such as SWHs and HPWHs, lag significantly behind those of conventional electric storage heaters. This is despite these systems generally having far lower lifetime costs. This has occurred despite improvements in product information and other educational material available to consumers. Again, this could be because current arrangements are efficient.

These outcomes may or may not be influenced by market failures in the water heating market. These failures may occur in the form of split incentives (where the buyer of the water heater is not responsible for the ongoing energy costs) and information failures (where appropriate and consistent information on key appliance aspects such as sizing, operating costs and payback periods is not available).

It is estimated that at least 50% of water heater purchases may be influenced by split incentives where the purchaser (a builder, plumber or landlord) will not be responsible for the running costs of a hot water system (see Split incentives, page 25). Information failures are viewed to affect the entire water heating market.

When electric storage water heaters were last reviewed by governments: it was noted that the lifetime financial impact of heat losses on a convention electric storage water heater was typically larger than the installed cost of the water heater; governments and manufacturers agreed that heat loss levels should be a purchasing consideration but there was little enquiry for such information (perhaps because consumer's do not value this characteristic or are unaware of the financial implications at that point in time); mandated heat loss levels should align with worlds best practice over the longer term, with a lag of several years to take account of domestic market circumstances; and the case for energy efficiency labelling was rejected due to a low variation of energy efficiency levels in existing products but that industry should provide more systematic information on running costs and greenhouse gas emissions.

All of the above problems noted and acted on previously, are again relevant in the market for ESWH. With little to no improvement in heat loss levels since the 2005 government intervention and large increases in electricity prices since 2005, the lifetime costs of heat loss levels are again now typically higher than the installed costs of an electric storage water heater. Heat loss information is still not present in marketing material and while government has made available existing comparative heat loss information, this information will understate actual heat loss levels in the vast majority of Australia and all of New Zealand, is difficult to use and is not widely accessed by consumers at point of sale. The gap between 'world's best practice' and Australia and New Zealand is growing with additional reforms taking place in Europe and the USA. With the emergence of new water heating technologies since 2005 in the form of HPWH, and higher sales of SWHs, there is an increase case for energy efficiency labelling for ESWH due to a higher spread of efficiencies and a continued lack of systematic industry information on running costs for ESWH. These features may or may not provide the basis for government intervention.

Regulations were introduced in response to the perceived problems and market failures noted in the previous government review. These perceived problems and market failures are again viewed to exist and additional concerns about the efficacy and efficiency of the current regulations have been raised.

Objectives

This project, as an element of the wider government energy efficiency strategies, is focused on the water storage tank of electric water heaters (includes solar and heat pump storage tanks) and the heat wastage levels of these tanks caused by water cooling over time (and needing to be reheated). The project has two broad objectives.

The first objective is to streamline regulations and at the same time increase their effectiveness. For electric water heaters there are currently a range of overlapping allowable tests and a number of loopholes are being used to bypass minimum energy wastage levels. Current regulations are neither fully efficient nor fully effective. Options such as moving to a single, existing test (designed to supersede the overlapping requirements), ensuring that compliance and claim checking can be conducted on all systems (most new water heaters to be covered are already privately conducting the required tests to become eligible for various government incentives) and removing unnecessary size restrictions (to increase consumer choice and manufacturer flexibility) are proposed.

The second objective of the project is to save consumers money by improving the energy efficiency of water heaters and address 'failures' in the water heater market. If the current range of allowable tests are being reviewed, it is opportune to review the minimum heat wastage levels and other policy options. The project has found that tighter permitted heat wastage levels would allow water heaters of all sizes to remain available on the market and provide strong overall community benefit. The project also notes the possibility of developing an energy efficiency label that could apply to all water heaters (electric, gas, solar and heat pumps). A label would help inform consumers about what system would best meet their needs rather than relying on government initiated regulations. Such hot water system labels have been agreed to in Europe following years of consultation and research. However, a labelling framework in Australia or New Zealand would first require consistent testing methods for all water heaters to ensure that information is comparable and can be trusted. Secondly the labelling would ideally be based on a wider measure of efficiency than storage tank energy wastage levels – so some additional work is required in deciding what information should be on any label, how the label should be designed to best communicate this information and how information could present each water heater technology on 'a level playing field'.

In Australia, governments pursue this targeting of energy efficiency market failures under the GEMS Act. New Zealand has its own regulatory powers contained within the *Energy Efficiency (Energy Using Products) Regulations 2002*. Pursuing greater levels of energy efficiency is a key element of the NSEE. Trans-tasman co-operation on energy efficiency is performed through the E3 Committee. Governments across Australia and New Zealand place a priority on removing the barriers to, and realising the benefits of improved energy efficiency of appliances and equipment.

Proposals to achieve objectives

A number of policy options have been modelled and analysed to address market failures and improve outcomes in the ESWH market by improving regulatory consistency; improving regulatory effectiveness; and delivering substantial net-benefits.

- **Proposal 1: Streamlining existing regulations:** Remove regulatory overlap by moving to a single (existing) test standard. Align the Australian and New Zealand MEPS basis, remove restrictive size limitations. Mitigate against MEPS loopholes. Enable compliance-checking of existing HPWH and SWH MEPS.
- **Proposal 2: Streamlining existing regulations and strengthening Australian MEPS:** Implement Proposal 1 and strengthen the Australian MEPS.
- **Proposal 3: Streamlining existing regulations, strengthening Australian MEPS and scheduling additional MEPS review:** Implement Proposal 2 and conduct a market review of average efficiency levels in 2016. The review will enable E3 to vary each nation's MEPS arrangements by up to 10% with the goal of full harmonisation of MEPS levels by 2017.
- **Proposal 4: Streamlining existing regulations and all ESWHs to be treated consistently:** Implement Proposal 1 and fully close compliance loopholes and improve heat loss characteristics of SWH and HPWH by subjecting all ESWH to the same MEPS requirements.

- **Proposal 5: Appliance labelling:** Investigate an energy rating label framework to apply to all water heaters (not just ESWHs) which provides both energy use and sizing information.

Other proposals also considered included voluntary efficiency standards, voluntary certification or labelling programs, consumer education campaigns and dis-endorsement labelling. These options were not subject to detailed modelling and analysis as they were viewed as not being able to deliver a justifiable impact on the efficiency of ESWHs – if stakeholders have suggestions about how these policies, or other approaches, could meet the objective of this report, submissions are welcome.

Conclusions

Overall, based on available information and analysis undertaken in preparing this report, there seems to be policies that are capable of meeting the identified objectives of this report. The identified policies include standardising/harmonising heat loss testing, closing emerging compliance loopholes and improving consumer outcomes by strengthening MEPS levels and improving the ability of consumers to make informed decisions. Similar tools are being used internationally to address identified market failures and to deliver significant energy savings for consumers.

Subject to consultation on the identified policy options, it appears that a revised MEPS option combined with an appliance labelling project would be most effective in meeting all the stated objectives. Based on current information, Proposal 3 is recommended for implementation closely followed by Proposal 2 which also has merit. Proposal 3 is estimated to deliver net benefits of almost half a billion dollars over ten years, with benefit to cost ratios of 8.2 for Australia and 3.9 for New Zealand and positive net impacts are modelled for every Australian State and Territory. Financial benefits would continue to accrue past this ten year period.

Proposal 3 is considered the most effective identified option as it produces more net benefits, energy savings and greenhouse gas emission abatement than any other option. Proposal 3 introduces more stringent MEPS levels in Australia in 2013, and again further strengthens the MEPS levels in Australia and New Zealand in 2017. Proposal 3 also contains the advantages of Proposal 1 in terms of improvements to the current regulatory situation which will result in improvements to customer protection.

However, there is some uncertainty about the actual additional benefits of Proposal 3 versus Proposal 2, as Proposal 3 is proposed to be based on a future market review. The future market under this proposal will have changed due to the consistent usage of one Standard and hydrochlorofluorocarbons restrictions impacting the New Zealand market. Consequently, Proposal 2 could also be considered as it appears to provide greater certainty while still producing substantial net benefits to consumers.

It is also recommended that Proposal 5, an appliance labelling project, is provided to decision makers as it will assist in addressing information failures. As appliance labelling requires a consistent and robust testing process to ensure accurate and comparable information, it is not recommended that Proposal 5 be commissioned without the regulatory streamlining reforms presented as part of each of the other proposals.

Stakeholder comment is now being sought on the policy options in this document (including alternative options), on the details underpinning each option, and the assumptions made in assessing the magnitude and scope of the impacts of the policy options.

1. Introduction

Background

The term electric storage water heater (ESWH) covers three main product types, conventional ESWHs, solar water heaters (SWHs) and heat pump water heaters (HPWHs). Conventional ESWHs, also known as electric resistive water heaters, heat water through one or more electric resistive elements and store the hot water for later use. ESWHs can also be used as a key component of SWHs and HPWHs where the electric element typically provides limited heating (usually for 'boosting' low water temperature), with solar radiation (solar) or ambient air temperature (heat pump) providing the primary heat source. ESWHs are used in homes and businesses.

In dwellings where conventional ESWHs are used, they are a substantial contributor to the consumption of electricity and to greenhouse gas emissions (unless the dwellings use renewable power sources). The levels of associated greenhouse gas emissions are generally higher in Australia than New Zealand due to large levels of coal-based electric generation leading to a more carbon-intensive electricity grid.

In Australia, water heating is the largest single source of greenhouse gas emissions from most dwellings. On average, each ESWH produces around four tonnes of greenhouse gas emissions every year. Conventional ESWHs may produce up to three times the greenhouse gases produced by low emission technologies such as SWHs, HPWHs or gas hot water systems[3].

In New Zealand, water heating uses about 6% of the nation's total energy (EECA 2013). In homes, conventional ESWH are the predominant form of water heating, and electric water heating makes up about one-third of residential electricity consumption, substantially contributing to household energy costs.

In July 2009, the Council of Australian Governments (COAG) agreed to the comprehensive, ten year National Strategy on Energy Efficiency (NSEE)[4], to accelerate energy efficiency improvements and deliver cost-effective energy efficiency gains across all sectors of the Australian economy. By addressing a number of areas where low cost energy efficiency opportunities exist and are yet to be fully exploited, the NSEE will enable Australians to access highly energy efficient appliances and equipment for residential, commercial and industrial applications, aligned with leading international standards.

The NSEE included a pathway for the hot water industry to move to a low emission future through a mix of regulatory and industry development elements (National Hot Water Strategic Framework)[5]. Projects were scheduled to examine the main hot water technology types (electric, gas, solar and heat pumps) and two 'classes' of residential buildings (houses and apartments).

The coordination of appliance energy efficiency efforts across Australia and New Zealand, an action in the NSEE, is conducted through national legislation (the *Greenhouse and Energy Minimum Standards (GEMS) Act 2012*) on behalf of the Equipment Energy Efficiency Committee (E3)[6]. Appliances to be considered by E3 are carefully chosen based on the degree of community benefit which could be generated by E3 activities. The level community benefit is influenced by factors such as the number of appliances being sold, the amount of energy used by appliances and the availability of better performing appliances.

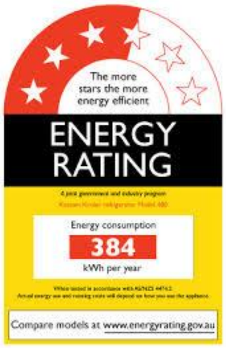
The activities of E3 have proved to be an extremely cost effective mechanism for reducing energy demand and greenhouse gases produced by consumer appliances, commercial and industrial equipment. It is currently estimated that E3 activities will yield a cumulative economic benefit to Australia of AUD$22.4 billion by 2024 and NZD$5.11 billion to New Zealand by 2036.

The main tools used by E3 are energy efficiency labelling and minimum energy performance standards. Energy efficiency labelling targets consumers. It requires that retailers provide information to consumers at the point of sale to enable the comparison of similar products on the basis of energy consumption and give manufacturers a

[3] Regulation Impact Statement: for Decision – Phasing Out Greenhouse-Intensive Water Heaters in Australian Homes
[4] http://www.coag.gov.au/sites/default/files/National_strategy_energy_efficiency.pdf
[5] http://www.ret.gov.au/documents/mce/energy-eff/nfee/committees/hot_water/default.html
[6] www.energyratings.gov.au

competitive marketing tool to promote efficiency improvements. Minimum energy performance standards target manufacturers and importers, requiring that specified products meet energy requirements which remove the worst performing products from the market. Technical requirements for MEPS are set out in the relevant appliance standard which can be referenced in state, territory and New Zealand regulations or a determination made under the Australian *Greenhouse and Energy Minimum Standards (GEMS) Act 2012*.

Figure 1: Example of an energy rating label



Reason for review

Best practice regulation and COAG

The COAG Best Practice Regulation Principle 6 requires that regulation is reviewed to ensure that it remains relevant and effective over time. Such a review should also consider the encouragement of competition, streamlining of the regulatory environment and reducing the regulatory burden on business arising from the stock of regulation. Under the COAG endorsed NSEE, there is also a goal to accelerate energy efficiency improvements and deliver cost-effective energy efficiency gains across all sectors of the Australian economy.

Ensuring regulations remain relevant and effective

The 2004 government Regulation Impact Statement (RIS), used as a basis for the 2005 reforms[7], noted that there was a market failure impacting the hot water market with heat losses from storage tanks at that time costing more that the installed costs of a water heater, by up to 20%. The RIS argued that the costs from these heat losses should be a consideration in consumer purchasing decisions but found low levels of consumer enquiry for such information. Additionally manufactures agreed that heat loss levels were not a primary or even a significant consideration in purchasing decisions.

There was a number of Objectives of the 2004 government RIS. Firstly technical differences in how ESWHs were being tested were to be removed to create uniform requirements and a regulatory level playing field. Secondly the 'world's best regulatory practice' would be applied over the longer term. This was defined as setting MEPS levels at broadly compatible levels with trading partner nations, but to follow these requirements with a lag of several years to take account of the domestic market. It was noted that Australian ESWH MEPS levels lagged behind New Zealand and North American MEPS. Finally it was noted that while the 2004 RIS did not include a proposal on mandatory energy labelling for water heaters, this was due to a small level of variation ESWH at the time, but it was also noted that there was a role for industry in providing more systematic information to consumers on running costs and greenhouse gas emissions.

The RIS and associated Ministerial decision resulted in more stringent MEPS for ESWH under 80L and new MEPS requirements introduced to heat exchange water heaters and vented water heaters[8]. Regulators and industry representatives, through the Standards Australia process, developed an improved testing methodology (introduced in 2005) with substantial public comment received. The Standards Australia Committee also undertook a 3 year testing development program which provided industry with the certainty it need to test under the existing standards, prior to the publication of the new improved testing requirements of AS/NZS4692.

For the regulations and the Ministerial decision to remain relevant, the regulatory requirements should be based on uniform requirements, with MEPS levels following (with a lag) the best practice as set by our trading partners, and the case for a label should be reviewed taking into account the efficiency spread of ESWHs and any systematic

[7] http://www.energyrating.gov.au/wp-content/uploads/Energy_Rating_Documents/Library/Heating/Electric_Water_Heaters/200403-riswaterheaters.pdf
[8] http://www.energyrating.gov.au/wp-content/uploads/Energy_Rating_Documents/Library/General/waterheater-300904.pdf

information being provided by industry. In line with best practice regulation requirements, competition effects, opportunities to reduce the stock of regulations and alternative policy options, including no action, should be considered. In line with COAG NSEE goals, opportunities to accelerate energy efficiency in a cost-effective manner should be explored.

The importance and challenges for ESWHs

The November 2012 report '*Reducing energy bills and improving efficiency*'[9] by the Australian Select Committee on Electricity Prices described energy efficiency as the 'low hanging fruit' of energy consumption reduction efforts and noted support for the GEMS program to drives energy efficiency though both MEPS and appliance efficiency labelling requirements.

The hot water market continues to be identified by Australian states and territories and the New Zealand government as a priority to improve consumer information and outcomes. Currently two appliances from this market are being investigated – electric storage water heaters and heat pump hot water heaters[10]. This project is focused on electric storage water heaters and has identified opportunities to reduce the number of regulations applying to these appliances while improving the effectiveness of current regulation. Research shows that substantial financial benefits to consumers and environmental benefits are achievable by limiting the heat wastage levels of water heaters without limiting the range of appliances available to consumers. The current MEPS requirements for ESWHs define the maximum allowable standing heat loss from the water storage tank, when tested under static conditions, and have been applicable for over 14 years in Australia (1999) and 11 years in New Zealand (2002).

ESWHs will remain a highly important appliance type into the future which gives additional reasons for policy makers to ensure that any regulatory requirements promote a level-playing field and to investigate market failures where the operation of the market may be unduly impacted. ESWHs are an appliance that could have a significant role in assisting the integration of high levels of renewable electricity into the grid by allowing the 'dumping' and storage of excess electricity generation. ESWHs could also have a role in optimising the electricity grid by demand shifting from peak to off-peak periods or even managing the constant differences between scheduled electricity generation and actual demand. These matters are outside the scope of this project, although there is a current E3 project examining the usage of electricity demand management devices in water heaters[11]. Regardless of the potential changes in the usage of ESWHs in the future, the ability to store heated water effectively and the ability for consistent heat loss information to be accessible to consumers are likely to remain be highly desirable.

Current ESWH regulations and market features

On 2 September 2005, a joint ESWH MEPS Standard for Australia and New Zealand was introduced by the Council of Standards Australia and Council of Standards New Zealand (AS/NZS4692.2.2005[12]) with the aim of simplifying and standardising arrangements. However, continued use of the different test methods that were in place at the time were permitted for transitional reasons. The MEPS levels for small water heaters were revised at the same time and the scope of the regulations were changed to include some less common types of ESWH.

The technical definitions and details of ESWHs subject to these requirements are contained within five standards AS1361, AS1056, NZS4602, NZS4606 or AS/NZS4692.1 with the applicable maximum heat loss levels presented in AS/NZS4692.2. These standards are applied within Australia and New Zealand by being referenced in relevant Acts, regulations and codes.

[9] http://www.aph.gov.au/Parliamentary_Business/Committees/Senate_Committees?url=electricityprices_ctte/electricityprices/report/index.htm

[10] Earlier research documents for electric storage water heaters and heat pump water heaters have been complied and subject to public consultation. Details are available at www.energyratings.gov.au.

[11] http://www.energyrating.gov.au/products-themes/demand-response/

[12] The formal names for standards always contain a reference to the year of their introduction, but to simplify discussion in this document, the year reference is not included in subsequent references to standards. Hence AS/NZS4692.2.2005 is referred to as AS/NZS4692.2.

Due to the complex mix of test standards currently in use for conventional ESWHs, differences exist in:

- permitted heat loss levels for various technologies of ESWHs;
- permitted heat loss levels for tanks being manufactured/imported into Australia compared to those manufactured/imported into New Zealand;
- permitted heat loss allowances for ancillary equipment or tank features; and
- calculation and test methods for water heaters sold in Australia and New Zealand.

Due to the nature of these test methods, the measured heat loss levels under the standards are not directly comparable with each other making it difficult to provide consumers with clear information about the heat loss characteristics of different water heaters or the associated running costs.

The transitional arrangements that have allowed the continued use of the legacy standards since the creation of the joint Standard have now been in place for eight years. The closure of this transitional arrangement in conjunction with any other regulatory changes that may occur as a result of the policies proposed in this document would be timely, reduce regulatory overlap and streamline future standards revisions for government, manufacturers, importers and other interested parties.

Heat losses from ESWHs occur regardless of hot water demands of the consumer, with losses occurring while the storage tank contains hot water. Improved heat loss levels can provide consumers a substantial financial advantage over the long life-span of an ESWH. Past government intervention on heat loss levels of ESWHs have resulted in improvements. However, market failures are constraining additional improvements in the heat loss characteristics of ESWH being installed. As there are a range of products with different heat loss levels for all sizes of ESWH already available on the market, there already exists the potential for tightening the maximum amount of heat loss that is permitted.

For SWHs and HPWHs, the current MEPS requirements only exclude SWHs and HPWHs when these systems are modelled to provide a reasonable level of energy savings compared to a conventional ESWH. However, this modelling cannot be independently assessed for compliance by governments or consumers and is based on the system operating correctly, being installed correctly and being well matched to a consumer’s hot water requirements and climatic zone.

There may be a case for simplifying this requirement to ensure that the claims can be tested through compliance and consumers are receiving products that meet the MEPS requirements specific to SWHs and HPWHs. Additionally a compliance loophole has been identified where the installation of below MEPS performing ESWH is currently permitted (such as units sold as ‘solar-ready’). This loophole has led to water heaters being installed and operated as conventional ESWH which may not meet the minimum heat loss level requirements – and thereby increasing energy consumption and operating costs.

Comparable information on heat loss is not available at the point of purchase. Heat loss will occur regardless of the hot water demands of the consumer and as it is unlikely the consumer would notice the impacts of heat loss on the amount of hot water available or on their electricity bills. As a result consumers are generally unaware of the existence or implications heat losses and are not able to make fully informed purchasing decisions as a result.

Overall, under the above circumstances there appears to be considerable potential to meet the government objectives of improving the efficiency and effectiveness of regulations and to save consumers money through improved energy efficiency. This document explores these opportunities and analyses the potential costs and benefits of identified policy options that could deliver the stated objectives.

Scope

This consultation Regulation Impact Statement (RIS) has been prepared to enable informed discussion on potential costs and benefits arising from the policy options to meet the objectives of regulatory improvement and energy efficiency. The RIS follows consultation concerning the Product Profile on ESWH released in July 2012 (EnergyConsult 2012). This RIS seeks to provide, to varying degrees:

- **Regulatory consistency** – removing regulatory overlap and harmonising remaining arrangements.
  - Potentially impacting: Registrations and tests for conventional ESWHs, SWHs and HPWHs; low and mains pressure ESWHs; and consumer information.
  - Not impacting: Water heaters outside the scope of the existing ESWH Standards.
- **Regulatory effectiveness** – updating existing requirements that do not work as intended and closing loopholes.
  - Potentially impacting: Conventional ESWHs sold as 'solar ready'; SWH and HPWH exclusions; and manufacturers wishing to produce ESWHs of non-standard sizes.
  - Not impacting: Existing conventional ESWHs.
- **Net-benefits** – providing financial savings to consumers based on existing technological outcomes.
  - Potentially impacting: MEPS requirements for unvented ESWHs, information and labelling requirements, availability of educational resources or key product information.
  - Not impacting: Building code requirements; or installer licencing requirements.

In investigating these outcomes, the policy options explored in this RIS include:

- Business-as-usual (no change);
- Consolidation of the Australia and New Zealand testing requirements the single, existing joint standard AS/NZS4692.1 (as intended in 2005);
- Harmonise and improve the relevance of the methods by which tank heat loss is calculated (to be based on nominal capacity) and to require the disclosure of rated hot water delivery for all tanks (essential consumer information);
- Addressing the shortcomings of MEPS arrangements for SWHs and HPWHs to enable for the first time independent compliance of heat loss claims currently being made and to provide consumers basic protection from incorrectly operating, poorly installed or poorly chosen systems which have a significant reliance on electric boosting. Only the systems with the very highest levels of heat loss for a give size are anticipated to be affected by a new, specific MEPS in acknowledgement that these systems are generally far more efficient that conventional ESWHs;
- Mitigating the existing MEPS compliance loophole associated with 'solar/heat pump ready' tanks;
- Initiating an investigation into appliance labelling for hot water heaters which could help ensure that important information can be provided on a consistent basis and allow consumers to drive improvements in the hot water market;
- Removing the unnecessarily prescriptive 'stepped' based MEPS framework and allowing a 'smooth line' MEPS to provide more flexibility and innovation in manufacturing as well as improved consumer choice (for example an Australian water heater suppling 199 L of hot water has a heat loss requirement over 10% more stringent than a system supplying 200 L[13], but an identical requirement to a 160 L system – as a consequence systems are generally designed to supply either 160 L or 200 L rather than values between these MEPS 'steps').;
- Strengthening Australian MEPS requirements, although not to the level of New Zealand requirements. The nominally higher New Zealand MEPS levels are to be maintained;
- Commissioning a future market review to investigate strengthened and/or harmonised Australian and New Zealand MEPS levels informed by the availability of transparent and consistent information; and
- Instigating a consumer education campaign to help ensure that appropriate water heaters are chosen and average life-time costs of different water heating technologies are highlighted.

Stakeholders with an interest in the exact scope of this report may wish to note that, for simplicity, the term ESWH in this document relates only to unvented ESWHs, unless otherwise specified. It is also important to note that water heating technologies such as gas water heaters or renewable pre-heat systems are not in scope of the regulatory improvement policy options, but may be affected by the information-focused labelling investigation and consumer education campaign options.

[13] Based on Table A1 of AS/NZS4692.2 comparing the post-October 2005 MEPS for unvented electric storage water heaters of 160L rated hot water delivery (2.02 kWh/24h) with the MEPS for 200 L rated hot water delivery (2.23 kWh/24h).

While the RIS is nominally focused on ESWH, customers seeking to purchase a hot water system will not constrain themselves to this narrow section of the wider hot water market. When this RIS considers consumer behaviour and the operation of the market for ESWH, discussion of the wider hot water market is necessary. In addition, as ESWHs are one of the available technology choices in the market, any change to this section of the market will have implications for other technologies. However, from a modelling perspective, any flow-on impact to the wider market is considered to be a second-order effect and is out-of-scope. As ESWHs are generally one of the less efficient or more expensive to operate technology choices, any shift to other technologies as a result of changes to the ESWH market would likely provide net financial benefit to consumers and positively affect energy productivity.

It is also important to note that there is also a project under consideration by the E3 committee which is examining energy efficiency requirements for HPWHs. Interested stakeholders can access the relevant Consultation RIS and other project details from www.energyrating.gov.au.

2. Current ESWH market

Market characteristics

This section of the RIS provides a brief overview of the difference between the Australian and New Zealand water heater markets, including government policies, notes the key industry stakeholders and provides estimates on the installed stock of water heaters and sales levels. For general information on aspects of the water heater market that are not directly linked to the proposals being considered, please see *Appendix B – Market Features*.

Conventional ESWHs come in a variety of types and sizes. Restricted tariff units tend to be larger in size and installed in the detached house and townhouse market. ESWHs on a continuous tariff tend to be much smaller units and are often preferred for flats and apartments. While larger ESWHs tend to have higher heat losses than smaller ESWHs, a large system that uses a cheaper restricted (off-peak) tariff may not necessarily cost the consumer more than a smaller system using a more expensive continuous tariff - however energy consumption will be greater for the large systems.

Australian market

Based on 2011 Australian Bureau of Statistics (ABS) data, conventional ESWHs constituted 52% of residential water heater stock in 2011, SWHs (both gas and electric) composing 9% and HPWHs responsible for around 2% (ABS 2011). Gas water heaters constitute the remainder of the sales. The share of water heaters sales for conventional ESWHs in 2011 estimated to be 29% of total sales, or around 270,000 units (derived GWA 2010). This means that proportion of conventional ESWHs in the installed water heater stock is declining.

For SWHs, only part of the total number of SWH installations will be electric boosted. Data provided by the Clean Energy Regulator (CER) suggest around 65% of such installations in recent years are electrically boosted – with the remaining systems using gas to supplement solar heating. This equates to around 4.5% of the total water heater sales in Australia being electrically boosted SWHs. Recent regulatory changes and rebates at the state and national level have assisted the sales of SWHs and HPWHs, especially for installations in new homes.

Based on data provided by the CER, approximately 65,000 electrically boosted solar systems are estimated to have been installed in 2010 however 80,000 may have been installed in 2011. The annual Australian market for HPWHs was under 5,000 units five years ago and has increased to around 70,000 in 2009. In 2011 the total number of HPWHs installed decreased to approximately 20,000.

The decline in sales of conventional ESWH in recent years is partially in response to restrictions on the installation of conventional ESWHs due to their relatively high level of associated greenhouse gas emissions. The restrictions, or phasing-out, of greenhouse gas intensive hot water systems have targeted Class 1 buildings (defined as detached, row, terrace or townhouses in the National Construction Code).

Under the Building Code of Australia (BCA 2010), greenhouse gas intensive hot water systems can no longer be installed in new Class 1 buildings. However, the Northern Territory, Tasmania and Victoria have not adopted the relevant provisions of BCA 2010. Victoria introduced a related requirement for either a SWH or a plumbed rainwater tank to be installed. In addition, Queensland recently removed its restriction on greenhouse gas intensive hot water systems.

The decline in sales was also affected by a partial phase-out of electric water heaters for existing Class 1 buildings in two States, rebates and incentives encouraging the installation of lower emission water heaters and the increasing cost of electricity.

New Zealand market

Conventional ESWHs dominate the New Zealand market and generally these tanks are either 135 litres (30 gallon), or 180 litres (40 gallon) in capacity. Most of these water heating systems use an elevated header tank in conjunction with the storage tank to supply the pressure. The majority of New Zealand houses still use low pressure water heating systems but sales of mains pressure systems have increased in recent years to over half of all sales.

It is estimated that about 77% of homes have a conventional ESWH installed, which is a much greater share than in the Australian market. This estimate is based on 1996 Census data (Statistics New Zealand 1996) and a more recent (much smaller) survey (BRANZ 2005) which show that the proportion of homes using only electricity to heat water is between 73% and 82%. Allowing for a trend towards the use of instantaneous gas water heaters since the 1990s, the number of conventional ESWH currently installed in homes and businesses is estimated at 1,225,000.

Conventional ESWHs are expected to continue to have a major share of the New Zealand market because there are no anticipated changes to government policy regarding hot water heaters outside of potential MEPS reforms. In 2011, sales of SWHs and HPWHs were only equivalent to approximately 6% and 2% of the sales of conventional ESWHs respectively.

Manufacturers

In both Australia and New Zealand, ESWH sales are dominated by a few key suppliers. In Australia the majority of sales are by Rheem, Rinnai and Dux and consist principally of sales of conventional ESWHs i.e., not HPWHs or SWHs. In New Zealand, Rheem is also the dominant player with around two thirds of the market share. As some companies produce water heaters with different branding, the degree of market dominance of a small number of key manufacturers is often not apparent to consumers.

Australia has had a well-established SWH manufacturing base for many years with over 50 SWH manufacturers currently operating and a wide variety of product types are available. Some of the larger manufacturers include Solahart, Chromagen, Dux, Edwards and Rinnai Sunmaster. There are also now 18 different suppliers of HPWHs in Australia including Rheem, Dux, Quantum, Siddons and Stiebel Eltron.

In New Zealand there are five major SWH manufacturers selling a total of 3,000 systems annually. Nova is the dominant company and other major players include Solar City, Solar Group, Switch and Eco Solar. The HPWH market is smaller, with around 1,000 sales annually. Local manufacturers of HPWH include Hot Water Heat Pumps and Econergy. There are also twelve suppliers of imported HPWHs including New Zealand divisions of Rheem and Quantum.

Market trends

Australian market trends

There are a number of market drivers which have contributed to the increasing sales of SWHs and HPWHs at the expense of sales of conventional ESWH. Some of these drivers are expected to continue into the future. The main drivers identified are:

- The Australian Government Renewable Energy Target and Small-scale Renewable Energy Scheme;
- Rebates and white certificate schemes; and
- Water heater regulations.

The Small-scale Renewable Energy Scheme, rebates programs and white certificate schemes are separate mechanisms that reduce the effective cost to the consumer of installing low emission water heaters. Regulations in most jurisdictions also encourage the installation of low emission water heaters. These factors have contributed to the current market trends which suggest that Australians are moving away from conventional ESWHs. In 2008, 53% of Australian dwellings used conventional ESWHs and about half of water heater sales were conventional ESWHs but by 2010 the share of sales for these products had dropped to 29% (GWA 2010). These factors have resulted in a significant increase in the sales of SWHs and HPWHs over the past few years and to varying degrees are likely to drive an increase in sales in the future, noting that some rebate programs have recently closed and others have either a fixed duration and/or a maximum amount of funding.

Another factor in Australia which may affect the nature of the conventional ESWHs is a shift to time-of-use tariffs. At present approximately 75% of conventional ESWHs are on some form of restricted tariff. Sustained changes in tariffs may affect both the size and cost of operating ESWHs.

New Zealand market trends

The vast majority of water heating in New Zealand is provided by conventional ESWHs. In recent years increasing electricity prices, some expansion of the reticulated gas supply, increasing popularity of gas water heating as well as concern about the environment have become factors which have put pressure on the market for conventional ESWHs. Unlike the shift to SWHs and HPWHs in Australia, gas water heater sales, in particular, have increased and now stand at approximately half the comparable number of conventional ESWH sales (E3 2012). As a result, there is a slow decline in predicted conventional ESWH stock from 1,250,000 in 2011 to 1,000,000 in 2025 (forecast in Figure 3).

Between November 2006 and June 2012, EECA's ENERGYWISE program provided SWH grants in various forms for eligible households. The same program also provided grants for eligible HPWHs between January 2011 and June 2012. While both grant schemes have recently ended, the consumer information provision component of the ENERGYWISE program continues.

Another trend is that New Zealand households are increasingly converting from low pressure hot water systems to mains pressure systems. Low pressure systems generally have better heat loss characteristics than comparable mains pressure systems. This trend has been occurring due to households seeking to reduce the effect of multiple users of hot water reducing the delivery pressure. The trend in new housing is likely to see more mains pressure systems being installed and as a result the conventional ESWH products in the New Zealand market may become increasingly similar to the Australian market.

At present, water is predominantly heated outside periods of peak transmission loads using a 'restricted tariff'. The current price differential between the general and the restricted tariffs could result in a gradual shift towards the use of the latter. This would lead to larger sized ESWH products being installed in New Zealand, similar to the size of products on the Australian market, to better take advantage of these tariffs.

Current and forecast stock and sales

The estimated current stock of conventional ESWHs, HPWHs and SWHs in Australia and New Zealand is presented in the table below, estimated from census and surveys (ABS 2011, BRANZ 2005). The size of the New Zealand stock is approximately 20% of Australia's stock. These estimates include commercial installations.

Table 1: Estimated current storage water heater stock - 2012

Type	Australia	New Zealand
Conventional Electric	4,320,000	1,225,000
Solar-Electric	627,000	31,000
Heat Pump	158,000	2,500
Total	**5,105,000**	**1,258,500**

The total number of water heaters in Australia and New Zealand is increasing, and conventional ESWHs are being progressively replaced with gas, SWHs and HPWHs, leading to a reduction in the stock of conventional ESWHs. In particular, there are fewer installations of conventional ESWH occurring in new buildings, due to regulatory pressure and consumer preference (Figure 2 illustrates).

The 2011 sales of conventional ESWHs, SWHs and HPWHs in Australia and New Zealand have also been estimated.

Table 2: Estimated annual storage water heater sales - 2011

Type	Australia	New Zealand
Conventional Electric	270,000	53,000
Solar-Electric	80,000	3,000
Heat Pump	20,000	1,000
Total	**370,000**	**57,000**

These 2011 estimates are based on estimated replacement rates for installed ESWHs and industry research on annual sales. Stakeholder consultation in 2012 provided industry feedback that the sales of SWHs and HPWHs may have declined during 2012, with a greater uptake of conventional ESWHs and instantaneous gas water heaters. However, there is no reliable data available to confirm if there has been a change in the market trends.

Forecasts have been developed for the future sales of ESWHs, SWHs and HPWHs in Australia and New Zealand using historic sales and stock figures as well as sales trends over recent years, which ignores the reported decrease in SWH and HPWH sales in 2012. These projections are based on business-as-usual settings – i.e. they assume no change in government regulations, rebates/subsidies and no significant external shocks to the market. Information on the assumptions used, including the assumed rate of improvement in heat loss levels, are at *Appendix C – ESWH RIS Modelling Summary*.

Figure 2: Forecast sales of electric storage water heaters in Australia and New Zealand

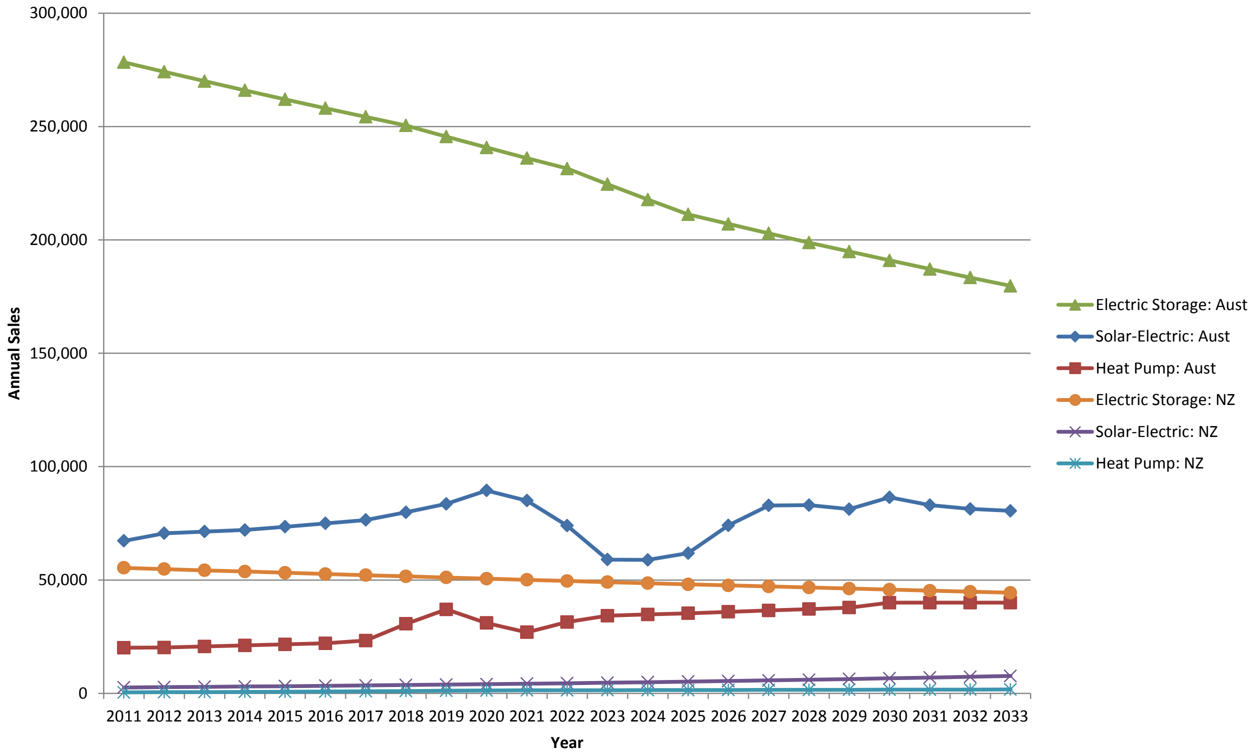


Figure 2 shows the forecast sales in Australia and New Zealand (New Zealand specific figures can be found in *Appendix B – Market Features*). The results show a decline in the sale of conventional ESWHs while the corresponding number of sales of SWHs and HPWHs increase over the longer term.

The projected rapid increase in sales of SWHs and HPWHs in Australia during the period 2018-2020, and subsequent decline for the following few years, is due to householders replacing units to the end of their life which were purchased in the mid to late 2000's when government incentives created a surge in the installations of SWHs and HPWHs before the incentives were decreased. These trends differ slightly between the SWHs and HPWHs due to differences in operating lives and number of original sales.

Figure 3: Forecast stock of electric storage water heaters in Australia and New Zealand

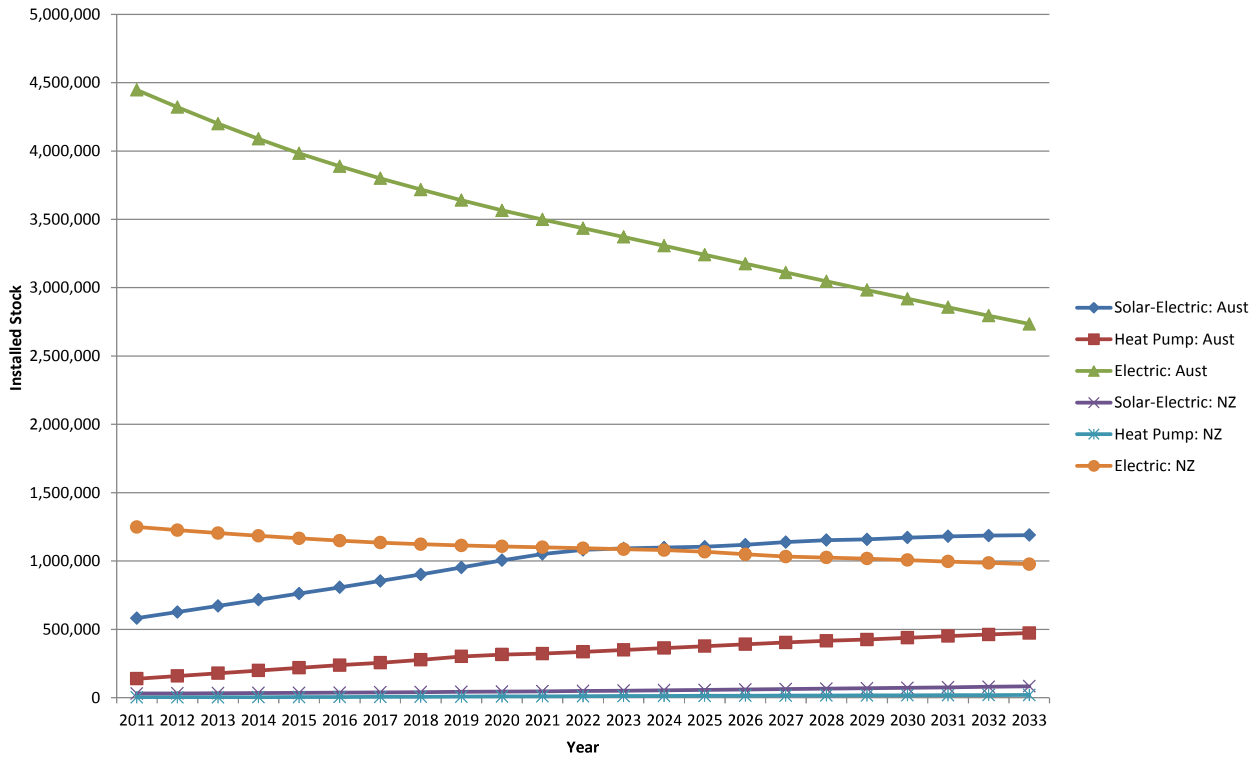


Figure 3 shows the forecast stock in Australia and New Zealand. Again, conventional ESWH numbers decrease in the longer term while SWHs and HPWHs increase. In New Zealand the decline in conventional ESWHs is less pronounced as is the increase in sales of SWHs and HPWHs.

Current and forecast energy consumption levels

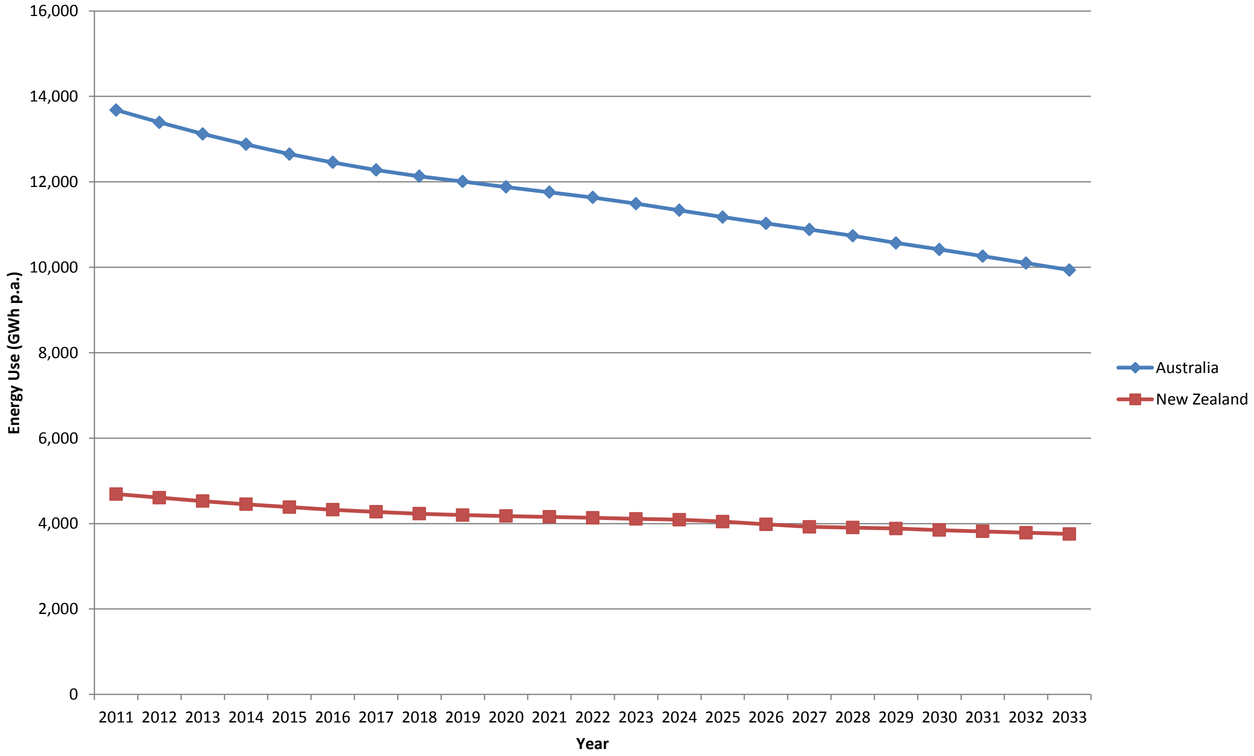
The sources of energy consumption for ESWHs include electric resistive heating, operating a compressor and associated parts (HPWHs) and pumping of water or alternative heat transfer fluids (some SWHs and HPWHs). The energy consumption is in response to hot water demand and reheating water following tank heat loss. The majority of energy consumption for a properly functioning ESWH relates to the energy supplied in the form of hot water demanded by the user. However, tank heat loss levels create an unavoidable energy loss to a consumer as these losses will be occurring regardless of a consumer's behaviour and level of hot water demand. While generally a smaller component of energy use, tank heat losses are a form of wasted energy. These tank losses are the subject of the current MEPS framework.

In order to develop estimates of current and future business-as-usual (BAU) energy consumption of ESWHs, by product and technology type, several parameters were taken into account: the market share of different sizes and types of water heaters, the anticipated sales trends for different ESWH types, the impact on such trends of carbon pricing and estimates of improvements in the energy efficiency of the different technologies. *Appendix C – ESWH RIS Modelling Summary* contains details of assumptions while *Appendix B – Market Features* provides a detailed forecast of energy consumption by ESWH technology. Forecasts of total annual energy consumption for ESWHs and by each nation are presented in Figure 4.

The figures indicate a decline in energy consumption in Australia over the forecast period largely through a decrease in the proportion of stock that are conventional ESWHs and an increase in the proportion of stock of more efficient SWHs and HPWHs.

The decline in energy consumption also occurs in New Zealand but is not as pronounced. The New Zealand decline is a reflection of the decrease in the total numbers of ESWHs of all types due to the uptake of gas water heaters which are not subject to analysis in this RIS.

Figure 4: Total annual energy consumption of all electric storage water heaters

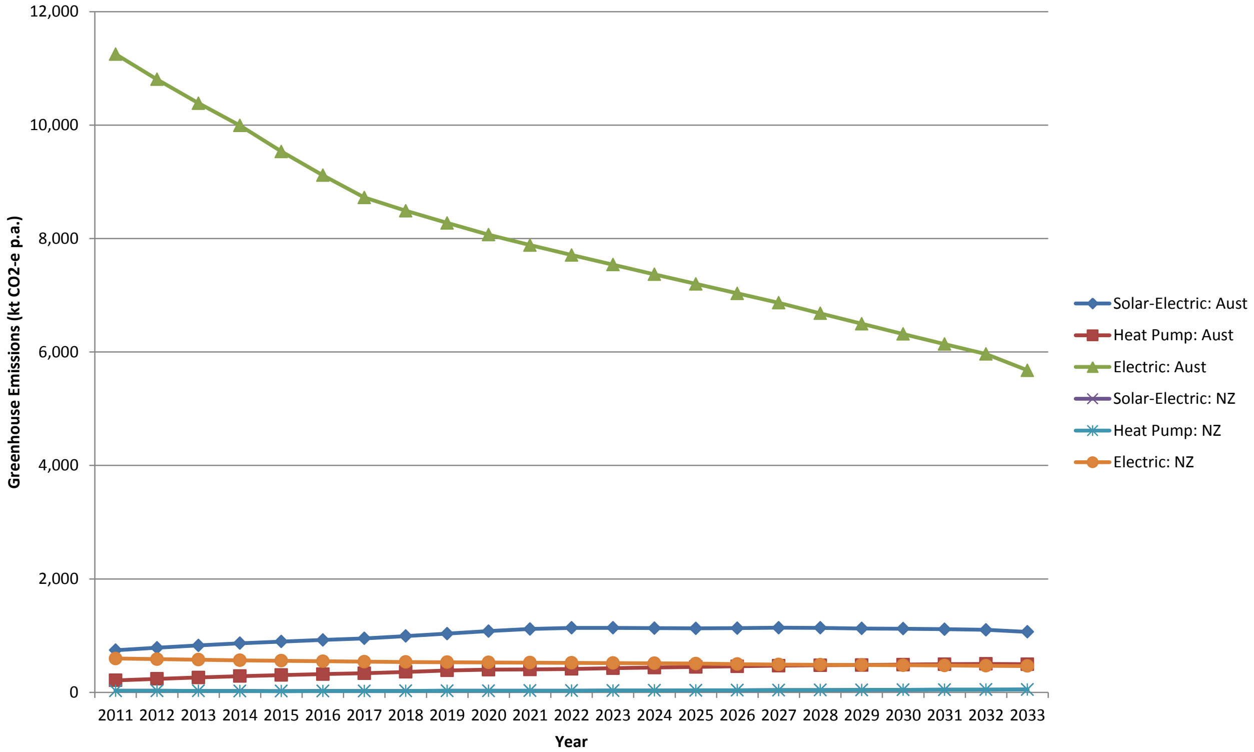


Greenhouse gas emission characteristics

The greenhouse gas emissions of ESWHs were calculated from energy consumption data and the resulting emissions forecast for each technology type is illustrated in Figure 5. For Australia under a business-as-usual scenario, there is a reduction of emissions associated with ESWH usage due to both reduced installations of the greenhouse gas emission intensive conventional ESWH and a change to less emission intensive electricity generation. There is a lower level of change estimated for New Zealand due to smaller changes in stock numbers and less change in electricity generation emission factors.

The difference between the greenhouse gas emissions of water heating in Australia and New Zealand is larger than the difference in energy consumption as New Zealand's electricity supply is less carbon-intensive due to the large proportion of renewable energy.

Figure 5: Annual greenhouse gas emissions of electric storage water heaters by technology



The total greenhouse gas emissions from both Australia and New Zealand from all forms of electric storage water heating are expected to decline due to decreases in installed stock numbers, reductions in energy consumption and expected changes in emission factors for electricity.

Consumer behaviour

A variety of factors influence consumer purchasing decisions. These include individual preferences, available options and decision making processes. Understanding how consumers behave and take decisions in relation to hot water systems is important in considering options to support them in taking informed decisions.

Consumer preferences

Traditional economic theory assumes that consumers make choices to maximise their satisfaction, otherwise known as utility. Consumer choices are assumed to be driven by preferences, constraints and prices. The most obvious considerations in the hot water market are:

- Perceived ability of the system to provide sufficient hot water;
- Capital costs and 'lifetime costs'; and
- Time to research a suitable system and importantly the time it will take to be installed.

As most water heaters are installed out of clear sight, it is unlikely that their appearance is a key purchasing consideration. However in instances where systems may be installed in highly visible locations, systems are available in a range of colours. The noise levels of HPWHs may also be a consideration for some consumers.

If lifetime costs are one of the key drivers of consumer preference, are increasing energy costs already driving consumers to products with lower costs? While household energy prices have been increasing in recent years (electricity prices increased by about two thirds between 2006 and 2012 (AER 2012)), the sales levels of relatively cheap conventional ESWH have been relatively stable in recent years (36% of all Australia sales in 2008, and 25% in both 2010 and 2012 (BIS 2012)). The stable sales across 2010 and 2012 occurred even though there were some regulatory restrictions on conventional ESWH at a jurisdictional level (sales in South Australia dropped from 25% to 8%). This suggests the increasing impact of energy costs in recent times has had little impact on consumer behaviour to date. It would appear that for the majority of consumers purchasing water heaters, upfront cost appeared to be the main consideration in the purchase.

While capital costs appear to be a dominant factor for many consumers, sales of SWHs and HPWHs still occur albeit at a relatively low level. These technologies have no clear advantage over the dominant cheaper ESWH technology except that they have lower lifetime energy usage and thereby lower lifetime operating costs and emissions levels. As there are no other clear advantages, it is reasonable to conclude that the lower lifetime energy usage is a preference for some water heater buyers, whether motivated by financial or environmental concerns. The marketing of these systems, which focuses on levels of "free hot water" that systems can provide or on "percentages of energy saving" that can occur seem to confirm this conclusion.

Marketing of conventional ESWHs is generally limited to the ability to supply stored hot water instantly, the ability to reheat water quickly, warranty periods and ease of installation. This suggests that these factors, rather than lifetime costs, are currently driving consumer purchasing decisions.

However, the ability to connect some system to lower cost off-peak electricity is also a marketed feature which demonstrates that the running cost of ESWH is also important to some consumers. As conventional ESWHs all heat water in a similar manner, the main drivers of running costs are the amount of hot water used, the cost of the electricity used and the amount of tank heat loss. Marketing of the features that drive tank heat loss such as insulation type and thickness, stratification of water and location of tank fittings does not seem to feature in the vast majority of advertising material despite the financial impact of heat loss for a conventional ESWH likely exceeding the installed cost of the appliance. The advertising of off-peak electricity suitability indicates that some consumers of conventional ESWH may be interested in running costs. However, the lack of marketing information on heat loss characteristics, which also lower costs, indicates that providing heat loss information may be too difficult to do in a manner meaningful to the consumer – otherwise appliances with better heat loss characteristics would be able to advertise this fact and gain a commercial advantage. It is noted in the 2004 government review of ESWHs that a proposal for mandated energy efficiency appliance labelling was rejected at that time in favour of a MEPS-only proposal but the industry was called on to provide more systematic information to customers on running costs and greenhouse gas emissions – such systematic information has not been introduced.

Consumer choice process

The process and influences that drive consumer behaviour are key to understanding the current market and how any measures may better inform consumer behaviour.

Water heaters are purchased in different ways from many household appliances as they are not regularly sold through retail stores, but rather decisions are often made through agents such as plumbers and builders. This complicates consumer behaviour and creates a unique consumer choice process that needs to be considered. The market research company Artcraft Research reports:

> *Qualitative research has shown anecdotally that the purchase decision-making process for hot water systems (and air conditioners) is considerably different from the decision process for refrigerators. The decision regarding a refrigerator is fairly clear-cut and considered – there is usually time to decide (refrigerators tend to give warning of problems to come). People usually understand the appliance, a range of makes and models is readily available and able to be directly compared in showrooms, and energy usage parameters are simple as the appliance is on all the time. On the other hand, the decision regarding a water heater is often unexpected (water heaters rarely give warning of problems), hasty and ill-considered. The current study clearly identifies that the appliance installer (plumber and/or electrician) has a primary role to play in the water heater decision (Artcraft Research 2006).*

For water heaters the choice is also more complicated than other common appliance purchase decisions because there are usually two dimensions to the decision – the choice of water heater technology (e.g. conventional ESWH, SWH, HPWH or gas) and the choice within the technology (e.g. which HPWH model).

Most purchases of water heaters fit into two categories: emergency purchases to replace a suddenly failed system and those that are planned as part of renovations or new dwelling construction. Emergency purchases are often made quickly, and the time taken to restore hot water is often the key consideration in the purchase decision as identified by the speed of most installations. A consumer survey of the water heater market found that about a quarter of all water heater replacements are carried out within 24 hours, and the rest within a few days (BIS 2012). Planned purchases allow households more time to consider a range of systems and features in order to select one that best meets their needs.

Behavioural economics is essentially a series of tested observations of actual consumer behaviour that builds on traditional economic theory (OBPR 2012). Behavioural economics research provides some useful insights into actual consumer behaviour that is relevant to water heater consumers including:

- Bias in preferences could lead consumers towards replacing a system with the same technology or brand, without consideration of alternatives. Specific evidence of a bias in consumer selection towards replacing a failed system with a like system was evident in the BIS Shrapnel 2012 survey, with 66% of conventional ESWH buyers undertaking no research at all on alternatives and with 52% claiming this was due to satisfaction with the technology of the failed system (BIS 2012). This could be a way for consumers to reduce search costs. In some instances the benefits of saved search time could outweigh energy efficiency gains, provide a better outcome for consumers;
- Consumers may evaluate changes relative to their experience with the last water heater as a reference point, rather than objectively considering alternative technologies or broader issues such as lifetime operating costs. A reference point is evident in conventional ESWH consumers, as 52% of these consumers claimed they installed a new ESWH as they were satisfied with their last model and 88% of consumers replacing a failed conventional ESWH purchased a new conventional ESWH (BIS 2012). Similarly, basing purchasing decision on previous experience can be a useful way for consumers' to reduce search costs with a possible trade-off of higher running costs; and
- Aversion to change could reduce consumer appetite to try alternative technology or brands. This may be one reason why only 20% and 7% of conventional ESWH consumers considered SWHs or HPWHs respectively (some overlap between these percentages may have occurred). However, consumers may not want to try alternative technology because they view their current choice as optimal.

Anticipation of the likely impact on the consumer choice process and preferences may help ensure that any policy options are appropriately designed.

The majority of formal submissions to the recent HPWH Consultation RIS noted the presence of market failures in the hot water market. These were generally described as the consumers focusing solely or primarily on the upfront costs of a water heater rather than considering the efficiency of the water heater or other key features. Many submissions suggested that a label applied to all water heaters (based on a consistent test) would help inform consumers and enable improved water heater selections.

Current MEPS regulations

The standards that are used in MEPS regulations generally consist of two parts, a test method, and a MEPS standard. These documents list the minimum energy efficiency requirements that products must meet to be sold in Australia and/or New Zealand.

Conventional ESWHs have had to comply with MEPS in the form of maximum tank heat loss requirements since 1999 in Australia and since 2002 in New Zealand. In 2005, the MEPS levels for small water heaters was strengthened as well as the scope of the regulations changed to include some less common types of ESWH. Since this time the requirements have remained unchanged.

Currently to register and sell an ESWH in Australia, testing can be undertaken to the joint MEPS Standard, AS/NZS4692.1, or to the Australian 'legacy' Standards of AS1056 or AS1361. If registering products in New Zealand, the testing can be undertaken to AS/NZS4692.1:2005, or the legacy standards (NZS4602 or NZS4606.1) as applicable. These legacy standards were the standards that were in force at the time when the joint AS/NZS4692.1 Standard was developed and introduced in 2005.

The Standard AS/NZS4692.2 contains equations and tables that express the MEPS levels according to all the currently permitted test standards. In addition the MEPS levels for the AS/NZS4692.1 test method include both Australian and New Zealand tables, calculated and presented differently. A summary of the key relevant aspects of the current MEPS regulations is provided below with additional information at *Appendix A – Details of Current Regulations*.

Regulatory overlap

The Ministerial Council for Energy (MCE) agreed in 2002 to introduce a joint ESWH MEPS Standard which was to simplify the regulatory arrangements (GWA 2003, AGO 2004). In 2005, AS/NZS4692.1 was finalised and released by Standards Australia and the preface notes the intention for this Standard to supersede the older requirements and to 'promote high levels of quality, performance and energy efficiency in water heaters'. However, an extension to the use of the legacy, country specific, test standards was granted by governments following requests for a longer transitional period for testing and registration in moving to the new Standard. As ESWH MEPS arrangements have not been reviewed for some time, this temporary extension has now been in place for eight years.

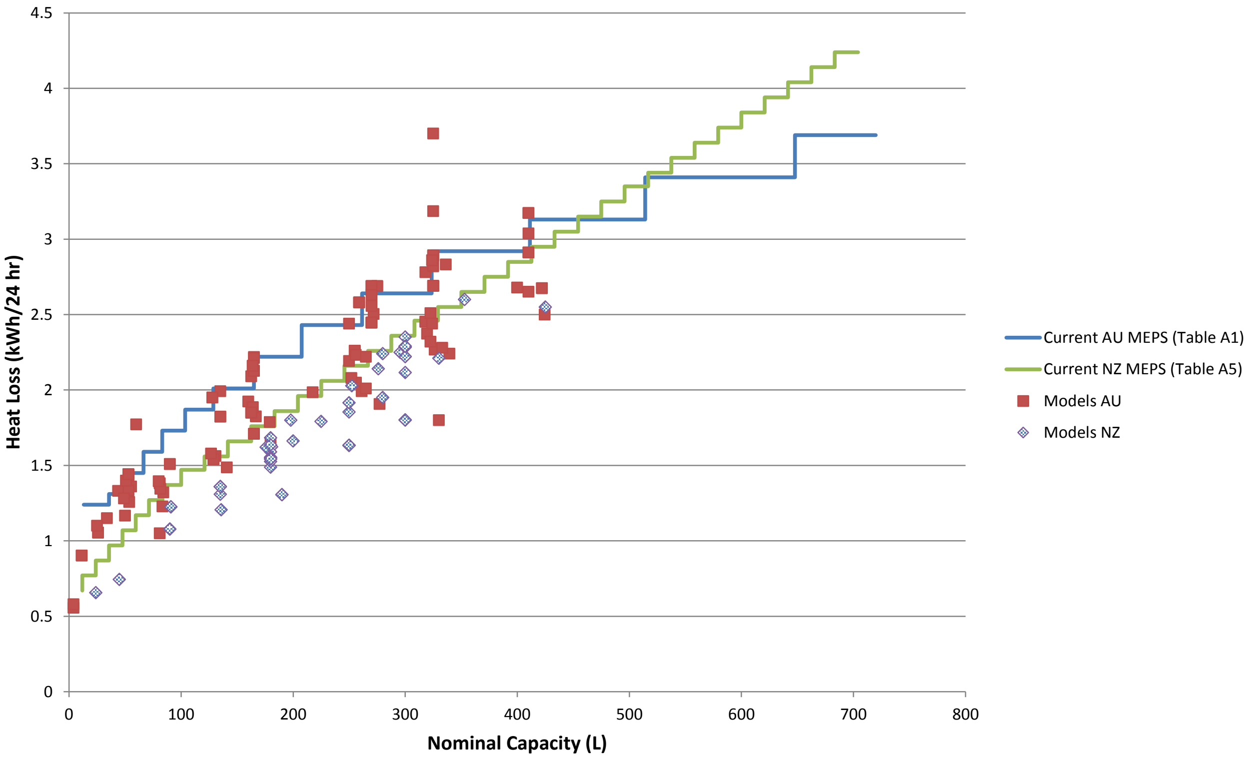
Differences in MEPS basis and levels

Even if the legacy test methods are removed, differences in the basis and levels of MEPS for Australian and New Zealand ESWH remain which prevent an accurate comparison of MEPS.

The basis of the MEPS requirements for Australian ESWH is rated hot water **delivery**, while New Zealand MEPS are referenced to nominal tank **capacity**. The rated hot water delivery is the quantity of hot water that can be drawn off continuously at a specified flow rate without exceeding a specified temperature drop (12°C in AS/NZS4692.1) while the nominal tank capacity is the volume of water that the tank holds.

To enable an informed consideration of the differences in MEPS levels between Australia and New Zealand, Figure 6 plots the MEPS of both nations against nominal capacity. Details of the method used to convert the Australian rated hot water delivery MEPS basis to a nominal capacity basis is provided in the section *Appendix C – ESWH RIS Modelling Summary*.

Figure 6: Australian & New Zealand Minimum Energy Performance Standards levels and registered water heaters heat losses: unvented mains pressure water heaters



Note: The figure assumes a TPR allowance but no allowance for additional elements, therefore some Australian models exceed the estimated Australian MEPS (blue line) but will still comply with the requirements. The models above the green line do not meet the New Zealand MEPS levels. Table A1 and Table A5 relate to tables in AS/NZS4692.2.

Based on the above MEPS analysis it appears that the New Zealand MEPS arrangements are stronger for systems under 450 litres nominal capacity (the majority of the market). Around 60% of the Australian registered ESWHs would likely fail the New Zealand MEPS requirements. However the degree to which New Zealand ESWH market outperforms Australia in terms of heat loss levels is complicated by the fact that the majority of New Zealand ESWHs are registered under the New Zealand specific test standards and, due to the relatively small New Zealand water heating market, there were no independent testing laboratories accredited to these standards when the testing was conducted.

Compliance and Comparative Testing

The E3 committee undertook testing of 14 Australian and five New Zealand registered ESWHs. These tanks were subject to compliance checking (tests conducted to the standard that ESWH was registered against) and comparative testing whereby all tanks were assessed against the joint AS/NZS4692.1 test standard.

The testing raised some concerns about the compliance of some tanks, and follow-up compliance activities have been carried out in the country of registration.

For the initial round of testing, three of the Australian tanks and five of the New Zealand tanks had concerns raised.

The results suggest that most Australian tanks are able to meet current Australian requirements and so there may be potential for further tightening.

The MEPS requirements of each nation set the minimum allowable thresholds that products must meet or exceed. In practice, appliances may exceed these requirements. The comparative testing conducted indicated that the difference in the actual performance of Australian and New Zealand ESWHs, suggested by Figure 6, may not be as great as indicated. However, it is important to note that separate testing laboratories were used for the testing of Australian tanks to the testing of New Zealand tanks.

The two low-pressure New Zealand ESWHs tested had lower (better) heat loss levels than similarly sized Australian ESWHs (which were all mains-pressure systems). However, the three mains pressure New Zealand tanks had comparable heat loss levels to the Australian ESWHs. So the result of the comparative testings was that it is unclear by what margin New Zealand tanks in the market may be outperforming Australian tanks in terms of heat loss levels.

Since the original testing, an independent test laboratory has become accredited to test to the New Zealand standards. Additional testing of New Zealand tanks is now underway which will enable more comprehensive information on the New Zealand market should this project proceed to a Decision RIS.

Exclusion for efficient SWHs and HPWHs

Efficient and well-designed SWHs and HPWHs are currently provided an exclusion from the MEPS requirements. This exclusion is *only* for systems that have the 'renewable energy' portion of the systems suppling at least half of the energy used in heating water when modelled under a specified scenario. SWHs and HPWHs that are not able to supply this level of energy savings are currently intended to be subject to the heat loss MEPS. The joint Standard defines the excluded water heaters as:

> *"Water heaters that use electric-resistive heating to provide less than 50% of the energy supplied in a typical year (e.g., heat pump and solar water heaters) when simulated to AS 4234 under Climate Zone 3 with an energy delivery of 22.5 MJ/day for an electric boosting heating unit and energization profile specified by the manufacturer."*

As well-designed SWHs and HPWHs can deliver substantial reductions in energy usage compared to conventional ESWHs and as heat loss is often only a small part of energy usage, it is sensible to provide these systems an exclusion from the MEPS requirements. If these systems were subject to the same MEPS used for conventional ESWHs, many highly efficient systems may be removed from the water heater market – which would likely reduce the overall average efficiency of ESWHs available.

However, it has become apparent that with the model-based exclusion, independent 'off-the-shelf' testing of units is not possible. This is discussed in more detail in the section *Effectiveness of heat loss MEPS for SWHs and HPWHs* on page 37. This has meant that despite SWHs and HPWHs being covered by the MEPS arrangements for many years, no compliance tests have been able to be conducted.

International ESWH regulations

The 2004 government review of ESWHs noted the intention that 'world's best regulatory practice' would be applied over the longer term with MEPS levels set at broadly compatible levels with trading partner nations, but with a lag to take account of the domestic market pressures. In 2004, it was noted that Australian ESWH MEPS levels lagged behind New Zealand and North American MEPS. The COAG Best Practice Guidelines also require that relevant international standards are noted in RIS documents, with any variation from such standards justified. The USA has announced it will be tightening its energy efficiency MEPS requirements in 2015 - to a degree that will effectively ban conventional ESWH larger than 200L. The European Commission will be subjecting all water heaters to harmonised labels, overall energy efficiency requirements (with two scheduled increases in these requirements) and maximum heat loss requirements.

The United States of America

The US Department of Energy has imposed energy efficiency requirements on residential water heaters since 1990. These requirements cover water heaters that use oil, gas or electricity and cover both storage and instantaneous type units. The requirements were strengthened in 2004 and a further round of strengthening has been announced to commence in 2015[14].

The current requirements for ESWH are based on the appliance meeting an 'energy factor' with an allowance provided based on the size of the unit. The energy factor is an efficiency based metric where a rating of 1 would imply that the appliance converted and stored electrical energy into usable heat energy in the ratio of 1:1 over the duration of a 24 hour test – with tank heat loss negatively affecting the result.

From 2015, separate requirements for ESWH based in the size of the unit will be applied. For units smaller than 55 gallons (just over 200L) the 2015 energy factor requirements are being strengthened. However the most substantial change is introducing a required energy factor for larger ESWH that is impossible for conventional ESWH to meet. This new rule effectively bans large conventional ESWHs and ensures that any large ESWH, such as HPWHs, must be around twice as efficient as current conventional ESWHs.

$$\textit{Required energy factor}_{2004} = 0.97 - (0.00132 * \textit{storage capacity in gallons})$$

$$\textit{Required energy factor}_{2015\ \textit{smaller ESWH}} = 0.960 - (0.0003 * \textit{storage capacity in gallons})$$

$$\textit{Required energy factor}_{2015\ \textit{larger ESWH}} = 2.057 - (0.00113 * \textit{storage capacity in gallons})$$

The 2015 energy efficiency requirements are estimated by the US Department of Energy to generate substantial savings over the period 2015-2044 – 3.3 quads of energy (approximately 970 billion kWh), $USD 63 billion in energy savings ($AUD 68 billion or $NZ81 billion[15]) and save 172.5m tons of CO_2-e, the equivalent to the annual emissions of 33.8 million US automobiles.

The European Union

Most water heaters currently sold in the European Union (EU) are conventional ESWH or gas units. The European Commission (EC) estimated that water heating in the EU consumed 2,156 PJ of energy (approximately 600 billion kWh) and resulted in 124m tons of CO_2-e emissions in 2005[16].

The EC states that the main reasons for the high sales of low-efficiency water heaters are: end-users focusing on purchase costs, not lifecycle costs; not fully including environmental costs in energy costs; limited information causing information asymmetry; split incentives affecting end users; and no standard information to allow sellers to promote new products.

To address these concerns, the EC has introduced regulations to create a harmonised label for water heaters. The labels to be implemented will provide information on energy efficiency, energy consumption and provide standard product information. The explanatory memorandum for the regulations state that the labelling requirements will 'provide a dynamic incentive for manufacturers to improve energy efficiency and to accelerate the market take-up of energy-efficient' water heaters. In addition the promotion of highly efficient products will 'greatly improve energy efficiency, support the transition to a resource-efficient economy, encourage investment in R&D and ensure a level playing field for (water) heating products'[17].

The EC regulations also contain some MEPS elements which include both standing heat loss requirements and overall energy efficiency requirements. The justification provided by the EC in setting MEPS on these features was that 'the energy consumption of water heaters and hot water storage tanks can be reduced by applying existing cost-effective non-proprietary technologies which can lead to a reduction in the combined costs of purchasing and operating these products'[18]. There are additional requirements relating to emissions of nitrogen oxides and sound levels.

The MEPS on overall energy efficiency are to be phased in to allow manufacturer to adjust to the new requirements. Initial requirements are to apply two years after the regulations are passed, additional tighter pre-

[14] Energy savings, financial savings and metrics used may be found at http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/27

[15] Values calculated on the basis of $1AUD = $0.925USD and $1NZD = $0.78USD.

[16] http://www.eceee.org/Eco_design/products/water_heaters/

[17] The European Commission Explanatory Memorandum to the energy labelling of water heaters.

[18] The European Commission regulation implementing Directive 2009/125/EC with regard to the 'ecodesign' requirements for water heaters and hot water storage tanks.

set limits are to apply four years after the regulations pass and there is a second pre-set tightening of energy efficiency requirements for the larger units six years after the regulations pass. The efficiency test is based on a 24 hour test with a number of water 'draw-offs' to replicate a real-life situation.

The MEPS for heat loss is to apply four years after the regulations pass. This limit is defined to be

Standing heat loss[19] $\leq 16.66 + 8.33 * V^{0.4}$ *Watts*

Where V = Volume in litres

A number of test standards can be used in determining standing heat loss and different tests will provide different results. However is appears that these limits are tighter than the current Australian requirements[20] - approximately 6% tighter for a 50L tank, 15% tighter for a 200L tank and 18% tighter for a 315L tank.

It is understood that the EC proposal was approved on 18 February 2013 with energy efficiency and labelling requirements to apply from 2015 and standing heat loss MEPS requirements from 2017.

The EC expects that the combined effect of the water heater labelling and MEPS requirements will result in annual energy savings estimated at 450 PJ (125 billion kWh) by 2020, corresponding to about 26m tons of CO_2-e, or the annual gross energy consumption of Lithuania and Cyprus together, compared to what would happen if no measures were taken.

[19] A number of 'harmonised' test standards may be used for testing purposes.
[20] Numbers are based on AS/NZS4692.2 Table A1 and assuming an adjustment of 0.2 kWh / 24 h as per Note 2 of this table. Also assumes that rated hot water delivery for an Australian tank will be equal to its volume. As delivery tends to be a few percent less than volume, and the EC limits increase with volume, this assumption will slightly penalise Australian tanks in the comparative calculations.

3. Market and regulatory failures

If the only market failure for the ESWHs market was the externality regarding greenhouse gas emissions, Government interventions such as the Australian carbon pricing scheme or the New Zealand emissions trading scheme could be used to address this failure. Both of these schemes result in carbon emissions being incorporated in the price of energy use, but only to the extent that the respective schemes reflect the full environmental cost of the greenhouse gas emissions.

These schemes may provide a marginal incentive for a consumer to choose an efficient water heater. This is due to the greenhouse gas costs now falling on consumers rather than society in general which provide an additional reason to minimise ongoing energy use. This is not likely to be a major additional incentive, as the additional carbon costs would be minor compared to the overall operating and capital costs of a water heater, and the uncertainty over the efficiency of products due to information failures would persist.

A range of market failures in the water heater market have been identified and are viewed to be caused by a lack of information and split incentives. Carbon pricing or emission trading schemes do not directly address such failures and the failures are persisting despite the original introduction of MEPS for ESWH. These market failures result in sub-optimal purchasing decisions in some instances and may reduce consumer utility.

These market failures were observed some years ago in both Australia and New Zealand and this led to the existing levels of government intervention. Such market failures have also been observed in other nations/economic zones which has led to a variety of international government interventions such as a policy to eliminate large conventional ESWHs from the market (USA) or labelling of all water heaters on an identical basis to ensure adequate information levels (Europe).

Formal submissions made by manufacturers to the recent consultation RIS on HPWHs confirmed that market failure in the hot water market exist and these failures are resulting in a number of sub-optimal outcomes. The suggested responses by these manufacturers varied but generally supported the introduction of MEPS for HPWH for the first time (with possible second rounds of MEPS scheduled in advance). There was also manufacturer and plumber industry support for energy efficiency labelling, especially if such labelling was applied to either all ESWHs or extended to all water heaters (including gas water heaters).

The specific market failures in Australia relating to energy efficiency were recently investigated in the November 2012 report '*Reducing energy bills and improving efficiency*' by the Australian Select Committee on Electricity Prices. The nature and implication of the continuing market failures were summarised by the below statement:

> *'residential consumers are poorly informed when it comes to retail electricity arrangements, the price of electricity and how their electricity consumption impacts on their bill. As a consequence, consumers have been unable to choose retail electricity offers better suited to their needs or modify their electricity consumption in ways that would help minimise their electricity costs*[21]*.'*

The Select Committee described energy efficiency as 'the "low hanging fruit" of electricity consumption and emissions reduction efforts' and as 'the easiest, simplest and most cost efficient' tool to meet these goals. Further expanding on the case for energy efficiency, the report highlighted the submission by the Energy Supply Association of Australia which argued that energy efficiency efforts should focus on heaters, air conditioners and hot-water systems as these appliances can offer faster payback periods and will result in 'material' rather than 'symbolic' benefits to households[22].

The Select Committee noted its support of the federal and state and territory governments ongoing commitments to improving energy efficiency such as the GEMS program which drives energy efficiency though both MEPS and appliance efficiency labelling.

[21] Executive summary - 'Reducing energy bills and improving efficiency', Select Committee on Electricity Prices.
[22] Point 5.89 - 'Reducing energy bills and improving efficiency', Select Committee on Electricity Prices.

Similar market failures are viewed to exist in New Zealand due to the similarity of the hot water market in each nation.

Market failures

The characteristics of the water heater market result in it being subject to a range of market failures, including information failures and principal-agent issues, including split incentives. Such market failures tend to result in sub-optimal purchasing decisions and result in lower levels of consumer utility. However, there is presently no direct evidence, to establish either the extent of such failures, or the consequences on consumers. As no model specific ESWHs sales data or price data is available to analyse, it is not exactly clear what proportion of sales are of the more energy efficient models on the market compared to those models which just comply with the current MEPS. Rather the information presented in this section is limited to government statistics, market surveys conducted by a private market research company, extracts from an Australian Senate report, information from government websites, calculations, ESWH registration data and aggregated sales-weighted heat loss levels for New Zealand. As a result the extent to which the current MEPS is not adequately addressing any market failures is also not fully clear.

In the event there are significant impediments, government intervention in the market has the potential to improve economy wide utility levels if the intervention is aimed at correcting or reducing the impact of market failure.

Split incentives

A principal-agent issue can arise when agents act in their own best interests rather than in the interests of their principal. In the case of domestic hot water systems, a principal-agent problem could arise when a home owner or building owner delegates the choice of a hot water system to their agent (builder or plumber). The consequences for the home owner or building owner may be a higher overall cost of delivered hot water than would have been the case if the owner had taken a greater role in selecting the most appropriate hot water system for their needs.

- **Builder/owner split incentive:** For approximately 20% of the Australian and New Zealand residential market, the purchase of ESWHs are for new or renovated homes. In many of these situations, the builder or plumbing sub-contractor may be responsible for or have a high degree of influence on the choice of hot water system. Typically the builder/plumber will be motivated to install a hot water service that maximises the financial return to them, and to disregard the whole-of-life cost of the hot water service to the owner. A similar situation may occur in the commercial property sector where commercial buildings are built by developers with no specific owner/occupier in mind.
- **Plumber/owner split incentive:** Many replacement water heaters are supplied by plumbers or purchased on advice provided by the plumber. If the plumber has an incentive to install a particular type or brand of water heater (for financial reasons or because of greater experience or familiarity with particular types or brands of hot water heaters) the owner may not receive the most appropriate type, style or size of unit to meet their hot water needs. Additionally some plumbers may have a bias in the brands they recommended due to free or low cost training programs provided by manufacturers.
- **Landlord/tenant split incentive:** Choices by landlords about the type of hot water system they purchase and install may increase the total amount of energy expended in delivering hot water if the landlord has little incentive to purchase efficient water heaters, but rather may be motivated to minimise their capital outlay. As 28.5% of Australian households are rental properties (ABS 2008), and 33% of privately owned dwellings are rented in New Zealand (Statistics New Zealand, 2006), a large proportion of residential water heaters sales may be influenced primarily by the installation cost.

The Australian Council of Social Service argues that the landlord/tenant split incentive has resulted in 'some of most vulnerable households living in the most inefficient properties in Australia'[23]. Furthermore for situations where the rental period is intended to be of a short duration, renters may not be willing to raise the issue of poor energy efficiency as they may not be in the dwelling long enough to benefit from any reductions in energy bills.

In any event, the value of the relative efficiency of water heaters is unlikely to be incorporated into property and therefore rental values. This is a result of the performance of the water heater, or previous occupant's energy bills and hot water demands, not being presented to renter at the point of contract negotiation. Without this information, estimating water heater efficiency is difficult. The renters ability to estimate the cost of operating an ESWH is further complicated by their installation often being in out-of-sight or difficult to access locations, such as

[23] Point 6.51 - 'Reducing energy bills and improving efficiency', Select Committee on Electricity Prices.

in the subfloor or in cupboards. If there are any instances where water heaters impact rental prices, lower up-front capital cost water heaters would likely be reflected in a lower rental price but such ESWH may be the least efficient and result in higher energy costs.

Unlike some other product markets where consumers almost always purchase the appliance themselves (for example, TVs), the market for ESWH involves agents who purchase the appliance on behalf of end users — perhaps more than 50 per cent of annual sales. In such cases, there is the potential for consumers to acquire ESWHs which meet some of their needs (e.g., provide reliable hot water at an acceptable upfront price) but are not as energy efficient as comparable models and therefore may have higher lifetime costs.

To the extent that this is happening, this may be one reason (among others) why average heat loss levels have not improved much since the current MEPS was introduced. Accordingly, as part of this consultation process , we are seeking specific and direct evidence from consumers or consumer advocates, on the extent to end users receive models that are not in accord with their expressed wishes; or, would otherwise better meet their various needs in relation to an ESWH (price, brand, colour, reliability etc.).

Information failures

Garnaut (2008) makes the point that, regardless of a carbon price, the market's efficient adoption of established technologies and practices may not be efficient as it requires individuals to know:

- the options available;
- the approximate costs and benefits of the different options;
- how to deploy the options (including hiring experts); and
- the cost of investigating the options.

Garnaut argues that if the information barriers regarding efficiency levels are caused by market failures, a government may be able to intervene to improve the efficiency of the market. In the water heater market information failures apply to a number of key variables required for a consumer to choose the more appropriate water heater for their needs - these include sizing, operating costs and payback periods. The water heater market may or may not be subject to substantial market failures, and there may be a case for further intervention in the market.

The implications of market failures in a water heating market were comprehensively studied by the EC from 2008 to 2012 with EU members, international stakeholders, member state experts, manufacturers, retailers, environmental non-government organisations and consumer organisations involved in consultation forums and committees. A discussion of this consultation process, the result and associated implications are publically available[24]. The main conclusion of this study was that information asymmetries and split incentives were affecting the hot water market, and that these market barriers where best addressed by a package of reforms including appliance labelling and design requirements that standing tank heat loss MEPS and overall system energy efficiency MEPS, with the latter to be tightened twice within four years of being established.

Water heater sizing

As the first step in a purchasing decision, a consumer would need to estimate their hot water needs to enable the identification of a suitable water heater. Failure to correctly size a water heater may result in higher capital costs and increased heat loss levels (oversized system) or insufficient hot water or an over reliance on electric resistive heating (undersized system). Hot water needs are very difficult to identify. Even if the consumer could estimate the volume of water provided within a dwelling, additional considerations are required. Examples include:

- The temperature of the water being supplied at the inlet of a water heater is a key driver of the energy required to heat the water to a desired temperature. Inlet temperatures will vary depending on both the climatic location of the dwelling and the time of year. Water inlet temperatures are typically colder in the cooler months when hot water demand is higher.
- Smaller systems may be less able to cope when much of the demand is 'peaked' (such as multiple showers operating).
- As electric resistive heating occurs more rapidly than heating via heat pump compressors or solar gain, a conventional ESWH may be able to supply more hot water than an HPWH or SWH of equal volume. Alternatively a large 'restricted tariff' conventional ESWH, HPWH or a SWH can heat water cost effectively and store this water to meet future demand.

[24] The European Commission Explanatory Memorandum to the energy labelling of water heaters

- Tempering valves are safety devices which mix cold water into the hot supply to restrict the temperature of hot water in the household. Consequently, the volume of hot water being supplied by an appliance may be less than what is measured from within a dwelling, reducing the ability of a consumer to estimate their hot water requirements.

Alternatively, a consumer could pay a supplier or producer to assist them with this process but in doing so may be exposed to split incentives.

Water heater operating costs and payback

Estimation of running costs requires assumptions on future use and energy costs, which are uncertain and difficult to forecast. In the case of water heaters, the running costs over the lifetime of the appliance can exceed the capital costs. The mean price (including installation costs) for a conventional ESWH in Australia was $1,105 in 2012 (BIS 2012).

Comparable information on the efficiency of conventional ESWHs, SWHs or HPWHs is not available – either in the form of appliance energy efficiency labels on water heaters or via a web-based product registration database.

The E3 website (www.energyrating.gov.au) enables consumers to access data on declared heat loss levels for specific ESWHs in kWh/ 24 hours. While technically sophisticated and engaged consumers can convert this into an annual cost for their specific electricity tariff, the heat loss costs are only one component of running costs – most energy will be used by an ESWH in supplying hot water rather than countering heat losses. Additionally, larger systems (with relatively high heat loss levels) may be designed to use cheaper 'restricted' tariffs which further complicate the estimation of annual costs. Finally, while heat loss from a conventional ESWH will be countered by additional electric resistive heating, heat loss in a SWH or HPWH may be replaced through more efficient and cheaper water heating methods.

Without relevant and readily available information on ESWH running costs, there is limited ability for a consumer to form an informed view on the likely operating costs without significant additional research or expert assistance. This provides an opportunity for buyers to be misled or confused by claims on the efficiency and suitability of products. While some water heater suppliers do provide information on energy use, operating costs and claimed efficiency, this information can't be verified by a consumer as it is not available on a consistent basis for all products and does not come from an independent source - which means that objective product comparisons are currently very difficult, if not impossible, for the average consumer.

While many consumers (and renters) may be aware that SWHs and HPWHs are designed be more energy efficient and have lower running costs, information to enable the consumer to estimate the 'lifetime savings' or the 'payback period' of a specific SWH or HPWH system is typically not available to the consumer. As such payback periods can be very short, this lack of information results in sub-optimal decisions on the most cost-effective water heating systems to install.

Prevalence and magnitude of market failures

The total impact of a market failure is dependent upon if that market failure exists; how frequently the failure occurs and the magnitude of the failure when it occurs. It is inherently difficult to determine the existence of an information-based failure. However, information is available which provides some insights into the operation of the market and informs discussion on the presence of any market failures.

The information in this section is sourced from survey results which indicate how consumers in the market are behaving, calculations that indicate the potential magnitude of a 'failure' and observations of the hot water market over time to assess if market forces are leading to improved heat loss levels.

Consumer behaviour

Potential for the influence of information failures

A survey of the water heater market, including information on factors that influenced consumers was conducted by BIS Shrapnel in 2008, 2010 and 2012 (BIS 2008; BIS 2010; BIS 2012). The 2012 survey found that about a quarter of all water heater replacements are carried out within 24 hours, and the rest within a few days. Where buyers are operating under time duress there is little time to research hot water options such as the suitability of different technology types, sizing, running costs or even if the current hot water heater was appropriate for the current needs of the dwelling. As water heaters have lifespans in excess of ten years it is likely that the water heating outcomes of the dwelling will have changed due to reasons such as more efficient showerheads and changes in residents since the water heater was installed and changes in energy tariffs.

The survey identified that 22% of water heater buyers conducted no research at all and 66% of buyers of conventional ESWH considered no alternative hot water technologies. When prompted, purchasers of conventional ESWH replied that the cost of SWH (67%) HPWH (69%) was the reason that these systems were not purchased – despite upfront costs only being one aspect of the costs to consumers. The low consideration of alternative water heater technologies, which will generally have far lower operating costs, suggests that consumers may not be aware of the options available or the costs and benefits of these options, which Garnaut (2008) noted are required for efficient operation of the market. Alternatively, these purchases could reflect consumers' time preferences.

There has been an increase from 13% in 2008 to 35% in 2012 of buyers that have been using the internet to find information before purchasing a water heater. This trend is likely to continue as consumers increasingly become comfortable with internet purchasing, and as new technology such as smart phones become more prevalent. However, manufacturers do not provide information in a format that makes it easy to compare different products, in particular with competitors' products. Industry claims may range from levels of free hot water to percentage energy savings levels or the ability to generate a certain number of STCs when installed in a given climate. Additionally, even if manufactures choose to display factors such as heat loss in the future, the current mix of standards under which heat loss may be tested would mean that results may not be directly comparable. With these information limitations, even a consumer attempting to undertake research may not be able to find reliable, comparable and independent information.

Potential for the influence of split incentives

The BIS 2012 survey found that when consumers needed a new water heater, about 40% used plumbers as a first point of contact, 19% used energy retailers and 18% hot water specialists. About three quarters of replacement water heaters are purchased through the first point of contact. This strong reliance on plumbers, energy retailers and specialists for advice, combined with their divergent incentives compared to the buyer, result in a high potential for principal-agent driven split incentives to occur in the market. While a reliance on these parties can provide consumers reduced search costs, there is a possible trade off in higher energy costs if a less efficient system is chosen.

Approximately 15-20% of consumers use retailers or stores as a first point of contact. While in these situations a consumer will be able to see the products, due to limitations about likely hot water demand levels and due to a water heaters size not always being a primary driver of its ability to deliver hot water (due to differences in recommended tariff settings and/or technology differences), the consumer may still be highly influenced by the retailer who has an incentive to maximise profits. However, this incentive to profit maximise may or may not be based on meeting customers' preferences, potentially leading to a mutually beneficial outcome.

Magnitude of potential market failures

To examine the potential magnitude of a failure in the hot water market, the financial implications to a consumer of purchasing a conventional ESWH (typically lower up-front costs but higher operating costs) are contrasted (below) to a SWH and a HPWH (systems that generally deliver far lower lifetime appliance costs). In addition the financial implications of purchasing a conventional ESWH with high heat losses is contrasted with one with better heat loss characteristics. It is worth noting that the cost-benefit analysis later in the RIS has conservatively only examined the potential consumer savings of improving heat loss levels – it does not cover the benefits that consumers may gain from switching technology types. Any improvement in information (accessibility or consistency), heat loss outcomes (through tighter mandated levels, improved compliance or removal of loopholes) or consumer faith in a product (mitigation of poor outcomes via improved compliance or removal of loopholes) could encourage a shift to more efficient technology. As such the benefits modelled in this report can be described as being conservative.

The BIS 2012 survey calculated the mean 2012 purchase price (including installation) of survey respondents for different hot water technologies. For conventional ESWH the mean price was $1,105, for SWHs $3,070 (a $1,965 premium over a conventional system) and $1,904 for a HPWH ($799 premium). These figures do not take into account the average sizes of SWHs and HPWH being larger than conventional systems hence the price premiums may be overstated.

In relation to operating costs, a shift from a conventional ESWH to a HPWH may provide an energy saving of 2,400 kWh per year. This would provide an annual saving of over A$330 in Australia (assuming 14c/kWh for

18 hours supply per day) and NZ$600 in New Zealand (25c/kWh)[25]. Based on a A$799 mean price premium for a HPWH in Australia, a typical and correctly installed HPWH may have a payback period on the premium of 2.4 years (A$799/A$330) with the 'savings' paying for the entire water heater after 5.8 years in Australia ($A1,904/330). The payback period would be even smaller if higher electricity tariffs are used. As HPWHs are estimated to have average lifespans of 12 years, the total lifetime savings of a HPWH can be substantial. Equivalent calculations are not available for SWH, although this technology does have the potential for higher energy savings due to its slightly longer average operating life of 15 years.

As there were 427,000 sales of ESWHs in Australia and New Zealand in 2011 (see Table 2) 323,000 of which were conventional ESWHs, the total potential national benefits of improved ESWH purchasing decisions is considerable.

If the market failure of purchasers of conventional ESWHs not shifting to highly efficient HPWHs and SWHs is ignored, the magnitude of the impact associated with the purchase of a conventional ESWH with poor heat loss characteristics can also be quantified. Figure 9, on page 34, shows that for tanks around 160 or 250 L nominal capacity, within the spread of both Australian products and New Zealand products, there is a variance of approximately 0.5 kWh per day between the best and worst heat loss levels. The spread of declared heat loss levels associated with 315 L tanks is far larger (but may be distorted by 'outlier' data points which have allowances for multiple elements).

Examining the potential impact of the current heat loss spread on the market to a consumer, a saving of 0.5 kWh per day equates to 182.5 kWh per year due to higher heat loss levels. At $0.20 per kWh[26] this is a $36.50 cost per appliance per year. As a conventional ESWH is expect to have a lifespan greater than ten years, there is the potential to save at least $365 over the life of the appliance. The potential energy cost reduction of $365 for a medium sized appliance is approximately 30% of the mean installed cost of a conventional ESWH ($1,105). If the removal of market failures caused the market to produce appliances with better heat loss characteristics, even greater savings would be available to the consumer.

If electricity tariffs increased over the life of the appliance, the above saving would increase further. With annual Australian sales of conventional ESWH at 270,000 units, a 0.5 kWh per day heat loss improvement, with no other changes, would lower the lifetime impact for the appliances sold in one year by almost $100m (492 million kWh saved over 10 years). More conservatively, even a 0.1 kWh improvement in heat loss levels saves $7.30 per year per appliance or $2m (9.8 million kWh saved over 10 years) for the lifetime costs of the appliances sold in one year.

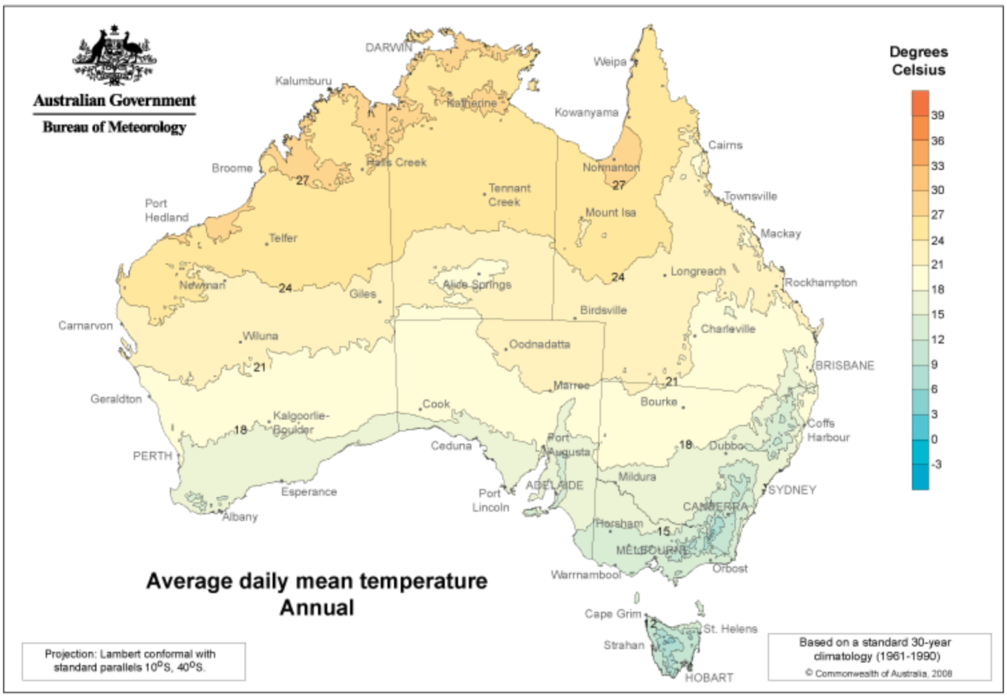
The above calculations assume that the tank heat loss levels, assessed under the conditions specified in standards, are reflective of 'real life' heat loss levels. For example AS1056 and AS/NZS4692 specify testing to occur at 20°C with certain connections that would cause 'real life' heat loss being removed and insulated (see Table 14: Comparison of methods of test measurement between standards page 72). The annual average daily mean temperature experienced by a water heater will depend on the climate of where it is installed. The most heavily populated areas of Australia experience annual average temperatures lower than 20°C. This implies that many externally located storage tanks will experience higher levels of tank heat loss than the declared, laboratory based, heat loss levels. This also means that externally located storage tanks in these areas may benefit from even greater energy savings from any improvement in tank heat loss characteristics.

For colder climates, a small improvement in heat loss levels would provide 'real life' lifetime savings that would probably substantially exceed 30% of the upfront capital costs (as conservatively calculated above). Any stakeholder information on this topic would be welcome.

[25] http://www.energyrating.gov.au/wp-content/uploads/Energy_Rating_Documents/Library/Heating/Heat_Pumps/costs-res-heat-pump-water-heaters.pdf

[26] Electricity tariffs vary by country, state, provider and plan. In Australia costs generally range from 35c to 11c per kWh depending on the plan, but can exceed 50c in peak hours for some plans. See http://www.energymadeeasy.gov.au/ to compare tariffs in Australia. In New Zealand average residential prices are around 26c per kWh.

Figure 7: Australian annual average daily mean temperature, 1961-1990



Source: The Australian Bureau of Meteorology

Above and beyond the potential impact of a market failure to an individual consumer, the EC research and modelling on the implication of a comprehensive labelling and MEPS regime (that is assumed by the EC to substantially mitigate market failures) can provide some useful insights into the magnitude of any failures in the Australian and New Zealand markets. The modelled energy savings between the application of the EC requirements in 2015 and 2020 are 125 billion kWh while the magnitude of energy consumption from all water heating in the EC in 2005 was estimated to be approximately 600 billion kWh. The EC is expecting to save an amount of energy broadly equivalent to 20% of total energy used for water heating in one year – this is even though only a portion of their water heater stock will have been renewed during the five year period. Any new and more efficient stock would continue to deliver ongoing energy savings over the life of the appliance.

While the quantities of hot water demanded by Australian/New Zealand residents may differ from EU residents and while the markets may differ in other keys areas (climate, hot water fixtures etc.) the potential to save around 20% of the total annual water heating energy use over a five year period, with benefits compounding into the future, will have a sizable and beneficial impact in the energy bills of consumers.

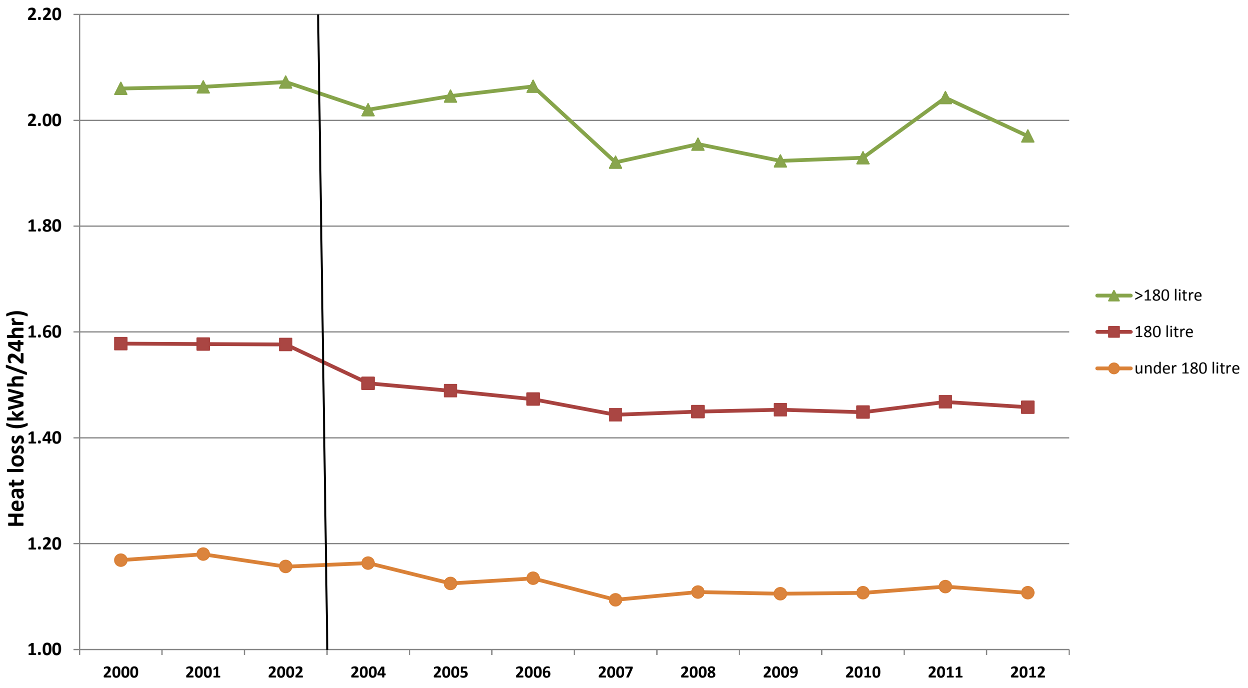
Market observations

There are two sets of information that can be used when observing the market. The first is the registration data for both Australia and New Zealand and the second is the sales data (including heat loss levels) that has been collected in New Zealand for over a decade.

As illustrated earlier (Figure 6, page 20), the heat loss level being declared by manufactures and importers of ESWH are typically at or slightly within the MEPS limits. Note also that any manufactured good can have slight variations in the individual goods being produced. As a result some manufactures may choose to make appliance slightly superior to the MEPS level to ensure that each individual product will comply and reduce the risk of legal penalties associated with non-compliance. Generally the MEPS levels have been in place since 2002, with a 2005 revision for smaller tanks. Yet despite 11 years of 'market forces' for most tank sizes and 8 years for smaller ESWH, there remains a 'bunching' of heat loss levels around the minimum requirements. This suggests that the 'market' has not been able improve heat loss levels over time, although the cause of this cannot be identified from this data. This could be the result of market failures, or could result from producers and agents responding to fully informed consumer demands which may be weakly related to energy efficiency. The former would represent market inefficiency, the latter would represent market efficiency.

The second market observation available relates to the New Zealand hot water market as sales data has been collected on ESWHs since 2000. This information has been used to identify sales-weighted heat loss levels of ESWHs by size category – these trends are shown in Figure 8.

Figure 8: New Zealand sales weighted average heat loss trends for conventional ESWHs



Note: The vertical line divides the pre and post MEPS data.

Up to 2002, the heat loss trends in Figure 8 are flat but with the MEPS applying from 2003 (note: there is no 2003 data) the heat loss averages declined and continued to decline until around 2007. For example, there was a 2.5% and a 4.6% drop in sales weighted heat loss for the standard 180L and smaller systems (typically 135L) respectively from 2002 to 2004. This trend continued for several years, as suppliers redesigned and supplied more efficient models into the market to meet the new, more stringent requirements. These figures therefore show both a lack of market improvement prior to the introduction of MEPS and illustrate the impact and effectiveness of the 2003 MEPS intervention.

It is also worth noting that after a period of time, from approximately 2007, the average heat loss levels have stopped declining (and actually have slightly increased). This indicates that the impact of a MEPS intervention can only drive improvements in energy efficiency for a limited time. It also shows that the market, after the 2003 intervention, has not been able to drive improvements in ESWH heat loss levels.

Summary of market and information failures

The primary considerations in choosing an ESWH for most consumers are likely to be sizing (output), cost and technology. Consideration may also be given to factors such as noise, colour (if installed in a visible location) and branding. However for a particular size and technology of ESWH, the only costs that can be reliably identified by the consumer are relative differences in purchase and installation costs, not running costs. If a consumer had the time and technical knowledge to review running cost information, this would influence some consumers. Conservative calculations show that the difference in running costs over a 10 year appliance lifespan for an existing, average sized system that only just meets MEPS versus one that exceeds MEPS may equal around one third of the purchase and installation cost of a system – if the consumer lives in an area that has mean annual temperatures cooler than 20°C the savings may be even higher. If electricity prices increase in the next ten years, these savings would be even larger. If some consumers were influenced by running costs, the supply side of the market would adapt towards producing ESWH with lower operating costs.

It appears a lack of comparable and relevant information relating to operating costs is preventing consumers from being able to research which system will best suit their needs (make informed decisions). Consumer surveys have demonstrated there is currently a low level of research underpinning ESWH purchasing decisions. Consumers also have a strong reliance on agents that creates the potential for split-incentives. Research and calculations show that either a shift to a more efficient ESWH technology or a move to a conventional ESWH with better heat loss characteristics, all other things being equal, can provide financial savings to consumers. Policies in the USA and EU markets which seek to address these market failures are estimated to drive consumer choice and result in considerable energy savings and related emissions savings. Unfortunately local market observations seem to show that while MEPS interventions in Australia and New Zealand did improve the heat loss levels of ESWHs, general local market forces have not able to drive additional improvements. Additional improvements in Australia and New Zealand are possible based on the findings and actions of the USA and EU.

With over 400,000 sales of ESWHs occurring annually in Australia and New Zealand, with ESWHs having lifespans in excess of a decade (effectively locking in any sub-optimal appliance choices for a long period), and due to large savings that can occur in buying a more efficient ESWH for given output/size, the consequence of a market failure can be considerable to a consumer.

Regulatory shortcomings

The current MEPS regulations were introduced in 1999 in Australia to address a number of identified market failures. The introduction of MEPS requirements led to an improvement in heat loss levels and helped to address the market problems in part that existed at that time. A number of current problems have been identified by this project that are either not being addressed by the current MEPS or are being caused by the current MEPS framework– a degree of regulatory failure is considered to exist.

Many ESWH are only designed to provide the lowest level of heat loss protection permitted by MEPS requirements (see Figure 9, page 34). These requirements were introduced in 1999 for medium to large Australian ESWH and small water heaters in 2005. Requirements were introduced in 2002 for New Zealand. Regulations have been in place for between 14 and 8 years. However a lack of detailed sales data prevents governments from knowing the sales-weighted average standard of ESWHs installed in Australia - New Zealand sales-weighted data is presented on page 31. While the New Zealand data shows no improvement in heat loss levels since the last MEPS intervention, it is not clear if Australian sales are already at, or moving towards, the more efficient models on the market. As many registered ESWH are only meeting heat loss requirements introduced 14 years ago, if sales are favouring more efficient ESWH, stakeholder explanations on when any markets trends commended and why the market is still producing unpopular units would be beneficial. Feedback from stakeholders would help governments identify the extent of the current ‘gap’ between Australia’s and New Zealand’s ESWH energy usage and what may be possible if changes to the joint AS/NZ MEPS levels were made.

Several countries have introduced more stringent energy efficiency and/or heat loss requirements and appliance labels to help communicate these requirements (see page 21). Stakeholders’ views are sought on the appropriateness of these measures in the Australian/new Zealand context. These views may help clarify the nature and degree of any problem with the current MEPS regulations.

There are also a number of other features of the current MEPS framework which can be described as regulatory failures. These features include regulatory overlap, the usage of an inconsistent MEPS basis, exclusion claims that cannot be independently confirmed, non-validation of claims and compliance loopholes. These features are discussed in detail below. Feedback from stakeholders on these matters will help to determine if changes to the current regulatory framework are warranted and what type of changes should be considered.

Problems with current ESWH MEPS regulations

Governments have a requirement to ensure that where a market intervention is regulatory in nature, that regulation is efficient and effective. The design and magnitude of the current MEPS interventions have been justified through past analysis and subject to significant consultation. However, this section outlines a number of shortcomings which have become apparent with the current regulations over time.

The purpose of a MEPS is generally to improve the average efficiency levels of appliances on the market by removing poorly performing appliances. The current ESWH MEPS regulations are focused on tank heat loss levels. While electric-resistive heating within an ESWH can be an efficient use of energy, tank heat losses from ESWH are a form of wasted energy. The level of heat loss is strongly correlated to the volume or size of a tank as tanks with larger volumes typically have larger surface areas from which heat can be lost. The current MEPS framework allows increasing levels of heat loss for larger tanks rather than setting a single defined level that must be met.

While the general principles underpinning the ESWH MEPS regulations are sound, the details contained within standards, the manner in which the ESWH MEPS have been implemented and how the MEPS have been interpreted by the market have resulted in the regulations no longer being as efficient and effective as possible. These are discussed in turn below.

Regulatory overlap and efficiency

Continued usage of multiple standards

While a move to a single test method was one of the key goals of the introduction of the AS/NZS4692.1 in 2005, the extension to the use of the older legacy standards has resulted in four separate test methods still being used to calculate heat loss levels. Consequently there are differences in the MEPS calculation basis, MEPS levels and other allowances permitted for products being registered in Australia and New Zealand. Additionally, as a result of the extension of the legacy test standards the joint MEPS Standard AS/NZS4692.2 also contains equations and tables that express the MEPS levels according to the legacy test standards.

As at November 2012, the number of approved (non-expired or superseded) registrations for ESWHs on the EnergyRating database were:

- AS/NZS4692.1 = 65 (32% of the 202 registrations);
- AS1056 = 88 (44%);
- NZS4602 = 10 (5%); and
- NZS4606 = 39 (19%).

The implication is that, eight years from when the joint ESWH MEPS and testing standards were introduced, only a minority of products are being tested and registered to AS/NZS4692.1. The use of different standards for the testing and registering of ESWHs affects the ability of consumers to compare the efficiency of ESWHs, and means products are being required to meet different MEPS requirements. In addition, when industry, government or other interested groups seek to update the standards for ESWHs, they may be required to make similar changes to a number of the test standards – this requires additional effort and will require separate payments to a standards body to process the amendments. Interested parties will then need to purchase copies of all the updated standards.

The current level of regulatory overlap is not efficient as it results in less consistent information, a duplication of effort for Standard updates and increased information costs associated with understanding each overlapping requirement.

Calculation inconsistency

Even within the new test and MEPS standards introduced in 2005, two features that are worth examining from a regulatory efficiency perspective is the different basis for the MEPS calculations for Australian ESWHs (rated hot water delivery) and New Zealand ESWHS (nominal capacity) and the different approaches to defined MEPS 'steps'.

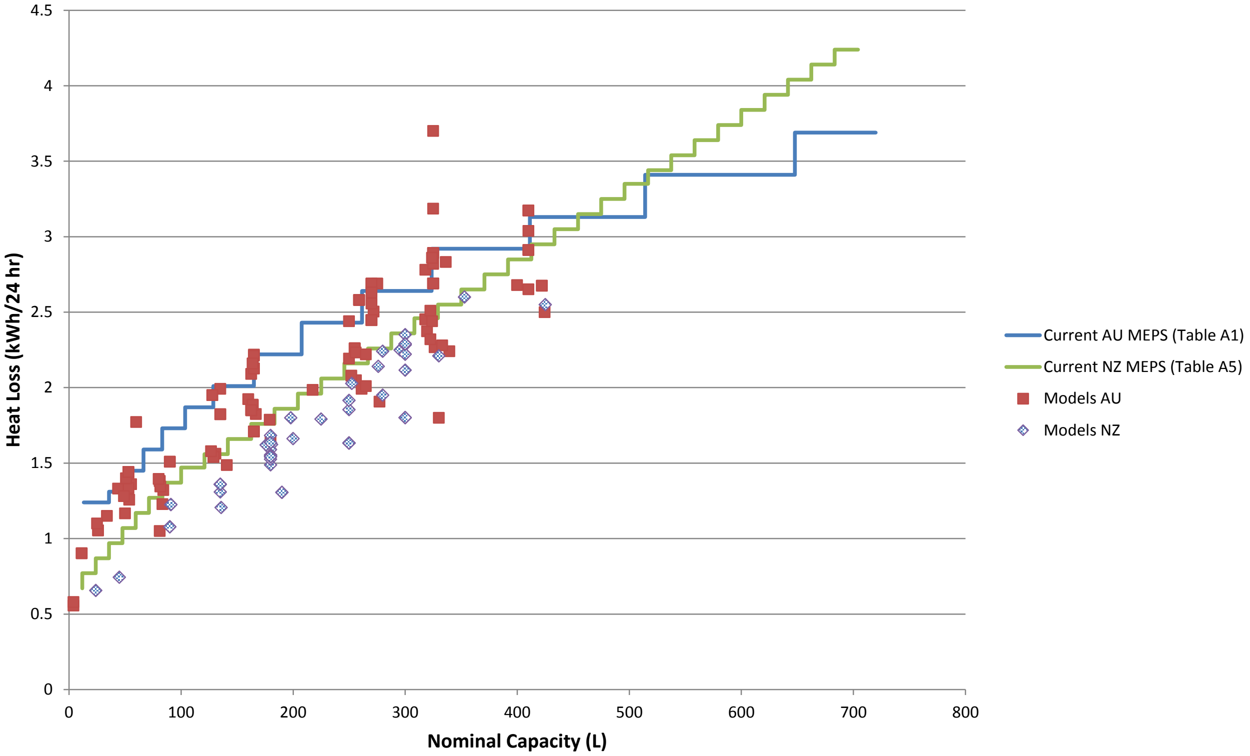
Currently hot water delivery information is only required for Australian ESWHs and the hot water delivery test is often conducted at the completion of a (multi-day) heat loss test - so the calculation of this information does not come at a significant additional cost. The current nominal capacity test used for New Zealand ESWH involves filling a tank with cold water and testing that the claimed size is within +5% to 0%. Nominal capacity differs from physical capacity due to displacement by internal components (minor difference) but more importantly some tanks do not fill completely with water but rather retain an air pocket. The size of the air pocket can be affected by the method of filling the tank (e.g. water pressure used) as well as the location of dip tubes (which may vary unit to unit due to differences in transport or manufacturing). In 'real life' installations the air pocket would be expected to be replaced by water over time. As testing labs cannot always determine the presence or size of air pockets, the New Zealand tolerances for nominal capacity seem justified.

While both approaches have merit, and the hot water delivery tests provide useful consumer information, as the measurement of nominal capacity appears the easiest and cheapest to conduct and as the capacity of an ESWH seems to be more directly linked to heat loss level, there is a case for standardising the approach to nominal capacity. Hot water delivery declarations may also be justified from a consumer information basis. It should also be noted that the EC and US MEPS are based on volume, not hot water delivery.

A second area of inconsistency in the MEPS framework applying to Australian and New Zealand ESWH is the MEPS steps used. The 'stepped' nature of the MEPS provides a disadvantage to systems that are not designed to closely meet one of 15 sizes (defined by rated hot water requirements) in Australia and a larger range of 37 allowable sizes (defined by nominal capacity when tested against AS/NZS4692.1) for New Zealand - although only 17 of the New Zealand sizes are for systems under 300 litres. MEPS steps for Australian products existed prior to the 2005 reforms.

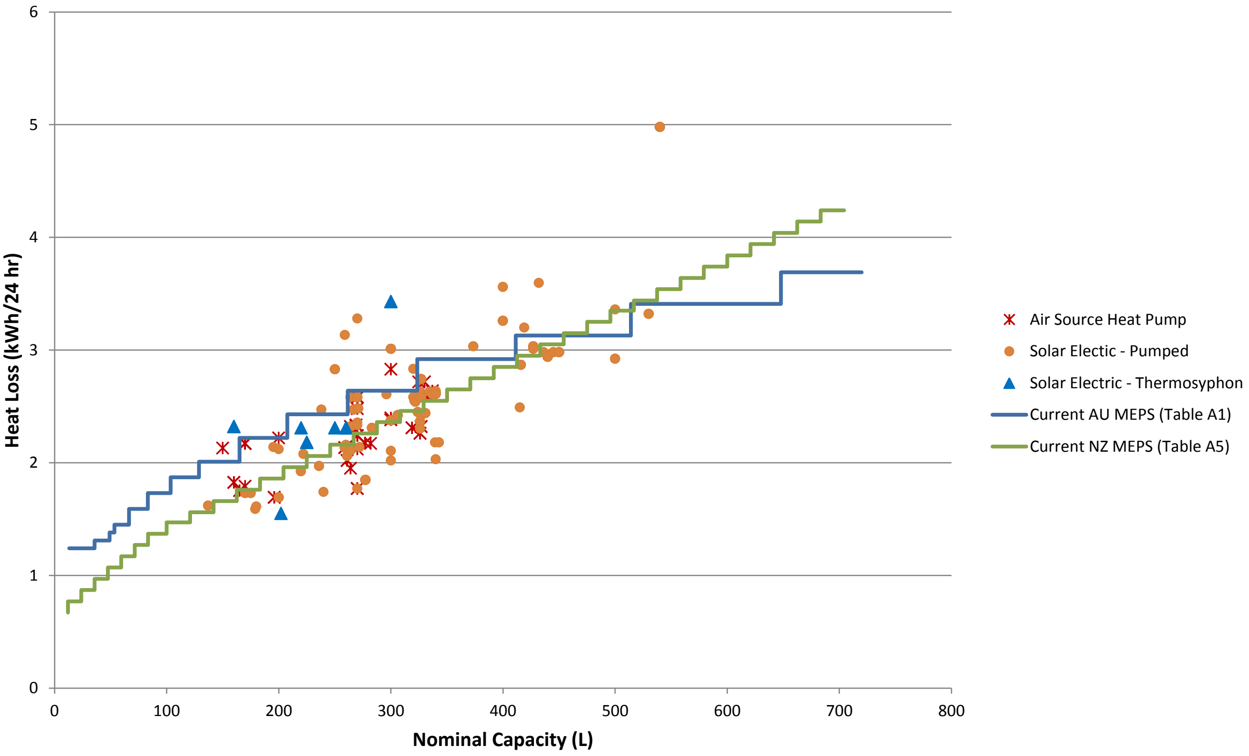
To understand the market impact of these steps, Figure 9 shows the variations in heat losses declared by tank manufacturers or importers for different sized conventional ESWHs (unvented mains pressure water heaters only, adjusted to AS/NZS4692.1 test method with no allowances for additional elements) while Figure 10 shows the equivalent information of SWHs and HPWHs (Australian systems only as no data was available for New Zealand systems), which as noted above, are effectively excluded from the current requirements. It is important to note that for any given size of tank in Figure 9, the heat losses of the least thermally efficient tank are 10% to 20% greater than for those of the most thermally efficient tank.

Figure 9: Declared heat losses for unvented electric storage water heaters by storage volume; current registrations in Australia and New Zealand



Note: Table A1 and Table A5 relate to tables in AS/NZS4692.2.

Figure 10: Declared heat losses for solar electric and heat pump water heaters by storage volume; current models Australia



Note that in Figure 9, the sizes of registered conventional ESWH typically cluster around certain values while for the SWHs and HPWHs (Figure 10) there is a more general spread of the sizes available. As efficient SWHs and HPWHs are provided an exclusion the MEPS requirements, there is less of a need for the systems to be closely aligned with these defined sizes. There is also no energy efficiency gain from limiting the size of ESWHs to defined sizes. Indeed the inflexible nature of the MEPS requirements, especially in relation to smaller water heaters, may hinder both innovation and consumer choice.

In recent years the nature of domestic hot water use has changed rapidly. New technologies such as HPWHs have emerged and water saving devices (such as efficient shower heads) have become more common. Continued innovation in water heating and efficient use of hot water is expected to continue. As such, government restriction of water heater sizing may be both reducing consumer choice and restricting innovation. If the 'stepped' MEPS framework was replaced with a 'formulae based' (algorithm) smooth line, consumer choice and innovation could be improved while still maintaining the integrity of the MEPS program.

Consistency of MEPS levels

The current mix of test standards being used and the different metrics Australia and New Zealand use as a basis of MEPS requirements complicates the comparisons the MEPS levels used in each country. Further complicating the comparison is Australia's use of rated hot water delivery versus New Zealand's use of nominal capacity.

To enable the MEPS to be compared, Australia's delivered capacity for MEPS was converted to nominal capacity[27]. Once the Australian MEPS values had been converted to relate to nominal ESWH capacity, the Australian and New Zealand MEPS for unvented ESWHs were compared. These approximations are shown in Table 3.

[27] This was done by multiplying the delivered capacity specified in the MEPS by the average ratio of delivered capacity to nominal capacity for the relevant ESWH size. This ratio was determined by comparing the average delivered capacity and the average nominal capacity of ESWHs listed in the Australian registration database for each size cohort.

Table 3: Australian and New Zealand MEPS levels compared – unvented mains pressure MEPS

Aust rated hot water delivery step, L	Calculated Ratio of Capacity to Delivery	Equivalent nominal capacity step, L (up to and inc)	Australia MEPS kWh/24h	NZ MEPS kWh/24h	Percentage NZ MEPS of Australian MEPS
<=25	1.04	23.8	1.24	0.77	62%
31.5	1.13	35.7	1.31	0.87	66%
40	1.23	49.0	1.38	1.07	78%
50	1.07	53.5	1.45	1.07	74%
63	1.05	66.4	1.59	1.17	74%
80	1.04	83.2	1.73	1.27	73%
100	1.04	103.5	1.87	1.47	79%
125	1.03	128.8	2.01	1.56	78%
160	1.03	164.9	2.22	1.76	79%
200	1.04	207.7	2.43	1.96	81%
250	1.05	261.5	2.64	2.16	82%
315	1.03	323.5	2.92	2.46	84%
400	1.03	411.3	3.13	2.85	91%
500	1.03	514.2	3.41	3.35	98%
630	1.03	647.9	3.69	4.04	109%

The table shows that the Australian MEPS requirements are less stringent than the New Zealand equivalent for ESWHs up to approximately 500 L nominal capacity.

The results in Table 3 differ from those in Figure 9 due to the different methodologies used to estimate the differences in MEPS levels between Australia and New Zealand.

While the minimum requirements for New Zealand are more stringent than those for Australia, manufacturers may choose to exceed these requirements. Comparative testing (see page 20) showed that the actual difference in Australian and New Zealand appliances are less than the differences in minimum requirements. The spread of declared heat loss levels shown in Figure 9 suggests that there is technical potential to increase the Australian MEPS requirements.

Hydrochlorofluorocarbons in insulation

Hydrochlorofluorocarbons (HCFCs) are being phased out globally under the Montreal Protocol on substances that deplete the ozone layer. HCFCs are used as highly effective blowing agents for some insulation foams.

Australia has a licence and a quota system which restricts, and is phasing out, the importation or manufacture of HCFCs. While there is a regulation which currently allows the import or manufacture of equipment insulated with foam manufactured with HCFC, this regulation has a sunset clause of 30 June 2015. The result of these arrangements seem to be that Australian manufactured ESWH do not use HCFC based insulation, however ESWHs using such insulation can be imported into Australia. In New Zealand, the majority of the ESWH manufactures seem to be using HCFC based insulation, however these are scheduled to be banned from 2015. Alternative insulations are being investigated.

As HCFC based insulation can provide a thermal advantage over similar insulation, the ability for Australian manufacturers to meet New Zealand requirements and remain cost competitive is unclear. Additionally the scale of manufacturing changes that will be required in New Zealand once HCFCs are banned is also not clear.

In summary, the planned discontinuing of HCFC-based insulation usage from 2015 will challenge the New Zealand markets ability to meet current MEPS levels. In Australia, while there would be reductions in heat losses by some strengthening of MEPS, harmonising to New Zealand levels would remove around 64% of the current market and 75% of the market for smaller ESWHs of 165 L or less. The impact to this industry may be even greater from harmonising due to the disadvantage of Australian manufacturers in using non HCFC based insulation, and raises the risks to the industry of both a shift to importing HCFC based products and of manufacturing employment losses.

Effectiveness of heat loss MEPS for SWHs and HPWHs

Effect of the exclusion for some SWHs and HPWHs

The design of efficient SWHs and HPWHs is more complex and costly than conventional ESWHs due to the use and interaction with additional components. A SWH or HPWH that has a higher level of heat loss than a similar sized conventional ESWH system will likely have far lower running costs due to the overall efficiency of the systems.

As discussed earlier, SWHs and HPWHs are provided an exclusion from the Australian and New Zealand MEPS standard (AS/NZS4692.2) provided that they are able to meet a specified hot water demand requirements. This means that if an electric boosted SWH or HPWH is modelled to be able to meet more than 50% of its energy contribution via a source other than electric, it is excluded from the requirements of heat loss MEPS. SWHs and HPWHs failing to meet this requirement are intended to be subject to the current tank heat loss MEPS.

As the exclusion only relates to more efficient SWHs and HPWHs, the exclusion provides flexibility for manufacturers of efficient systems to cost-effectively design their overall systems to reduce electricity use without concentrating on the efficiency of individual parts (e.g. tanks). For less efficient SWHs and HPWHs, no exclusion to the heat loss requirements is provided to ensure that a minimum level of performance will be provided to the consumer.

While these arrangements appear well balanced, three separate problems have emerged with how these arrangements are actually being interpreted and applied.

Exclusions based on modelled results

A post implementation problem has become apparent with the exclusion for efficient SWHs and HPWHs being based on modelled systems outcomes. This problem has resulted in the eligibility of the exclusion being impossible to independently determine.

The modelling requires a number of physical tank tests and key information to be provided by the manufacturer. The information provided is difficult to verify and the need for such information means that testing cannot be conducted in a completely independent manner.

Additionally much of the information provided, such as how components of the water heater responds to certain situations, is regarded as critical intellectual property by manufacturers and has led to significant confidentially requirements being imposed on the information and some related outputs. As the information needs to be supplied to non-government bodies (the independent, accredited testing laboratories) concerns have been raised about the potential for this information to be indirectly misused such as by informing research that benefits competitors. This has meant that no compliance has been able to be conducted, essentially providing an exclusion to all SWHs and HPWH regardless of if they operate efficiently or not.

Additionally many situations can occur which will cause a SWH or HPWH to operate far less effectively than modelled. These include:

- the system or components are incorrectly or poorly installed – e.g. poor solar access for solar panels;
- incorrect settings – long or poorly timed boosting timeframes (including permanent boosting) or high temperature settings in response to hotter water preferences (which will be negated by tempering valves) reduce potential solar gain;
- components have a partial or full failure which is not visibly apparent – e.g. an under-gassed or malfunctioning heat pump system may rely on the electric resistive backup;
- the system is incorrectly sized for the consumers' needs e.g. small systems may overly rely on backup boosting while an oversized systems may have higher heat loss levels;
- the modelling is based on information supplied by the manufacturer which does not reflect the operation of the systems in 'real life';
- the system is not designed for local needs e.g. in climates colder than the modelling assumes, frosting of compressors or solar panels may result in higher energy use; and
- the compliance focus is on an actual storage tank. The modelling makes assumptions that the system, when installed, will be connected to a defined number, type and size of solar panels or heat pump units. There is no way to ensure that this actually occurs.

So while the modelling may provide a good indication of the potential for a SWH or HPWH to provide savings in energy use, the actual energy savings being delivered by a particular installed unit to a particular consumer may differ substantially from the modelled scenario. Testing of SWH and HPWH by E3 and both public and confidential research into the performance of installed SWHs and HPWHs have raised concerns about the prevalence of sub-optimal outcomes occurring.

Non-validation of claims

As noted above, there are problems with the interpretation and application of the exclusion framework. As a result independent compliance on both modelled energy savings and heat loss levels has not been possible and the E3 program has not been able to conduct a robust level of compliance checking.

There are both installation requirements (such as the Australian National Construction Code) and government incentives to the purchase of SWHs and HPWHs (such as Small-scale Technology Certificates (STCs)). Together, these requirements and incentives encourage consumers to purchase highly-efficiency water systems and assist to minimise upfront capital barriers. There are also other key outcomes of these requirements such as improving the energy efficiency rating of homes and to help meet renewable energy targets.

These requirements also depend on modelled outcomes for SWHs and HPWHs. Due to the substantial scope of these requirements and the quantum of associated financial incentives it is important to ensure that such requirements are robust. While these programs may be implemented with specific auditing programs, requirements for the provision of laboratory test reports or the use of lists of compliant systems, there does not seem to be independent, physical testing of components.

The E3 program conducted testing of HPWHs as part of a product profile released in 2012[28]. These tests required information to be supplied by manufacturers so cannot be regarded as wholly independent. These tests covered 10 models which were responsible for approximately 90% of the Australian HPWH market. The energy savings claimed for these products ranged between 60 and 75%. For climate zone 3 conditions (Sydney, Perth, Adelaide) the average estimated energy savings based on the test results was 57.3% (median was 59.2%) and two models recorded energy savings lower than 50% (the threshold used for the heat loss MEPS exclusion). As all products recorded lower 'tested' results than what they were claiming and two products failed to meet the 50% threshold for a MEPS exclusion, relying on non-validated claimed energy savings for a heat loss exclusion is not a robust framework.

The tank heat loss levels are a key input into the modelled results, and so incorrect tank heat loss claims will alter the result of the modelled outcomes.

Figure 10 showed that claimed heat loss levels of SWHs and HPWHs are generally at or below the MEPS requirements (note that these systems are all effectively provided exclusion to the above MEPS requirements). However a number of independent tank heat loss tests have recently been conducted by the E3 committee and the results of these are shown in the Figure 11.

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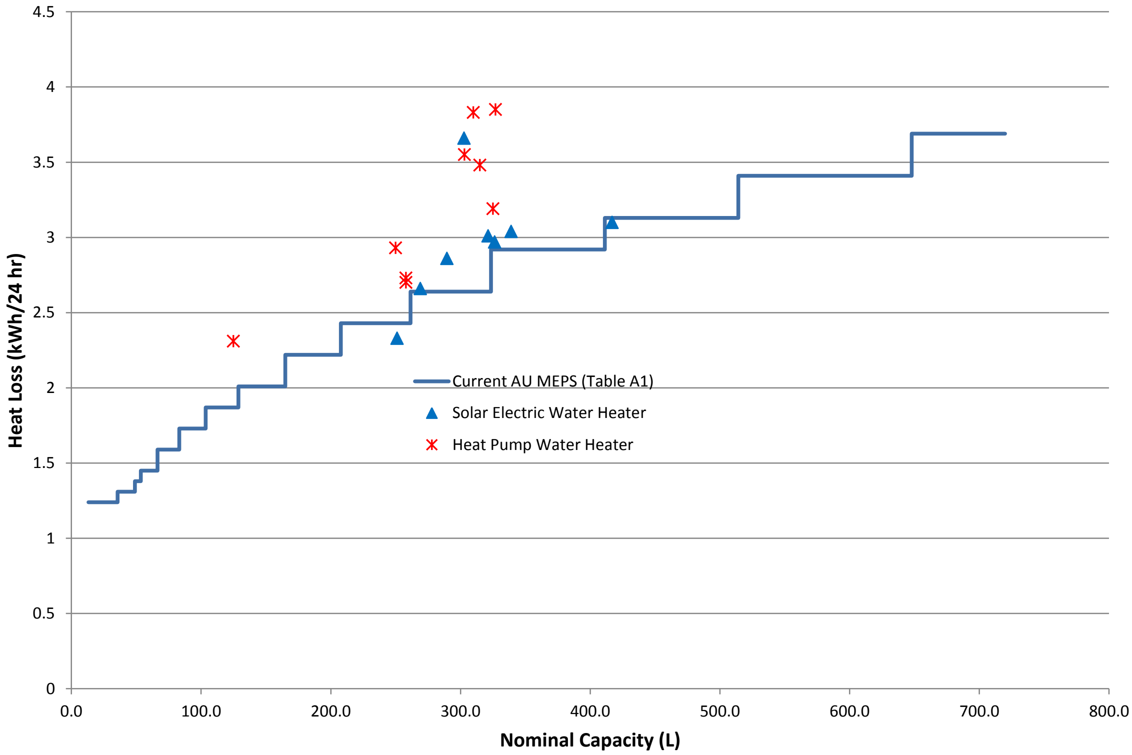
[28] http://www.energyrating.gov.au/products-themes/water-heating/heat-pump/product-overview/

Figure 11: Test results of heat losses for HPWH and solar electric boosted water heaters



These independent test results, while being from a small sample, indicate that actual heat loss results would not satisfy MEPS requirements (if applied) for the majority of water heaters tested. These results indicate a divergence from what is being claimed by suppliers (Figure 10, page 35) and therefore what is being used as a basis for modelling for other government programs, i.e. HPWHs and SWHs may not be producing the energy savings that their modelling suggests.

Given the divergence in heat loss levels being claimed by manufacturers and what has been measured by an independent source, it appears that there is a case for independent physical testing of tank heat loss levels. Any improvement in E3 compliance practices will not only improve MEPS compliance, but will also allow a more general assessment of heat loss levels being claimed and used for other important government initiatives.

Compliance loop-holes associated with the exclusion

As noted above, the application of the SWH and HPWH exclusion to tank heat losses is based upon modelling results which make assumptions about what other components may be *installed* with these tanks. A market has recently appeared where water heaters are being installed as conventional ESWH but these tanks are being marketed as being 'solar ready' (or heat pump ready) as they could be connected to solar panels in the future. Some stakeholders see this section of the market growing in the future.

While a 'solar ready' tank can provide a consumer the flexibility to 'upgrade' their water heater at a future point in time, there is no data on how many of these systems are actually upgraded. Innovations designed to provide consumer flexibility should generally be supported in principle, however, as such a tank can claim high modelled energy savings if connected to adequate solar panels, it will not be subject to tank heat loss MEPS. If such a tank is not upgraded, the level of tank heat loss may exceed that of other tanks operating as conventional ESWHs and will have higher operating costs as a result.

Imposing requirements and conducting compliance at the point of installation to ensure that all tanks are installed with defined solar panels or heat pump units would be complex and expensive. Alternatively, requiring all 'solar ready' tanks to be upgraded within a certain duration would also be costly, burdensome for plumbers and would require permission to access to an individual's home to verify the upgrade.

A targeted application of MEPS for all tanks that could be sold and used as conventional ESWHs is an option. This framework would likely target tanks designed for use in split-solar or split-heat pump systems and exclude integral HPWHs and thermosiphon tanks. However there is a risk that applying the MEPS designed for conventional ESWHs may eliminate a large number of split-systems as they will generally have higher heat loss than an ‘equivalent’ conventional ESWH due to being designed with additional ports or connection points (which are sources of heat loss). Removing generally energy efficient split-systems may lead to the market shifting to more expensive to operate and less efficient conventional ESWHs – a negative outcome that should be avoided.

An alternative policy response could be to add a visible warning to ESWHs which are not subject to the MEPS applicable to conventional ESWHs. A warning stating that a systems was ‘not optimised for water heating without a supplementary heat source’ (or a similar warning) may help to inform individuals that using such tanks as purely conventional ESWHs may be less efficient and more costly that using a conventional ESWH that meets MEPS requirements.

Summary

In summary, as SWHs and HPWHs are typically far more efficient that conventional ESWH, full application of heat loss MEPS may result in unintended consequences by removing many highly efficient water heaters from the market and hindering innovation. However the current exclusion designed for only efficient SWHs and HPWHs is not effective in its current form as compliance or verification of the exclusion cannot be conducted through independent ‘off-the-shelf’ testing. Additionally, even if compliance with the current model based exclusion was possible, testing and research has cast doubt on the appropriateness of modelled results for heat loss exclusions.

Simple approaches to protect consumers from poor performing SWHs and HPWHs may be possible. Increasing the scope of the current MEPS framework to clearly capture all SWHs and HPWHs, but to only apply a less stringent MEPS in acknowledgement that many such systems may have higher overall efficiency levels would solve many problems. It would enable compliance (on actual and claimed heat loss levels) to be conducted for the first time, would simplify arrangements through removing the need for model-based exclusions, could be designed to only affect systems with heat loss characteristics far worse than other similarly sized systems (outliers) and most importantly would provide consumers with a basic level of protection. Such an approach may also need to be combined with a warning to help prevent the MEPS loophole associated with using ‘solar ready’ tanks as conventional ESWHs.

Labelling and information

As the main source of market failure in the Australian and New Zealand water heater markets is an information failure, what capacity is there to address the information failure above and beyond the existing MEPS requirements and current BAU activities?

While the existing MEPS requirements provide strong national net-benefits in providing consumers with lower levels of heat loss from ESWH, MEPS reforms by their nature target the worst performing sectors of the market. A labelling framework will not by itself eliminate poor water heaters but will encourage consumers to purchase water heaters with lower expected lifetime costs and will also encourage innovation in high efficiency technologies. An effective label can also result in constant, consumer driven demand for improved appliances, potentially reducing the case for regular government MEPS interventions.

There is some evidence that a form of energy labelling on hot water systems is desirable and can have an effect on the market. In March 1993 the Australian Gas Association decided that gas energy ‘ratings’ be calculated and associated labels be affixed to all gas water heaters as part of the appliance registration process. Gas water heater labelling became mandatory in 1995, by which time all pre-existing registrations had to be renewed.

During the 1990s all major suppliers of gas water heaters introduced 5 star models in their product ranges and many also eliminated the least efficient models from their product ranges (e.g. models receiving 2 or 3 stars). More recently, suppliers of the instantaneous gas water heaters have been competing to introduce very high efficiency models and there appears to be an overall increase in the average efficiency of gas water heaters sold. However it is hard to identify the scale of the shift that has been caused by labelling as there have also been restrictions on plumbers that have prevented the installation of lower efficiency units in some homes.

The EC has also recently decided to introduce a labelling framework for water heaters after many years of detailed research and consultation. These labels will provide a ‘level playing field’ through consistent information on all water heater products.

The ability of the current Australian and New Zealand regulatory framework to be used as a basis of labelling is low. Currently the ESWH MEPS framework focuses on heat loss levels only and is complicated by a number of different test standards which may give different results for the same water heater. While minimising heat losses is very important, heat losses are only one driver of total energy usage in an ESWH. Indeed many highly efficient SWHs and HPWHs may have higher heat loss levels than a less efficient conventional ESWH. So even if the differences in test methods can be resolved, a heat-loss based label enabling comparisons of appliances would potentially drive customers who are interested in minimising energy usage away from highly efficient SWHs and HPWHs to a more energy intensive conventional ESWH.

Additionally a label that is only used for ESWH would not inform customers who wish to compare other water heating technologies.

There is a stronger case to look at labelling using the modelled energy usage information calculated via AS/NZS 4234. Currently in Australia most SWHs and HPWHs already undertake such modelling in order to receive STCs or meet jurisdictional installation requirements. However, this model informs potential energy savings, not energy efficiency levels. As such, a label based on this framework may lead consumers to buy systems larger (and likely more expensive) than they require as large systems have the *potential* to displace more energy use thus provide greater potential energy savings. A larger system may also cost more to run than a smaller systems in meeting the consumers' requirements. However if a label also included some sizing information, these shortcomings could be mitigated.

The labelling program that will be used in Europe[29], provides information on the ability of the water heater to supply hot water and indicates how efficient the water heater may be when installed in different climatic zones. If adopted in Australia and/or New Zealand, such a label would not only ensure that consumers could compare water heaters of all technologies and make a choice appropriate to their needs, but the consistency with the European market would minimise the regulatory burden for imported and exported water heaters.

In the recent stakeholder feedback to the Consultation RIS on heat pump water heaters, there was support from both a key plumber group and manufacturers for a single energy efficiency label that should either be applied to all electric water heaters or all water heaters (electric and gas). Most stakeholders said that such a labelling scheme should not be voluntary in nature, although one stakeholder said that a voluntary scheme could be used, but only as a short term transitionary measure.

So while an efficient and effective labelling regime applying to all water heaters has the potential to significantly reduce the level of information failure occurring in the current water heater market, the current mix of regulatory, heat loss focused arrangements for ESWHs are not well suited to be currently leveraged for labelling purposes. If a label was to be introduced for the entire water heater market, this would mean that products which are not fully covered by E3 energy efficiency requirements (HPWH, SWH and some instantaneous units) would be subject to new energy efficiency requirements.

Suitability of the current MEPS levels

The current MEPS framework has been developed through consultative processes in response to market failures and agreed at a Ministerial level. The MEPS seeks to minimise unavoidable heat losses, which occur regardless of a consumers hot water demand. The rationale presented for the existing MEPS framework in the 2004 government review was there a market failure impacting the hot water market with heat losses from storage tanks at that time costing more that the installed costs of a water heater, by up to 20%. The costs associated with these heat losses should be a consideration in consumer purchasing decisions but did not appear to be the case. Due to these market failures a MEPS policy based on a uniform test should follow 'world's best practice' with a lag to take account of domestic pressures. As sales of ESWH are still high, as there has been strong recent innovation with the introduction of HPWHs and as ESWHs may have an important future role in electricity grid balancing roles, the broad rationale for a MEPS policy appears to remain sound - but what about the actual MEPS levels?

While the preceding sections outline a number of shortcomings which have developed with the current MEPS levels, the majority of these are related to the manner by which the ESWH MEPS framework has been set and the associated interaction by the market. These are separate issues to the appropriate level of the MEPS.

If the magnitude of a MEPS is to be re-examined, a number of conditions generally need to be satisfied to ensure that any strengthening is sensible and any weakening is justified. Discussion on these general conditions is noted below, along with references to sections of this document where the underlying condition is discussed in detail.

- **MEPS compliance** – The level of compliance with the current arrangements is an important factor in considering MEPS levels. Compliance with current MEPS levels is generally seen as being a prerequisite for considering any tightening of MEPS levels. If there was only a poor level of compliance with current MEPS levels, any tightening would likely have little effect on most of the market. Indeed, a tighter MEPS in a market

[29] http://www.eceee.org/Eco_design/products/water_heaters/EU48_EN_1_1.pdf

with poor compliance may disadvantage any manufacturer that undertakes additional investment, as competitors that that do not undertake such investment may gain a price advantage.

- Compliance levels are discussed in *Compliance and Comparative Testing* on page 20. The results of compliance testing suggest that most Australian tanks meet current Australian requirements.
- **Scope for improvement** – Any tightening of a MEPS designed to improve the performance of products must take into account the scope for appliances to meet the revised MEPS. If there is scope for improvement across all appliances types (such as for all sizes of ESWH), a MEPS will be able to improve the energy efficiency across the entire market. If only part of the market shows potential for improvement, or there is no scope for improvement, any tightening would either need to only target the section of the market where tightening is possible or note that any tightening of the remaining market would 'phase-out' certain appliances.
- Some scope for improvement for conventional ESWHs is shown in Figure 9, page 34. For all sizes of conventional ESWH, the market is currently producing appliances which are superior to the MEPS.
- SWHs and HPWHs are effectively excluded from scope of the current MEPS. The claimed levels of heat loss levels for HPWHs and SWHs (Figure 10, page 35) hints that the market is producing systems with heat loss level that are generally lower (better) than the minimum requirements applied to conventional systems but independent testing has cast doubt on these claims (Figure 11, page 39). However, it should be noted that the costs of heat losses for these systems may be lower than conventional systems, due to their higher average heating efficiency.
- **Lack of BAU improvement** – The decision to impose any initial MEPS requirement is based on the presence of a market failure that is preventing, fully or partially, an improvement in the energy efficiency of the appliance and is resulting in a sub-optimal economic situation. The 2004 government RIS also outlined the desire for MEPS requirements to be 'world's best practice'. If the initial MEPS triggers the market to improve energy efficiency on an ongoing basis, then the case for any additional MEPS would be weakened. If however, the market was not improving energy efficiency levels overtime, there may be a case for an additional MEPS intervention to further drive the market.
- There are two observations that show that there has been little to no improvement in the market above and beyond the effect of the existing MEPS interventions.
    - For Australia, the majority of conventional ESWH have been subject to the same MEPS levels that were established in 1999 (14 years ago) with smaller ESWH subject to a revised MEPS in 2005 (8 years ago). For New Zealand the MEPS requirements applied from 2002 (11 years ago). Figure 9, page 34, illustrates that many Australian conventional ESWHs are either on, or very close to, the 'minimum' MEPS levels while for New Zealand many appliances are slightly superior to MEPS requirements.
    - Data on the sales weighted level of heat loss for ESWHs sold in New Zealand has been collected since 2000. This data shows that prior to the 2002 New Zealand MEPS, sales weighted heat loss levels were flat. Improvements occurred in the three years after the MEPS was introduced, but heat loss trends have again flattened out and have even recently regressed. See Figure 8, page 31, and related discussion and details.
- As the majority of the Australian market is sitting at levels established 14 years ago, there appears to have been no BAU improvement. For New Zealand, the additional sales data shows that improvements in heat loss levels have only occurred immediately after a MEPS intervention.
- As the key consumer markets of the USA and the EU are moving ahead with more stringent MEPS requirements, the shortfall between local requirements and 'world's best practice' is growing.
- **Net benefits, competition and unintended consequences** – When establishing or varying a MEPS level, a degree of analysis is required. Any MEPS policy needs to be carefully considered to ensure that a MEPS will result in net-benefits to the economy, does not result in undue implications to competition levels or consumer choice and is conscious of the potential for unintended consequences.
- These issues are examined in this RIS, but the associated policy options (and alternative options) remain open to stakeholder comment.
    - Both of the Proposals to alter the ESWH MEPS (Proposals 2 and 3) in this RIS provide net-benefits to the economy (see *Chapter 7. Impact Analysis*). Additional discussion on the potential benefits to an individual consumer is at *Magnitude of potential market failures*, page 28;
    - Both of the Proposals to alter the ESWH MEPS contain regulatory streamlining element including removing sizing based restrictions. Removing these restrictions may improve competition and consumer choice - see *Removal of Australian ESWH sizing constraints* and *Removal of New Zealand ESWH sizing constraints* from page 48;
    - Both of the Proposals to alter the ESWH MEPS suggest 'shaping' the MEPS requirements to ensure that current appliances of all sizes would remain on the market. This approach should minimise competition

impacts while maintaining consumer choice and triggering consumer gains – see *Australia - Strengthening of MEPS requirements* page 51; and

- Proposal 4, which included treating SWH and HPWHs exactly the same as conventional ESWH, was not subject to detailed modelling. While suggested by some stakeholders, this option could have substantial unintended consequences of increasing the total amount of energy used to heat water in households by removing many HPWHs and SWHs from the market (see *Proposal 4: Streamlining existing regulations and all ESWHs to be treated consistently* page 53). Instead, Proposals 1 through 3 suggest setting a less stringent MEPS, informed by manufacturer claimed heat loss characteristics, which would only remove a few 'outlier' SWHs from the market (see *Figure 14: Proposed reduced heat loss MEPS for solar electric and heat pump water heaters for Australia and current models* page 51). This alternative proposal would also address competition issues where sellers/manufacturers of HPWHs and SWHs may be over claiming the benefits of their products to the detriment of all other water heater types (see *Non-validation of claims* on page 38 and *Ensuring that arrangements applying to SWHs and HPWHs can be subject to compliance*, page 49).

5. Objectives of Government action

Objectives

The specific objectives of this NSEE[30] project are:

1) **To streamline regulations and at the same time increase their effectiveness.**

The Office of Best Practice Regulation administers the Council of Australian Governments Best Practice Regulation[31] requirements. These requirements help to ensure that any regulatory activity adheres to a best-practice framework to 'maximise the efficiency of new and amended regulation and avoid unnecessary compliance costs and restrictions on competition'.

As the regulatory MEPS framework has been in place since 1999 in Australia and 2002 in New Zealand, the 6th Principle of Best Practice Regulation, ensuring that regulation remains relevant and effective over time, is especially important. This Principle seeks the review of regulation 'with a view to encouraging competition and efficiency, streamlining the regulatory environment, and reducing the regulatory burden on business arising from the stock of regulation'. To address this outcome, this document reviews the current MEPS regulations to see if the arrangements have been effective in improving heat loss levels (above what may have been achieved by the 'market' in a business-as-usual situation), to investigate opportunities to streamline and remove regulatory overlap, to investigate the presence of any unnecessary restrictions, to ensure that the intended outcomes of clauses are actually occurring (stated as the goal to follow 'world's best practice' in the 2004 government review) and to review the arrangements for potential loopholes which undermine the regulatory outcomes stated.

2) **To save consumers money by improving the energy efficiency of water heaters sold in Australia and New Zealand and more effectively address the market and information failures that impact the electric storage water heater market.**

Although heat loss is generally responsible for a smaller component of overall energy usage, heat loss is a form of wasted energy. This energy wastage will occur regardless of consumers' hot water usage levels. Based on current insulation technology, it is unlikely that heat loss could be reduced to near zero. However better insulation and other innovations may be developed in the future and alternative, non-storage water heaters (instantaneous) are currently available. Reducing heat loss levels has the potential to provide appliances with lower life-time costs to consumers.

If there is evidence that there are feasible approaches to reduce the level of heat loss, but the adoption of these approaches are being negatively affected by market failures, then government intervention may be required to improve the energy efficiency of water heaters to reduce operating costs and save consumers money.

Where market failures are impacting upon the wider scope of overall appliance energy efficiency levels, policy responses to mitigate the magnitude of the market failures should also be pursued. For example, policies that inform consumers of sizing and operating costs to ensure consumers can make appropriate purchasing decisions.

[30] National Strategy on Energy Efficiency - http://www.coag.gov.au/sites/default/files/National_strategy_energy_efficiency.pdf
[31] http://www.finance.gov.au/obpr/docs/COAG_best_practice_guide_2007.pdf

6. Options Considered

Policy options considered

A number of broad policy options were developed and presented in the Product Profile on ESWHs which could address the problems identified, satisfy government objectives and initiate consultation with stakeholders. As a result of the consultation on these options and the associated information and views provided through stakeholder submissions, the potential options have been revised and refined. The options have been developed to:

- **Improve regulatory consistency:** removing duplication or unnecessary restrictions and harmonising parameters that do not materially affect the scope of stringency of regulations. Reforms will reduce regulatory burdens and enable consistent information to be provided to consumers;
- **Improve regulatory effectiveness:** review clauses that are not able to deliver their intent and mitigate loopholes to the current arrangements that were unforseen when the original arrangements were designed. Reforms will ensure that where regulation is used, it is effective at delivering outcomes; and
- **Deliver strong net-benefits through addressing market failures:** address market failures through either MEPS or labelling. Reforms must be feasible, deliver net-benefits and take account implications to the wider water heater market.

A number of options were developed and approved by the E3 Committee as being feasible. These policy options vary in scope and impact and have been subject to modelling and analysis in this RIS. These are:

- **Business-As-Usual (BAU):** The BAU approach would continue, with the existing MEPS requirements, standards and definitions to continue to apply (with the period 2013-2033 modelled). The majority of conventional ESWHs would still be required to meet established heat loss requirements;
- **Proposal 1: Streamlining existing regulations:** Remove regulatory overlap by moving to a single (existing) test standard. Align the Australian and New Zealand MEPS basis, remove restrictive size limitations. Mitigate against MEPS loopholes. Enable compliance-checking of existing HPWH and SWH MEPS and mitigate against loopholes;
- **Proposal 2: Streamlining existing regulations and strengthening Australian MEPS:** Implement Proposal 1 and strengthen the Australian MEPS.;
- **Proposal 3: Streamlining existing regulations, strengthening Australian MEPS and scheduling additional MEPS review:** Implement Proposal 2 and conduct a market review of average efficiency levels in 2016. The review will enable E3 to vary each nation's MEPS arrangements by up to 10% with the goal of full harmonisation of MEPS levels by 2017.;
- **Proposal 4: Streamlining existing regulations and all ESWHs to be treated consistently:** Implement Proposal 1 and fully close compliance loopholes and improve heat loss characteristics of SWH and HPWH by subjecting all ESWH to the same MEPS requirements; and
- **Proposal 5: Appliance labelling:** Investigate an energy rating label framework to apply to all water heaters (not just ESWHs) which provides both energy use and sizing information. Consistency with existing international labelling explored as a priority.

The degree by which these proposals could address the underlying market failures vary. In addition, the impact of proposals would affect the various classes of stakeholders differently. In general:

- Options which provide regulatory improvements but do not directly impact ESWH appliances will only have second-order effects on the market failures but will contribute to the objective of streamlining regulations and increasing their effectiveness. There would be short term costs associated with implementation and changed testing requirements for products tested under older arrangement - but savings associated with more streamlined testing and compliance arrangements and the potential for better consumer decisions due to comparable information;

- For options targeting MEPS levels, the impact of the market failures will be mitigated. Additional costs will be borne by any manufacturer who has products impacted by the change, and these costs are likely to be passed on to the consumer. The consumer will benefit from reductions in energy costs from improved MEPS. While a number of ESWHs currently available to consumers would be withdrawn from the market, ESWHs of all sizes will remain on the market and other water heater technologies (SWH, HPWH and instantaneous units) will continue to be available; and
- For options targeting labelling or information, these policies have the potential to most fully address the market failures. The degree to which the market failures would be addressed would depend on the type of information presented, the consumer confidence in the information and if the information requirements were applied to the wider water heater market. The ability of a label to positively impact a decision also depends on the presented information being consistent – i.e. multiple test standards may undermine or reduce the benefits of a label.

There are also a range of positive and negative second order effects which have not been quantified in this RIS. In terms of modelled greenhouse-gas savings the 'rebound effect' has been considered out-of-scope. Rebound can occur when a consumer saves money, as this money could be spent on other activities that create additional greenhouse-gases. This is likely to mean greenhouse-gas savings are slightly overstated. The effect of lower greenhouse-gas emissions from water heating lessening the impact on the rest of the economy in meeting domestic or international emissions targets is also classed as a second order effect and is ignored for the modelling in this document. The modelling also ignores the potential savings associated with lower levels of investment in the electricity grid being needed as a result of these reforms. For more detailed discussion on the impacts of the proposal, see 'Chapter 7. Impact Analysis'.

To further understand these regulatory options, details on the proposed features are presented below.

Business-As-Usual

The option to maintain the current policy settings is a valid choice. Under the BAU settings, conventional ESWH will continue to be assessed against the existing heat loss requirements. These requirements do partially mitigate against market failures. There will be no additional costs imposed on consumers or business, although some business and representatives in Standards committees will continue to invest time and effort into familiarising themselves with and maintaining the mix of overlapping regulatory requirements. There will continue to be additional costs imposed on any party seeking to update the ESWH Standards for any other reason due to the need alter multiple documents. Inconsistencies in requirements for Australian and New Zealand ESWHs will continue and multiple standards and testing methodologies will remain.

There will be no impact on consumer choice through either the removal of some appliances from the market or from improved consumer information in the form of product labelling.

The identified loopholes for 'solar-ready' appliances will persist and the inability to independently test SWHs and HPWHs for MEPS compliance will remain.

Proposal 1: Streamlining existing regulations

The intention of this proposal is to improve the efficiency and effectiveness of the current regulatory arrangements through removing regulatory overlap, align the basis of MEPS calculations (where such alignment will not materially alter the stringency of the MEPS), mitigate against loopholes and redesign the MEPS exclusion available to some SWHs and HPWHs to ensure compliance can be conducted. This proposal is also consistent with the objective of the 2004 government review of ESWHs which sought that 'the various types of electric heater(s) would be treated uniformly thereafter, there being no significant technical differences in respect of heat losses and measures to reduce them'.

These changes reduce costs to business and government through the removal of overlapping regulations; ensuring that all heat loss testing is conducted in a consistent manner; ensuring that the intended special treatment of efficient SWHs and HPWHs can continue but also be subject to compliance; and removal of unnecessary restrictions on ESWH sizing to allow greater consumer choice and industry innovation.

These changes are not expected to alter the range of ESWHs on the market or the efficiency of those products. However, the changes will partially address information failures by ensuring that heat loss data provided to consumers is comparable, introduce greater customer protections from 'loop holes' in the current regulatory framework and provide manufacturers with greater flexibility in meeting MEPS requirements through the smoothing of MEPS. Revising the MEPS concessions granted to SWHs and HPWHs so that heat loss levels can be tested will help protect consumers from poor outcomes associated with either deficient products or installations and allow information to be made available to consumers and improve the quality of data being used as a basis for rebate programs and building code compliance purposes.

The improvements obtained from this proposal are the result of it including the following features, which detailed below:

- Completing the implementation of past harmonisation reforms and additional alignment;
- Harmonisation within joint Australian and New Zealand standard;
- Closing loopholes to the current arrangements;
- Removal of Australian ESWH sizing constraints;
- Removal of New Zealand ESWH sizing constraints; and
- Ensuring that arrangements applying to SWHs and HPWHs can be subject to compliance.

Completing the implementation of past harmonisation reforms and additional alignment

- AS/NZS4692 was released by Standards Australia in 2005 was designed to supersede AS1056, NZS4602 and NZS4606 (Parts 1-3). It also contains requirements for heat exchange water heaters previously covered in AS1361. However due to industry concerns that the testing standards of AS/NZS4692.1 were not complete when the MEPS were being developed (AGO 2004), an extension was granted which has allowed for ESWHs to continue to be tested and registered using the legacy standards. This has meant that ESWHs cannot be compared on a consistent basis and therefore comparable information is still not available to the public. These legacy arrangements also mean changes to one Standard (by government or other stakeholders) may also need to be duplicated in other Standards (at significant time, cost and effort). It is recommended that all future requirements be based on AS/NZS4692.1.
- AS/NZS4692.2 contains separate MEPS requirements based on country of registration, the test standard used and the type of appliance (unvented/vented/heat exchange). The basis of MEPS calculations for unvented tanks should be harmonised to nominal capacity with the requirement to disclose rated hot water delivery. Nominal capacity is the preferred metric due to the more direct relationship with heat loss. Requirements for vented and heat exchange water heaters are not proposed to be changed (as these are out of scope of the current RIS).
- These proposed changes would simplify the regulatory framework (for registrations and compliance), improve the speed, consistency and cost of future standards work, provide the ability for water heaters to be compared on a consistent basis and address a complication where there are limited test facilities accredited for some 'legacy' standards. Consistent information helps correct an information-based 'market failure' and simplification will reduce regulatory overlap.
- In summary, this feature would require regulatory changes so that all future testing requirements are based on AS/NZS4692.1 – with other requirements being formally superseded or no longer referred to. The regulatory enhancements of all future requirements are to be based on AS/NZS4692.1, and the basis of MEPS calculations for unvented tanks should be harmonised to nominal capacity and a standard requirement to disclose rated hot water delivery. MEPS arrangements could be implemented through an existing 'standards' process, or through a GEMS determination (and an equivalent New Zealand mechanism) that could be made freely available.

Closing loopholes to the current arrangements

- There is a current loophole for 'solar ready/heat pump ready' ESWHs. This loophole could be fully 'closed' by subjecting SWHs and HPWHs to the same MEPS requirements as conventional ESWH but this would result in the negative consequence of removing many SWHs and HPWHs from the market regardless of the generally high overall efficiency levels of these systems.
- It is recommended that all ESWHs not being subject to the MEPS applicable to conventional ESWH (i.e. SWHs and HPWHs) be marked with 'water heater not optimised for hot water supply without a supplementary heat source' or similar message. Integral HPWHs and tanks which could only be used for roof mounted thermosiphon solar systems would not need to carry this warning.
- This warning would indicate to the installer and consumer that the ESWH may not provide acceptable performance if used as a stand-alone conventional ESWH. Marking of water heaters is covered in AS/NZS4692.1 Section 4.
- The warning would provide protection to consumers from poorly insulated tanks being used as a standalone ESWH while still allowing the market for 'solar ready/heat pump ready' tanks to exist (must meet MEPS).

- In addition it could be recommended that the Australian and New Zealand building code boards be notified of this warning, and the potential to reference it in AS/NZS3500.4 or Clause G12 of the New Zealand Building Code. This would could also 'fully close' the loophole as an installation requirement preventing the installation of a clearly marked tank without connection to a supplementary heating source(s) is a clear basis for any compliance/enforcement activities.
- In summary, this feature would require regulatory changes so that all ESWHs not being subject to the MEPS applicable to conventional ESWH shall be marked with 'water heater not optimised for hot water supply without a supplementary heat source' or similar message. The potential use of this marking for compliance would be noted to Australian and New Zealand Building Code Boards.

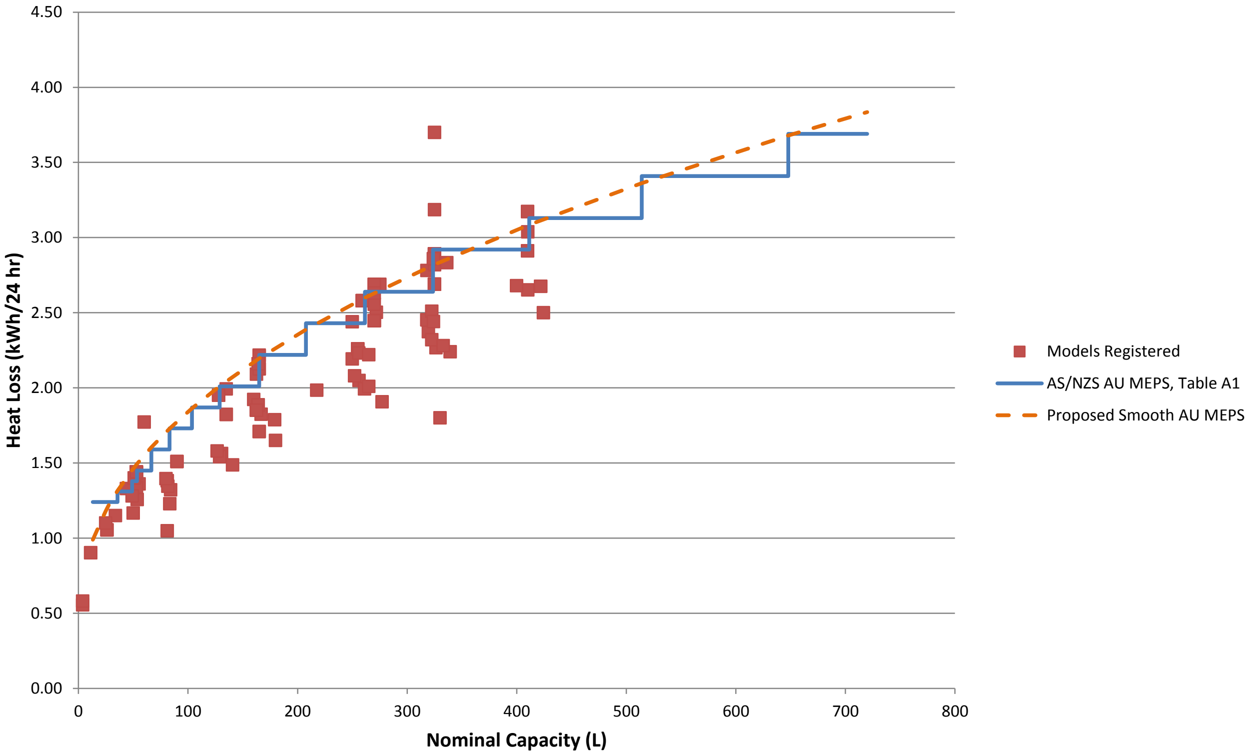
Removal of Australian ESWH sizing constraints

- At present, the MEPS requirements increase in 'steps' which encourage suppliers to design the capacity of their ESWHs to particular size ranges. This constrains their design approach and therefore the ESWH size options available to consumers in the market.
- As the hot water market will continue to change over time and as hot water use may continue to decline due to more efficient use of water, MEPS steps, especially at the smaller end of the water heater market, could become a problem in the future if consumers seek ESWHs in sizes that are 'penalised' under the current arrangements.
- While some manufacturers have previously noted a preference for MEPS steps to provide some standard sizes and reduce potential consumer confusion (e.g. confusion associated with comparing a 59 litre system with a slightly more expensive 60 litre system), this does not seem an adequate case for government restrictions - especially as it does not provide any energy efficiency benefits and the sizes of water heaters are clearly displayed.
- In summary, this option involves the removal of MEPS steps and re-establishing the MEPS as 'smooth' requirements. This approach would provide flexibility for manufacturers to develop a greater range of tank sizes for consumers. The proposed smooth MEPS based on equivalency with current arrangements is shown in Figure 12 and is and is determined by the formulae:

$$Maximum\ heat\ loss \leq 0.4 + 0.19 \times L^{0.44}$$

Where L is the nominal capacity of the tank in litres and maximum heat loss is rounded to the closest 0.01 kWh/24h

Figure 12: Example smoothed MEPS for Australia and heat losses of registered Australian models

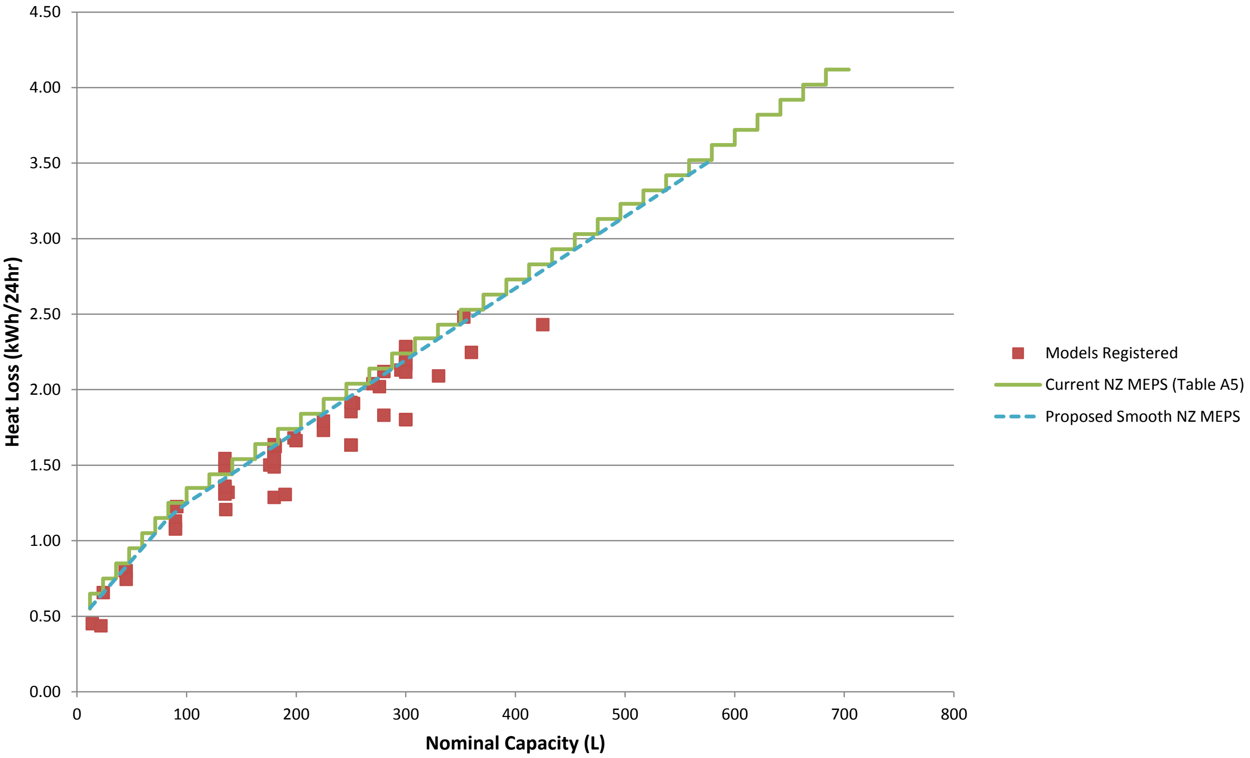


Note: some models with additional elements have not been adjusted, hence they exceed the MEPS

Removal of New Zealand ESWH sizing constraints

- Similar to the preceding section, New Zealand's MEPS requirements also currently have a 'stepped' MEPS requirement which imposes similar constraints on the design of ESWHs. Due to the impact of the constraints it is recommended the MEPS levels be smoothed to provide greater flexibility for manufacturers to develop a greater range of tank sizes for consumers.
- The feature involves the remove the MEPS steps and re-establishing the MEPS requirements so there would be new 'smooth' requirements similar to current levels. The new requirements would be based on current New Zealand requirements, except for tanks where Australian requirements would be more stringent (actual levels will depend on changes to Australian MEPS levels). For these larger sizes, New Zealand and Australian requirements will be harmonised and this may affect any future New Zealand registrations of large tanks.

Figure 13: Example smoothed MEPS for New Zealand and heat losses of registered New Zealand models



- The example of a new smooth MEPS line (above) is based on the current formula for tanks tested against NZS4602 or NZS4602, with adjustments for measurement differences according to Appendix D of AS/NZS4692.2. The formulae used are:

<u>For tanks with nominal capacity less than or equal to 90 litres</u>
Maximum heat loss ≤ (0.0084 × V + 0.40)/1.011 +0.06; and

<u>For tanks with nominal capacity greater than 90 litres</u>
Maximum heat loss ≤ (0.0048 × V + 0.72)/1.011 +0.06

Where V = nominal capacity in litres; and
Maximum heat loss = Heat loss in kWh per 24 hours

Ensuring that arrangements applying to SWHs and HPWHs can be subject to compliance

- At present an exclusion from the MEPS requirements prescribed in AS/NZS4692.2 mean that efficient SWHs and HPWHs are not a regulated product under AS/NZS4692.1 – less efficient SWHs and HPWHs are intended to be regulated under the current arrangements.
- An exclusion means that these water heaters are not required to be tested and their heat loss levels are not recorded in the E3 registration database - which means the public cannot access or compare this information.
- The current wording of the exclusion means that no compliance checking of *any* SWHs or HPWHs is possible. This means that less efficient SWHs and HPWHs, which are intended to be subject to MEPS, cannot be identified and are effectively provided an exclusion by default. Additionally, as independent government testing

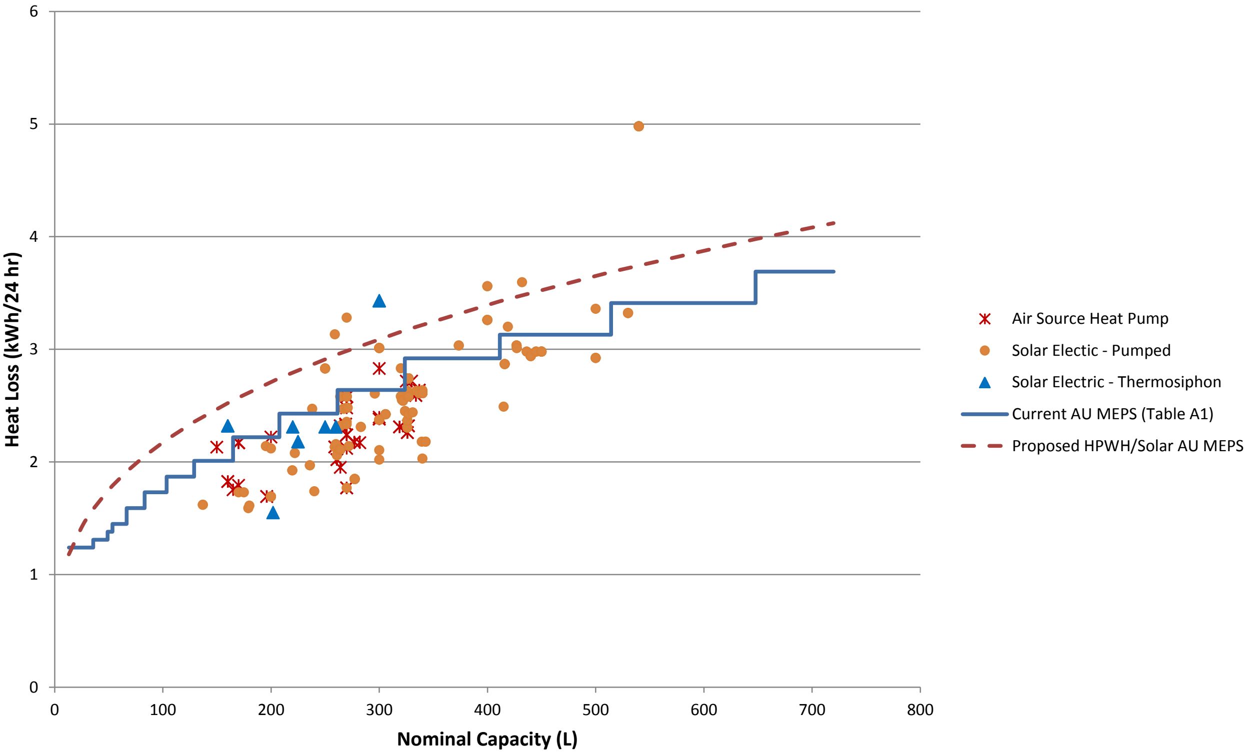
of SWHs and HPWHs is not taking place, the heat loss *claims* of all SWHs and HPWHs (including for efficiency heaters) are not being assessed for accuracy. There are currently concerns about the accuracy of this information with claimed heat loss levels (Figure 10, page 35) appearing to be superior to the results obtained through independent tests (Figure 11, page 39).

- As tank heat loss is one of the parameters that is used to model the efficiency level of products, not being able to verify claimed tank heat loss increases the risk of modelled outcomes being incorrect. This reduced quality of claimed performance information can result in consumers being misled and also impacts rebate programs and construction codes which often have eligibility based on modelled performance.
- Removal of the exclusion would make SWHs and HPWHs regulated products, ensuring consumers had access to efficiency information on the products, and would ensure that compliance and verification testing could be undertaken. However, the simple removal of the exclusion would remove many highly efficient systems and could constrain innovation.
- Updating the current, modelling dependant exclusion would not address concerns that when SWHs and HPWHs are not functioning or installed correctly, these systems can lead to substantial running costs for a consumer. Poor functionality can be the result of poor sizing decisions, poor installation, component failure, systems not suitable for climatic conditions or incorrect operation. Such poor performance is not always noticeable or diagnosable by a consumer, though poor performance of a system will have a large consequence on their electricity bills.
- The preferred middle ground policy option balances the need for compliance testing and quality information while not removing well designed SWHs and HPWHs from the market. By continuing to treat SWHs and HPWHs more leniently in heat loss requirements, the scope of the MEPS can be increased to directly cover all ESWHs (removes reliance on modelled results for HPWHs and SWHs) but this can be offset by reducing the stringency of the heat loss limits applied HPWH and SWH (i.e. a MEPS designed to only remove the very worst systems). Such a policy would also ensure that heat loss claims are tested and verified, information on heat loss levels could be made available to consumers via the E3 website and would help to ensure better outcomes for rebate programs and construction codes requirements.
- To still allow overall system flexibility and to take account of reasons why a SWH or HPWH tank may have inferior heat loss characteristics, the approach used in altering the current MEPS arrangements applicable to SWHs and HPWHs is that: the percentage difference between this MEPS and the general MEPS applied to conventional ESWH should be higher for smaller sized tanks (as additional connections to a small tank will affect a higher percentage of the tanks insulation shell); and the percentage difference should decline for larger tank sizes, however the absolute gap may still increase as larger tanks may be designed for multiple supplementary heat sources (e.g. heat pump and solar connections).
- Figure 14 illustrates the proposed SWH and HPWH specific MEPS and how it compares to claimed SWH and HPWH heat loss levels. The formula used is:

$$Maximum\ heat\ loss\ \leq 0.42 + 0.39\ \times L^{0.35}$$

Where L is the nominal capacity of the tank in litres and maximum heat loss is rounded to the closest 0.01kWh/24 hours

Figure 14: Proposed reduced heat loss MEPS for solar electric and heat pump water heaters for Australia and current models



Note: Data points based on DCCEE data from SWHs and HPWH registered for STC, some of these will include allowances for additional elements or inlets and hence the actual impact may be less.

Proposal 2: Streamlining existing regulations and strengthening Australian MEPS

As with Proposal 1, the intention of this proposal is to improve the efficiency and effectiveness of the current regulatory arrangements through removing regulatory overlap, align the basis of MEPS calculations (where such alignment will not materially alter the stringency of the MEPS), mitigate against loopholes and redesign the MEPS exclusion available to some SWH and HPWH to ensure compliance can be conducted.

In addition, the MEPS requirements in Australia would be strengthened, raising the average efficiency of ESWHs in the market. This is in response to a market failure leading to heat loss levels not being appropriately considered in purchasing decisions, the lack of improvement the market is able to deliver in heat loss in the absence of intervention, the spread of heat loss levels in the market showing that such a shift is possible and the strong net benefit that such a change will deliver to Australia. This is also consistent with the objective of the 2004 government review of ESWHs that sought Australian MEPS levels to follow 'world's best practice' with MEPS to be set at level broadly comparable with Australia's trading partners, but with a lag of several years. Under this proposal there would be no effective changes to New Zealand MEPS levels – for tank sizes where Australian arrangements are more stringent, over 450L, New Zealand MEPS will be tightened to match Australian MEPS, however there are currently no New Zealand tanks of that size registered. New Zealand would continue to have more stringent requirements for storage tanks under 450L.

Australia - Strengthening of MEPS requirements

- An examination of the spread of the efficiency of different ESWH models currently registered (Figure 9, page 34) shows that there is considerable variability in the efficiency of models available at any given size. This shows there is the potential for MEPS levels to be increased while still ensuring a wide range of models will be available in the market. As is discussed in *Cost benefit analysis results*, page 61, this increase in MEPS levels produces benefits that significantly exceed costs. The formula below is the recommended basis for a revised Australian MEPS level. This formulation assumes that a smoothing of the MEPS levels has taken place.
- The most efficient and transparent manner in which to regulate heat loss is to apply an overall limit and to allow manufacturers to design their tanks as they see fit, hence the below MEPS level has been set on the assumption that all mains pressure tanks have a temperature pressure relief (TPR) valve and that the current

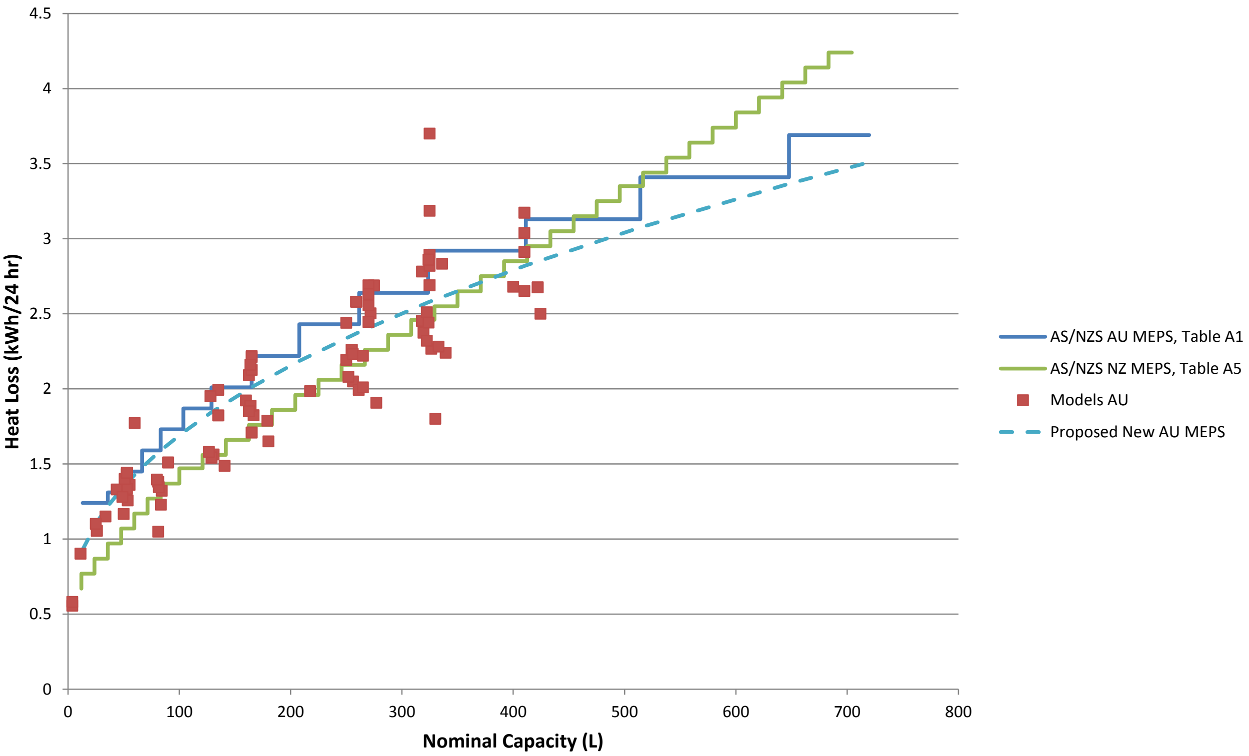
allowances to maximum heat loss levels are removed when the new limit is introduced (0.2 kWh/24 hours adjustments for additional elements). The need for allowances can only be justified where there is a key technical reason for doing so and such a justification does not seem to exist.

- The Australian arrangements would not be strengthened to New Zealand levels, as suggested in the product profile. This is due to the current usage of HCFC based insulation in New Zealand and complications in comparing the relative performance of the markets which reduce the level of certainty that such a shift would require. However, current Australian arrangements are less stringent that the requirements being introduced in the EC and the USA. Rather that proposing equivalent requirements, but with a lag of several years, it is viewed as more sensible to conduct a smaller tightening of MEPS but to conduct such a tightening as soon as it is reasonable to do so. Stakeholder comments on this approach are welcome.
- The proposed revision would impact on 46% of current Australian registrations. The new level has been designed to ensure that ESWH of all sizes would still be available to the market, noting that conventional ESWHs currently comprise 25% of sales in Australia (so the 46% of conventional ESWHs represent 11.5% of overall sales). It is assumed that many of these products will be redesigned and re-enter the market, reducing the medium term impact on the number of systems available to consumers. This assumption is explained by water heaters continuing to be made available, in Australia, New Zealand and other nations, after previous MEPS have been set.
- The proposed MEPS levels take into account the availability of alternative efficient and cost-effective water heating technologies which are available to consumers as substitute products. This means that the impact of this approach is greater for large water heaters (where SWHs and HPWHs are available) and for small systems (e.g. small instant gas and electric systems) where the consumer has a greater range of options available. The impact on medium sized systems is lower. This approach will further reduce the impact on consumer choice. It should also be noted that this proposal is more lenient that the current approach in the USA to set MEPS limits that remove all conventional ESWH larger than 200L.
- Note that any requirements would not impact the market until early 2015 at the earliest –actual timing and any 'grandfathering' or transitional arrangements are open for stakeholder comment. The proposed new MEPS level for Australia is as follows:

$$Maximum\ heat\ loss\ \leq 0.42 + 0.16\ \times L^{0.45}$$

Where L is the nominal capacity of the tank in litres and maximum heat loss is rounded to the closest 0.01 kWh/24 hours.

Figure 15: Proposed new heat loss MEPS for conventional storage electric water heaters for Australia and current models



Proposal 3: Streamlining existing regulations, strengthening Australian MEPS and scheduling additional MEPS review

The intention of this proposal is to improve consumer outcomes by removing unintended consequences and adverse outcomes of the existing regulations, to strengthen current MEPS requirements in Australia, to further strengthen the MEPS requirements in Australia and New Zealand in 2017. The impacts of the proposal are the result of it including the features of Proposals 1 and 2, plus the impacts from the additional feature described below. This proposal would mitigate, but not solve, the market failures affecting the water heater market. Similar to Proposal 2, this is consistent with the objective of the 2004 government review of ESWH that sought Australian MEPS levels to follow 'world's best practice' with MEPS levels broadly comparable with Australia's trading partners, but with a lag of several years.

Scheduling defined additional future MEPS strengthening

- MEPS requirements should be periodically reviewed to ensure their adequacy.
- Full harmonisation of requirements between Australia and New Zealand has the potential to provide additional regulatory simplification, to standardise compliance approaches and to deliver consumer savings. However the lack of quality comparable data and the scheduled changes in New Zealand insulation practices (banning of HCFC based insulation) make it difficult to determine an appropriate joint MEPS level at this time.
- The proposed streamlining of regulatory requirements will ensure that future heat loss data between Australian and New Zealand tanks is comparable. This will improve transparency and comparability of performance between systems and support compliance activities. Further, existing independent and accredited laboratories will be able to test all ESWH using one joint Standard.
- It is proposed that a market review be conducted using the improved data that will be available in 2016, view to updating MEPS levels in 2017. E3 will be tasked with this review with the mandate to consider both strengthening MEPS levels (if the market review provided evidence that is feasible) and further harmonise MEPS arrangement (with consistent data being available to inform appropriate MEPS levels to harmonise to). This E3 post market review is similar to that approved in the area of computers[32].
- The outcome of the 2016 market review cannot be predicted. However, for modelling purposes, assumed levels of change are required in order to enable indicative cost-benefit analysis to be conducted and to provide a basis for stakeholder feedback. A 10% strengthening in the MEPS levels of each country has been modelled. In reality, the level of change would differ between countries and for different sizes of ESWH.
- Only the MEPS level being applied to conventional ESWH would be updated as part of the market review– the less stringent MEPS proposed to be applied to SWHs and HPWHs would remain unchanged as such MEPS were designed to prevent poor systems, rather than to continually drive performance. If future government intervention is required to improve the efficiency of SWHs or HPWHs, product specific MEPS, market-wide MEPS or appliance labelling programs may be used.

Proposal 4: Streamlining existing regulations and all ESWHs to be treated consistently

Similar to Proposal 1, the intention of this proposal is to improve the efficiency and effectiveness of the current regulatory arrangements through removing regulatory overlap and, align the basis of MEPS calculations (where such alignment will not materially alter the stringency of the MEPS).

This Proposal was inserted due to stakeholder feedback provided during earlier consultation. It is consistent with the 2004 review objective of treating all types of ESWH uniformly and there being no significant technical differences in respect of heat losses and measures to reduce them.

However, while Proposal 1 seeks to address the problems of compliance loopholes and the non-enforceability of the exclusion designed for only highly efficient SWH and HPWH (through a warning label and SWH and HPWH specific MEPS), this proposal seeks to solve the problems by simply removing the existing SWH and HPWH exclusion. This proposal would mitigate the market failure associated with inconsistent information being available on heat loss levels, but by creating a sales shift to conventional ESWH at the expense of SWH and HPWH sales, a far more significant market failure would be introduced.

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[32] see 'Consultation RIS- Supplementary Information- Proposed MEPS for Computers and Monitors', 2010, http://www.energyrating.gov.au/resources/program-publications/?viewPublicationID=2152

Identical MEPS for all ESWHs (including SWHs and HPWHs)

- As an alternative to addressing the current MEPS loophole and compliance problems through the recommended combined effects of Proposal 1 (marking and installation requirements combined with lower MEPS), the problem could most simply and completely be addressed by subjecting all ESWHs to consistent MEPS requirements.
- This feature would involve the removal of the energy-saving exclusion of SWHs and HPWHs from AS/NZS4692, and subjecting these systems to the same MEPS requirements as conventional ESWHs. There would still be the potential to provided SWHs and HPWHs with a small, fixed adjustment similar to the current adjustment of 0.2kWh/24h provided to Australian tanks with certain valves under this scenario.
- This approach would prevent poorly performing products at the point of registration and would not rely on additional installation compliance. However, some manufacturers of SWHs and HPWHs would be critical of such an approach as it would eliminate many such systems from the market (despite most systems having low operating costs) and it would reduce 'whole-of-system' efficiency innovation by forcing manufactures to focus on one component (the storage tank). Some manufacturers' tanks already claim to meet current MEPS levels so they are unlikely to be opposed to such a change.
- While strengthening the MEPS for conventional ESWHs has significant net-benefits, the potential for ongoing savings by increasing the MEPS on SWHs and HPWHs is more limited. The water heating features of these water heaters can be three times more energy efficient than in a conventional ESWH. This means that reheating water cooled by tank heat losses can typically be done with less electricity usage. For example, a 10% improvement in the average heat loss levels of a conventional ESWH might result in an overall 2% energy savings, while in a properly functioning SWH or HPWH, the result is less than a 1% saving.

In summary, this feature, if implemented, would prevent systems with poor heat loss being supplied to consumers, would enable compliance for SWH and HPWH heat loss MEPS and remove the need to add warnings to such systems with poor heat loss. However, this feature would produce minimal energy savings for SWHs and HPWHs (in properly operating and installed systems) and would likely decrease the overall efficiency of the hot water market. Given that this option does not meet the best practice regulation framework requirements to maximise the efficiency of an amended regulation, it is therefore recommend that this proposal not be considered and further impact analysis of this option has not been conducted. However, stakeholder views on this are welcome.

Proposal 5: Appliance labelling

The intention of this proposal is to directly address the information failures facing consumers. It does this by investigating a labelling regime that incudes verifiable information on efficiency levels, indicates the suitability of a water heater to a specific climate, indicates the amount of hot water that can be supplied and can cover all hot water heater types, not just ESWHs. In the 2004 review of ESWH, labelling was not proposed as there was little variation in the efficiency of ESWH, but it was noted then that the case for additional information was changing and that industry had a role in providing more systematic information on running costs and greenhouse gas emissions to consumers. As the spread of efficiencies for ESWH has substantially changed with the introduction of HPWHs and as systematic information on running costs and greenhouse gas emissions is still not available, there is a case to re-examine appliance labelling for ESWHs, or for all water heaters (electricity, gas, storage and instantaneous).

A label provides information directly to a consumer to support them to take a decision informed about key performance aspects of a hot water system. In addition, there are a number of situations where the purchase of the ESWH is made by a party that will not be responsible for the ongoing energy costs (see Market failures, page 25). These are referred to as the builder/owner, landlord/tenant and plumber/owner split incentives. In these situations, while the purchaser may still have an incentive to purchase an ESWH with the lowest capital cost, the customer may still see the label on the water heater. In the case of the builder/owner and plumber/owner situations, the owner may have the capacity to either ask for a better system or to provide negative feedback where a water heater with label indicating poor efficiency has been purchased. The ability of a tenant to influence a landlord is less clear as factors like rental vacancy rates may determine how much potential influential a tenant may wield.

The EC also concluded (see page 22) that a water labelling framework, when combined with MEPS, will 'provide a dynamic incentive for manufacturers to improve energy efficiency and to accelerate the market take-up of energy-efficient' appliances and 'greatly improve energy efficiency, support the transition to a resource-efficient economy, encourage investment in R&D and ensure a level playing field for (water) heating products'.

Issues concerning the energy labelling of ESWH in Australia and New Zealand include:

- Any labelling must be based on clearly defined parameters to ensure that any information is accurate and suitable for comparison purposes. The presence of a number of divergent heat loss test methods means that current arrangements are unsuitable for a labelling framework to use, directly or indirectly.
- Labelling of ESWHs based solely on tank heat loss levels is undesirable as consumers reviewing a range of hot water technologies may be misled by the relative performance of some water heaters (e.g. an ESWH may still cost far more to operate than a HPWH with inferior heat loss characteristics).
- Some systems, such as SWHs and HPWHs, are very sensitive to the climatic conditions where they are installed. Climatic suitability information is often lacking or inconsistently presented between products and so a simple label without this information may also mislead some consumers.
- Given the increasing penetration of technologies such as HPWHs and instant electric/gas heaters in recent years, there is a strong case for a separate E3 project to investigate consistent labelling for all water heaters. The findings of the extensively researched EC labelling requirements demonstrate the significant potential of a well-designed label to address market failures and to deliver energy and emission savings.
- As any labelling framework needs to be underpinned by a transparent and robust compliance framework, there is a preference for physical testing rather than modelled results, the development of appropriate testing standards may be required.
- As there are a number of technical issues which need to be explored, such as the suitability to Australia of the inputs used in international labels, it is appropriate that any labelling project be separately considered from ESWH MEPS regulations.

E3 has commenced a project to explore water heater appliance energy labels in general (rather than a specific ESWH label) and more specifically the potential benefits of the adoption of energy labelling consistent with the international labelling frameworks currently in place. It is recommended that E3 develop a similar label for Australia and New Zealand. This recommendation is consistent with the preliminary recommendations in the Heat Pump Water Heater Consultation RIS.

Other options considered

A broad range of other options were considered to assess whether they would address identified market failures, while remaining cognisant of the likelihood of the options improving the quality of information available to consumers to help them choose the best system for their needs. These options were viewed as not being feasible due to either already forming part of BAU activities or being less efficient the preceding proposals. For transparency, these options are described in Appendix G to help inform and encourage stakeholder comment.

7. Impact Analysis

Impacts - Proposal 1: Streamlining existing regulations

Proposal 1 consisted of the following features:

- Completing the implementation of past harmonisation reforms and additional alignment of standards
- Harmonisation within the joint Australian and New Zealand standard
- Closing loopholes in the current arrangements
- Removal of Australian ESWH sizing constraints
- Removal of New Zealand ESWH sizing constraints
- Ensuring that arrangements applying to SWHs and HPWHs can be subject to compliance

Government benefits and costs

The key benefits for the Government are a simplification of the regulatory framework, simplification and improvement to the compliance framework. The costs of any future changes to the AS/NZS4692 will be reduced as there will be no need to alter any legacy standards in the future. These will result in secondary cost savings for the Government.

The only costs to government will be once-off changes to the current regulatory system, such as the costs of preparing the RIS, managing and preparing regulatory changes, gazetting any changes etc. These costs are estimated at $300,000 to Australia and $50,000 to New Zealand. The will be no additional ongoing operating costs, as the same compliance and regulatory scheme will continue to operate, so the current costs will be unaltered.

Business benefits and costs

In most cases, the storage tank component of an ESWH is locally manufactured (in Australia and New Zealand). As such the majority of the costs described below will fall on local, rather than international businesses.

The key benefit to suppliers will be simplified regulatory requirements and consistent testing of ESWH units, which will enable their customers to compare products using consistent information on performance.

For suppliers with currently complying ESWH units, measured to AS/NZS4692.1, there will be no compliance costs as their models will not need to be retested and will automatically be registered as complying with MEPS. The change from delivered to nominal capacity for calculating MEPS requirements also does not require any additional costs as AS/NZS4692.1 requires the disclosure of both nominal and delivered capacity.

For suppliers with registered models that have been tested to legacy standards, there would be some costs of compliance if suppliers incurred the cost of retesting and re-registering these models. However, the intention is to provide reasonable grandfathering requirements for models currently registered to legacy standards.

For systems that would have been registered under a legacy standard in the future, but would now be required to be registered to AS/NZS4692.1, it is assumed that any change in costs would be negligible. While testing to AS/NZS 4692.1 could cost more for some laboratories only set-up for testing to a legacy standard, there will also be offsetting savings associated with some laboratories only needing to be accredited to one Standard in the future. There will also be savings associated with less Standards having to be purchased by industry and less time and expense in any updating of Standards.

The only other business compliance cost will be a small cost to 'solar/HPWH ready' unit suppliers, due to marking the appliance with 'water heater not designed for hot water supply without a supplementary heat source'. These costs are likely to be small.

There will be no additional business costs associated with the smoothing of the MEPS levels, as these will not affect the compliance of any currently registered ESWHs and, as the MEPS levels are effectively unchanged by this measure, will not increase the costs of developing future ESWHs.

The inclusion of SWHs and HPWHs in the MEPS will generally not result in any additional business compliance costs. In Australia, testing of SWHs and HPWHs is already undertaken to AS/NZS4692.1 requirements, in order for these water heaters to get STCs (previously RECs) allocated. In New Zealand, SWHs and HPWHs are also tested in order to determine their level of energy efficiency (measured according to AS/NZS4234) to be eligible for rebates. However, a small number of Australian systems are not claiming STCs and the New Zealand rebate scheme has recently ended, hence a very small number of systems may have additional business compliance costs.

Consumer benefits and costs

The key benefit to consumers is increased consumer protection from the closing of loopholes to the current arrangements regarding SWHs and HPWHs, and the introduction of the lenient MEPS for SWHs and HPWHs. Consumers would be provided some protection from excessive energy costs when SWHs or HPWHs malfunction or are poorly installed, or when non-MEPS compliance 'solar/HPWH ready' units are installed to function as conventional ESWHs. The implementation of past harmonisation reforms and additional alignment of standards will also have the benefit of allowing consumers to more effectively compare the efficiency of ESWHs.

The shift to a single, consistent heat loss test method would provide results that are comparable across all ESWH. This standardisation is essential to enable any future labelling or consumer information initiatives that seek to address market information failures.

The costs to the consumer of these improvements to the regulations will be minimal. They will largely consist of any business costs associated with re-testing and registration of units that have been registered using legacy standards, which suppliers can transfer to the consumer. As many suppliers already test to AS/NZS4692.1, these suppliers will not incur any additional costs, so competitive pressures may restrict the ability of suppliers that have been using legacy standards to transfer these costs to the consumer.

Another small cost to the consumer will be the costs of marking 'solar/HPWH ready' units as 'water heater not designed for hot water supply without a supplementary heat source'.

In total, these costs will be spread over the sale of thousands of ESWHs, so the cost increase to the individual consumer is likely to be insignificant, approximately $2 per water heater sold in the first year of implementation.

Competition and trade issues

There will be no change to any existing trade issues, though comparisons between ESWH products will be easier if all suppliers are using one testing standard, which might encourage more trade. The Trans-Tasman Mutual Recognition Arrangement (TTMRA) issue of ESWH being required to meet different MEPS levels in Australia and New Zealand will continue, but the impacts of Proposal 1 will not make these any more severe (see *Chapter 9. Implementation and Review* for details).

Impact on energy use and greenhouse gas emissions

There will be no significant impact on energy use or greenhouse gas emissions from the Proposal 1. This is because the emphasis of this Proposal is on reinforcement of the existing regulations, improving their operation and on improving compliance.

There may be energy and greenhouse emission savings from these changes in the minimum efficiency of individual malfunctioning or poorly installed SWHs or HPWHs, or from the prevention of non-MEPS compliance solar/HPWH ready units being installed to function as conventional ESWHs, due to Proposal 1 being enacted. These changes means consumers are protected from excessive heat losses from these products, and resulting energy costs, if the products malfunction, are poorly installed or inappropriately installed. However, the total number of units affected by these changes cannot be known, nor the impact on energy use and emissions. Any savings from a societal perspective will be very small, though the energy savings to the individual consumer affected might be significant from their perspective.

Summary

Proposal 1 was developed to address Objective 1 (streamline regulations). It does not seek to directly address Objective 2, although there may be some unquantifiable gains against this Objective. The benefits from Proposal 1 therefore come from the reinforcement and simplification of the existing regulations, improving their operation and improving the regulatory compliance framework. The key benefit for consumers is increased protection from incurring excessive energy costs, when SWHs or HPWHs malfunction, are poorly installed or inappropriately installed.

The costs largely consist of a once-off to Government to change the regulations, and a once-off cost to suppliers who have been testing their products using legacy testing standards, as the suppliers will need to re-test and re-register their products. There are no increases to on-going regulatory and compliance costs, and in any event, such costs may decrease due to simplification of the regulations.

Impacts - Proposal 2: Streamlining existing regulations and strengthening Australian MEPS

Proposal 2 consisted of the following features:

- Proposal 1 features - The reinforcement of the existing regulatory features of AS/NZS4692, loophole closure for solar/heat pump ready ESWHs, smoothing of the MEPS levels and MEPS compliance for SWHs and HPWHs
- Strengthening the Australian MEPS to improve average efficiency of conventional ESWHs

Government benefits and costs

The key benefits for the Government are similar to those of Proposal 1, that is a simplification of the regulatory framework, simplification and improvement to the compliance framework. The costs of any future changes to the AS/NZS4692 will be reduced as there will be no need to alter any legacy standards in the future. These will result in secondary cost savings for the Government.

There is no additional cost to the government beyond the once-off costs required for the implementation of Proposal 1 or Proposal 2. These costs were $300,000 for Australia and $50,000 for New Zealand. As a regulatory regime already exists for water heaters, the ongoing costs of the scheme are already incurred and will not be affected by a change in the MEPS levels.

Business benefits and costs

The key benefit to suppliers will be the same as for Proposal 1, that is, simplified regulatory requirements and consistent testing of ESWH units, which will enable their customers to compare products using consistent information on performance.

The analysis used in this RIS assumes that the costs associated with increases in MEPS can be divided into compliance costs and product modification costs. The compliance costs are calculated according the Business Cost Calculator (OBPR, 2006). This process is described in *Appendix F – Supplier Compliance Costs*.

The compliance costs are calculated at approximately $534,000 to the suppliers in the first year of MEPS, based on the suppliers registering an additional 100 models. This cost does not vary between the Proposals involving MEPS increases. The cost-benefit assumes that new models are introduced to the market each year and, hence, are already required to be registered. Sensitivity analysis of these estimated costs shows that if the compliance costs increase by 100%, the effect on the cost-benefit is minimal.

The principal costs to businesses will be the cost of developing and producing ESWHs that meet the increased energy efficiency requirements of the new Australian MEPS levels. It is estimated that 46% of current ESWHs on the Australian market (based on registration data) will not meet the requirements of the new MEPS and hence these units will be either redesigned and their insulation increased or withdrawn from the market. For costing purposes it is assumed that machinery changes, that otherwise would not have occurred, will be made so that a large number of water heaters will be altered and re-released. If many products re-enter the market, the medium term impact on consumer choice will be reduced, however, there will be a higher amount of design costs which will need to be passed onto consumers. The estimated average costs applied to all updated models to account for this increase in product costs is 10%, which makes an approximately 5% increase in average product costs across all the ESWH models available. This is equivalent to a $20 for a small EWSH, $30 for a medium sized unit and $40 for a large unit.

The later sections examine the costs and benefits of the MEPS options from the perspective of consumers. It was assumed that all compliance costs incurred by suppliers are eventually passed on to buyers in the normal course of business. Hence, for the purposes of cost-benefit analysis, the cost impact on product suppliers as a group is neutral. The cost-benefit assessment provided in the following section assumes that the product suppliers recover the costs via an increase in the costs of the product to the consumer. As the benefits of the energy efficiency improvement accrue to the consumer, this approach allows for a consistent treatment of costs and benefits.

Consumer benefits and costs

The key benefits to consumers come from the reduction in water heating costs due to the increase in Australian MEPS levels, hence more efficient ESWHs. Additional benefits accrue from increased consumer protection resulting from the closing of loopholes to the current arrangements regarding SWHs and HPWHs. Harmonisation of testing will also provide benefits as consumers will be able to better compare the efficiency of water heaters and display greater trust in this information. Future labelling or related consumer information programs may be able to utilise the improved heat loss data.

The costs to the consumer of these improvements to the current regulations will be minimal, as discussed under Consumer benefits and costs, page 57. The main costs will be due to increased product costs, due to the suppliers incurring costs in developing and producing ESWHs that meet the new Australian MEPS levels, and transferring these costs to the consumer. As previously mentioned these are estimated to average $20 for a small ESWH, $30 for a medium sized unit and $40 for a large unit (weighted average of $26). In comparison, the average energy savings per ESWH is estimated to be $10 p.a. and $120 over the life of a unit. This means an average simple payback period of 2.5 years from the consumer perspective, and consumer benefits easily outweigh costs.

Competition and trade issues

The risk in increasing MEPS levels, or introducing MEPS, is that the regulation will have an uneven impact on the market, significantly reducing the number of products that are available of specific products sizes or types. For example, the MEPS might make it technically difficult to produce small ESWHs and so reduce the number of small water heaters in the market. Such an uneven impact from the MEPS could both restrict consumer choice but also encourage the installation of larger tanks than needed, and reduce competition in the market, as often suppliers specialise in one sector of the market and so the MEPS could disadvantage one or more supplier.

The MEPS level increase was designed to ensure it did not produce an uneven impact on one section of the market by removing an excessive number of models from any particular size category of ESWHs. With models of all sizes remaining on the market there would be negligible impact on consumers. Additionally, while this proposal is estimated to remove initially 46% of the current registered appliances, this is not viewed as having an undue impact on the broader water heater market due to: the continued presence of ESWH of all sizes remaining on the market, the ability for manufacturers of affected ESWH to revise their products for re-registration (100 new registrations have been assumed); conventional ESWHs only comprising approximately 25% of sales in the wider water heater market; and through the availability of other water heating options – either non-electric or non - storage options.

Additional care has been taken to minimise distortion to competition levels between the three types of ESWHs. As per Proposal 1, it is viewed that subjecting SWHs and HPWHs to the same heat loss MEPS as applied to conventional ESWH would likely result in many SWHs and HPWHs being removed from the market – a highly negative outcome to competition levels in the hot water market. However, initial testing has cast some doubt on the accuracy of some heat loss claims made by some SWH and HPWH manufacturers – any incorrect claims are likely to have undue competition effects for other water heater types. The introduction of a less stringent MEPS for SWHs and HPWHs will help to ensure that these water heating technologies are fairly treated, while addressing the possible negative competition effects which may currently exist.

There will be no change to any existing trade issues, though comparisons between ESWH products will be easier if using one testing standard, and more Australian MEPS compliant products may also meet New Zealand MEPS requirements, which might encourage more trade. The TTRMA issue of ESWH being required to meet different MEPS levels in Australia and New Zealand will continue, but the impacts of Proposal 2 will not make these any more severe.

The USA is using MEPS to effectively ban conventional ESWHs larger then 200L and the EC is introducing energy labels, energy efficiency MEPS as well as tank heat loss MEPS. These actions are likely to substantially decrease the number of conventional ESWHs being sold into these large consumer markets. As under Proposal 2, the regulations on conventional ESWH in Australia and New Zealand will be less restrictive than these large markets, there is a risk that international manufacturers may seek to export increasing numbers of conventional ESWHs to Australia and New Zealand. This additional competition may reduce the costs of conventional ESWHs for consumers but place additional pressure on local manufacturers.

Impact on energy use and greenhouse gas emissions

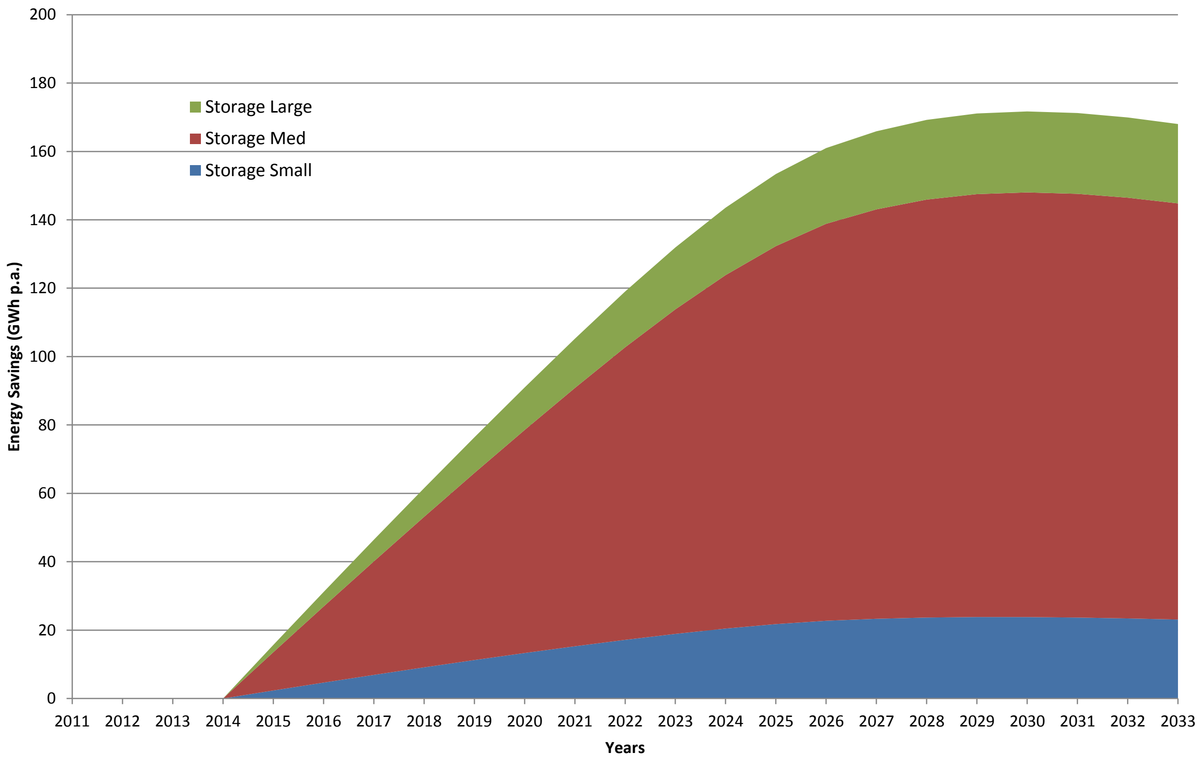
The strengthened Australian MEPS will apply in 2014 and the impact on energy use and greenhouse gas emissions is modelled for the period to 2023 and 2033 separately, as shown in Table 4.

Table 4: Energy Savings and GHG reductions for Proposal 2: Australia

Year	2023	2033
Energy Savings (GWh pa)	132	168
Energy Savings (GWh cumulative)	678	2,323
GHG Emission Reductions (kt pa)	105	122
GHG Emission Reductions (Mt cumulative)	0.5	1.8

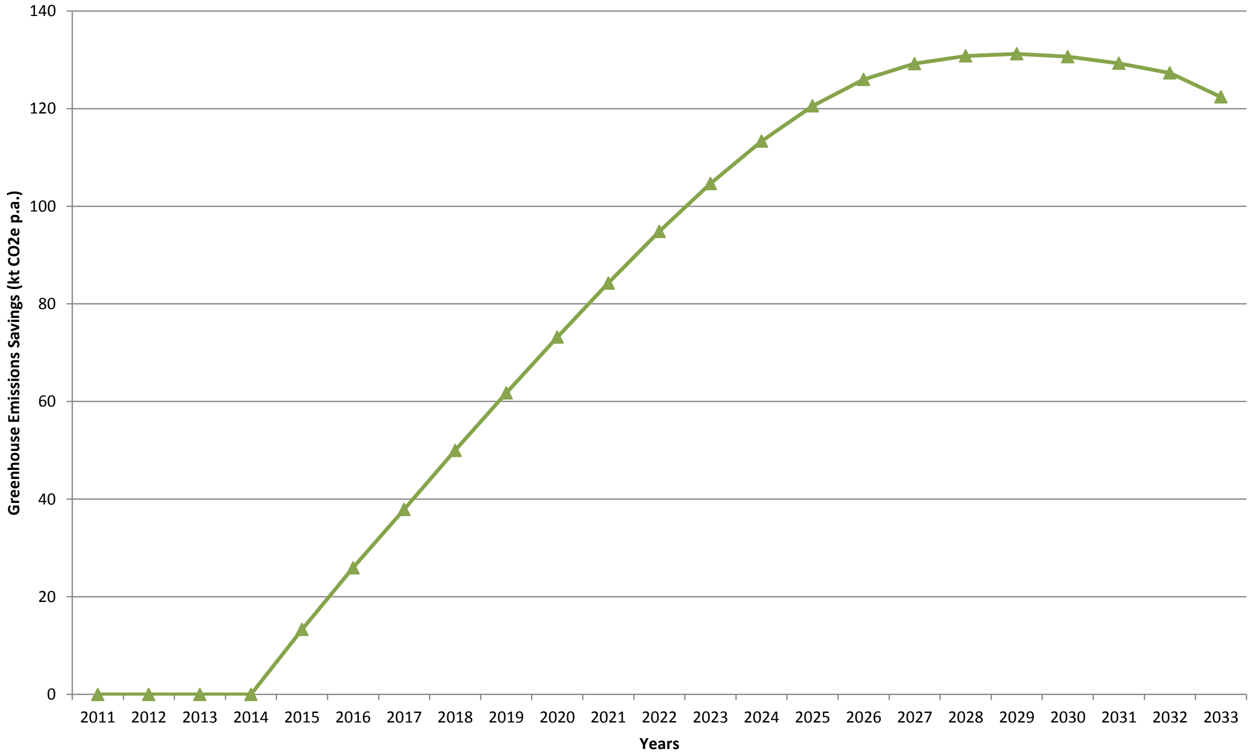
The energy savings by ESWH size category are shown in Figure 16. The declining post-2030 savings is a result of the declining sales and stock of conventional ESWHs which will occur over the life of these regulations (see *Current and forecast stock and sales*, page 13).

Figure 16: Energy savings by ESHW size category to 2033: Australia Proposal 2



Water heater sizes key: Small <80 L, Med 80 – 315 L, Large >315 L delivery

Figure 17: Greenhouse gas emissions savings to 2033: Australia Proposal 2



Cost benefit analysis

Cost benefit methodology

A financial analysis has been conducted on the societal cost benefits of the proposals being reviewed, with the analysis conducted at the State and national level. The costs take into account the incremental price increases of product to meet the new MEPS levels, State and Federal government implementation costs and business compliance costs. The benefits primarily include avoided consumer electricity costs due to the improved average efficiency of ESWHs. The methodology is explained in *Appendix C – ESWH RIS Modelling Summary*.

Cost benefit analysis results

The analyses were conducted for the impact of the MEPS over both a 10 year and 20 year period, and showed the benefits of Proposal 2 exceed the costs for all the discount rates assessed as shown in Table 5 and Table 6.

Table 5: Proposal 2 Cost Benefit Analysis – Australia – 20 year period (various discount rates)

Total Australia to 2033	NPV Low (3%)	NPV Med (7%)	NPV High (10%)
Total Costs $M	$26.9	$20.7	$17.3
Total Benefits $M	$462.9	$244.9	$160.1
Net Benefits $M	$436.1	$224.2	$142.9
Benefit Cost Ratio	17.2	11.8	9.3

Table 6: Proposal 2 Cost Benefit Analysis – Australia – 10 year period (various discount rates)

Total Australia to 2023	NPV Low (3%)	NPV Med (7%)	NPV High (10%)
Total Costs $M	$26.8	$20.7	$17.3
Total Benefits $M	$265.3	$160.9	$114.1
Net Benefits $M	$238.5	$140.2	$96.8
Benefit Cost Ratio	9.9	7.8	6.6

Summary

The key benefit from Proposal 2 is a reduction in energy consumption and associated avoided electricity purchasing costs, due to the increased MEPS levels increasing the average efficiency of ESWHs installed in Australia. The net benefit is estimated to be $224m over 20 years and $140m over 10 years, assuming a 7% discount rate. The cost benefit analysis shows the benefits of Proposal 2 greatly exceed the costs of implementing this proposal.

Other benefits flow from the reinforcement and simplification of the existing regulations, improving their operation and improving the regulatory compliance framework. The benefit to consumers from these regulatory improvements reduced water heater operating costs for consumers when SWHs or HPWHs malfunction, are poorly installed or inappropriately installed. The benefits from these regulatory improvements were not quantified.

Impact - Proposal 3: Streamlining existing regulations, strengthening Australian MEPS and scheduling additional MEPS review

Proposal 3 consisted of the following features:

- Proposal 2 features- The reinforcement of the existing regulatory features of AS/NZS4692, closure of loopholes for solar/HP ready ESWHs, smoothing of the MEPS levels, inclusion of SWHs and HPWHs in the MEPS and strengthening of the Australian MEPS to improve average efficiency of conventional ESWHs.
- Scheduling additional MEPS Increase- Use the results of a market review to harmonise and increase the stringency of MEPS levels in Australia and New Zealand in 2017 (modelled as 10% tightening).

Government benefits and costs

The key benefits for the Government are similar to those of Proposal 1, that is, a simplification of the regulatory framework and increasing the consistency of the compliance framework. The costs of any future changes to the AS/NZS4692 will be reduced as there will be no need to alter any legacy standards in the future. These will result in secondary cost savings for the Government.

There is no additional cost to the government beyond the once-off costs required for the implementation of Proposal 1, Proposal 2 or Proposal 3. These costs were $300,000 for Australia and $50,000 for New Zealand. As a regulatory regime already exists for water heaters, the ongoing costs of the scheme are already incurred and will not be affected by a change in the MEPS levels.

The cost of a future market review would be minimal as heat loss data will have been standardised and sales data will be available for both Australia (to be collected under GEMS requirements) and New Zealand (currently collected). The results of the market review would be provided to the E3 Committee for decision.

Business benefits and costs

The key benefit to suppliers will be the same as for Proposal 1, that is simplified regulatory requirements and consistent testing of ESWH units, which will enable their customers to compare products using consistent information on performance.

The initial business compliance costs for Australia are the same as Proposal 2, approximately $534,000 to the suppliers in the first year of MEPS, and then followed by another $534,000 when the second increase in MEPS is introduced. There are additional compliance costs for New Zealand and the Business Costs Calculator was again used to determine the costs per business, and then these costs were allocated on a “per model” basis for the cost-benefit analysis. The RIS cost-benefit analysis models the costs on the basis of each model supplied to the market in a particular year, as this approach provides a greater certainty to the costing of MEPS. A breakdown of these costs is presented in Appendix F – Supplier Compliance Costs, page 82. The total costs calculated are approximately $257,600 to the suppliers in the first year of MEPS, based on the suppliers registering an additional 50 models.

The principal costs to businesses of Proposal 3 will be the cost of developing and producing ESWHs that meet the increased energy efficiency requirements of the new MEPS levels. These will consist of the costs that Australian suppliers incur in product changes to meet the MEPS increases contained in Proposal 2, and then the costs to Australian and New Zealand suppliers of meeting the next round of MEPS increases in 2017. It is conservatively modelled that many current ESWHs will not meet the requirements of the new MEPS and hence these units will be either redesigned and their insulation increased or withdrawn from the market. For costing purposes it is assumed that all models will be altered and re-released and create a level of machinery changes that otherwise would not have occurred. The estimated average costs applied to all updated models to account for this increase in product costs is 10%, which makes an approximately 10% increase in average product costs across all the ESWHs models available. This is equivalent to an increase in the first year of the MEPS of $40 for a small EWSH, $60 for a medium sized unit and $80 for a large unit, though these costs will decrease over the medium term. For New Zealand, the same costs were assumed, and converted to NZD using the assumed exchange rate of 1AUD=1.25NZD. If the actual magnitude of the changes are less than 10%, the costs (and benefits) of this proposal will be reduced.

Consumer benefits and costs

The key benefits to consumers come from the improved consumer outcomes from the closing of loopholes to the current arrangements regarding SWHs and HPWHs, also contained in the features of Proposal 1 and 2, and the reduction in water heating costs due to the increase in Australian and New Zealand MEPS levels, hence more efficient ESWHs. An additional benefit is that harmonisation of testing will result in standardised information available to consumers to enable them to better compare the efficiency of water heaters and display greater trust in this information.

The costs to the consumer of these improvements to the current regulations will be minimal, as discussed under Consumer benefits and costs, page 57. The main costs will be due to increased product costs, due to the suppliers incurring costs in developing and producing ESWHs that meet the new Australian and New Zealand MEPS levels, and transferring these costs to the consumer. As previous mentioned these are estimated to average $40 for a small ESWH, $60 for a medium sized unit and $80 for a large unit (weighted average of $52). In comparison, the average energy savings per ESWH is estimated to be $34 p.a. and $408 over the life of a unit. This means an average simple payback period of 1.5 years from the consumer perspective, and consumer benefits easily outweigh costs.

Competition and trade issues

Similar to Proposal 2, many features of this Proposal will only have minor, but positive effects on many existing Australia and New Zealand competition and trade issues. However, the potential harmonisation of Australian and New Zealand MEPS levels as a result of the future market review, would remove a trade issue associated with the interaction of the TTMRA and each nation having different heat loss requirements.

As with Proposal 2, there may be a trade implication with having requirements less stringent than the USA and EC. This could lead to international manufacturers seeking to export increasing numbers of conventional ESWHs to Australia and New Zealand.

Impact on energy use and greenhouse gas emissions

This proposal assumes that in addition to the strengthened MEPS in 2014 and the MEPS will be increased again in 2017, with of 10% lower maximum heat losses to apply in both Australia and New Zealand across all sizes of conventional ESWH. The impact on energy use and greenhouse gas emissions is modelled for the period to 2023 and 2033 separately, as shown in Table 4.

Table 7: Energy Savings and GHG reductions for Proposal 3: Australia & New Zealand

	Australia		New Zealand	
Year	**2023**	**2033**	**2023**	**2033**
Energy Savings (GWh pa)	244	375	19	49
Energy Savings (GWh cumulative)	1,078	4,534	68	424
GHG Emission Reductions (kt pa)	192	271	2	6
GHG Emission Reductions (Mt cumulative)	0.9	3.5	0.01	0.05

The energy savings by ESWH size category are shown in Figure 18 and annual greenhouse gas emission reductions are shown in Figure 19.

Figure 18: Energy savings by ESHW to 2033: Australia & New Zealand Proposal 3

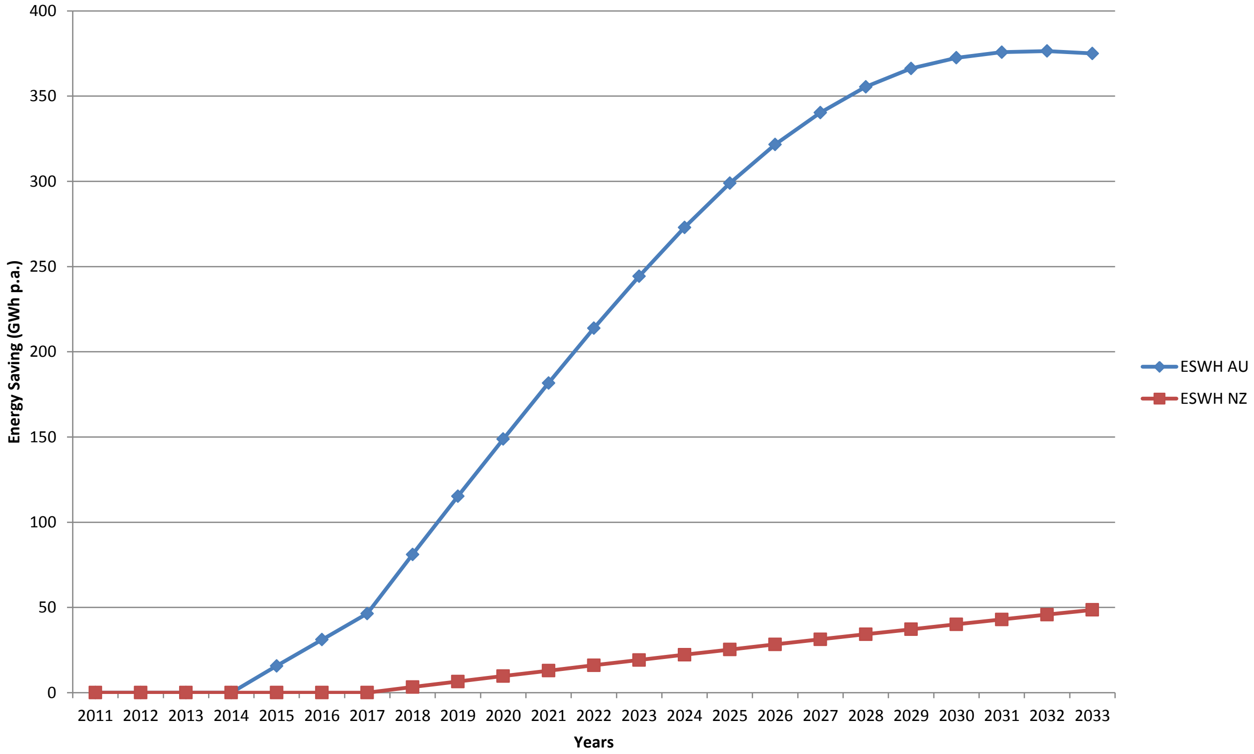
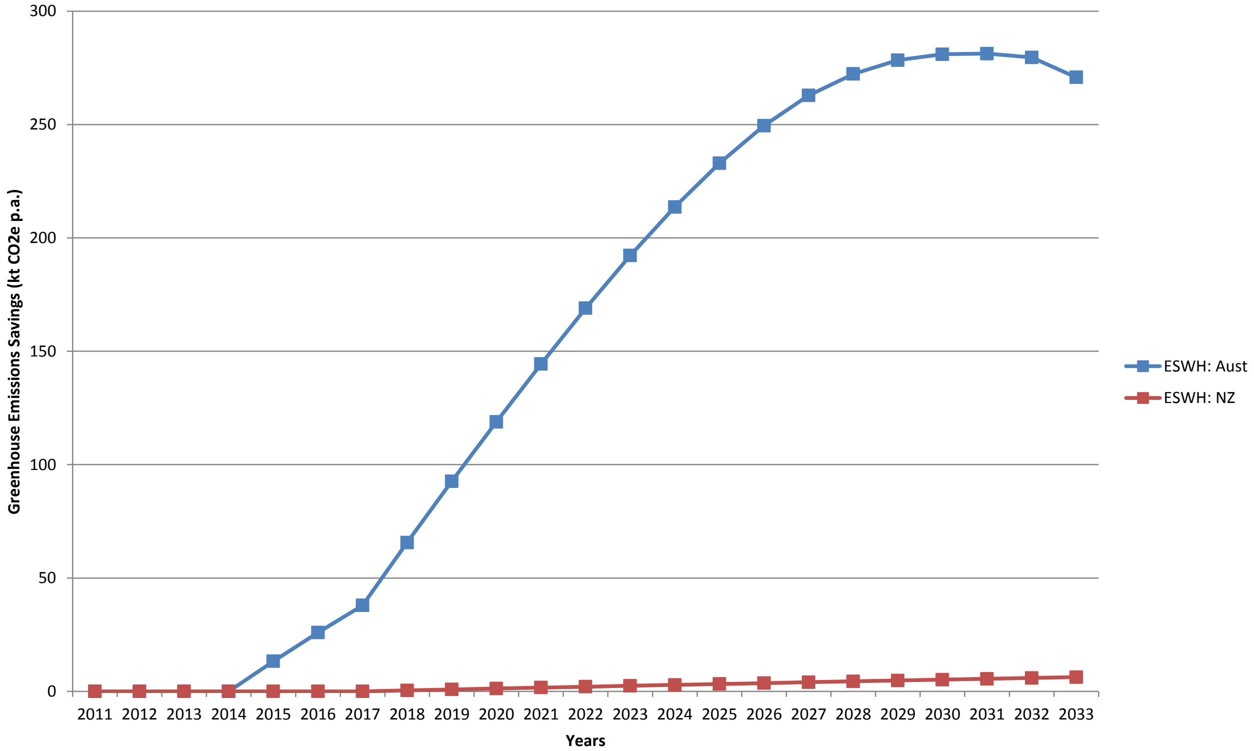


Figure 19: Greenhouse gas emissions savings by ESHW to 2033: Australia & New Zealand Proposal 3



Cost benefit analysis

The analysis from a consumer or product purchaser perspective revealed the results contained in the following tables. The analyses were conducted for the impact of the MEPS over both a 10 year and 20 year period, and in Australia and New Zealand, and in all cases showed the benefits of Proposal 3 exceed the costs.

Table 8: Proposal 3 Cost Benefit Analysis – Australia – 20 year period (various discount rates)

Total Australia to 2033	NPV Low (3%)	NPV Med (7%)	NPV High (10%)
Total Costs $M	$61.3	$44.3	$35.4
Total Benefits $M	$977.3	$497.9	$316.2
Net Benefits $M	$916.0	$453.6	$280.8
Benefit Cost Ratio	16.0	11.2	8.9

Table 9: Proposal 3 Cost Benefit Analysis – Australia – 10 year period (various discount rates)

Total Australia to 2023	NPV Low (3%)	NPV Med (7%)	NPV High (10%)
Total Costs $M	$79.3	$61.0	$44.2
Total Benefits $M	$767.9	$500.0	$295.2
Net Benefits $M	$688.7	$439.0	$251.0
Benefit Cost Ratio	9.7	8.2	6.7

Table 10: Proposal 3 Cost Benefit Analysis – New Zealand – 20 year period (various discount rates) NZD

Total New Zealand to 2033	NPV Low (3%)	NPV Med (5%)	NPV High (8%)
Total Costs $M	$11.6	$9.6	$7.2
Total Benefits $M	$113.8	$78.0	$45.8
Net Benefits $M	$102.2	$68.4	$38.5
Benefit Cost Ratio	9.8	8.2	6.3

Table 11: Proposal 3 Cost Benefit Analysis – New Zealand – 10 year period (various discount rates) NZD

Total New Zealand to 2023	NPV Low (3%)	NPV Med (5%)	NPV High (8%)
Total Costs $M	$11.5	$9.5	$7.2
Total Benefits $M	$50.4	$37.2	$24.1
Net Benefits $M	$38.9	$27.7	$16.9
Benefit Cost Ratio	4.4	3.9	3.3

Summary

The key benefit from Proposal 3 is a reduction in energy consumption and associated avoided electricity purchasing costs, due to the increased MEPS levels increasing the average efficiency of ESWHs installed in Australia and New Zealand. For Australia the net benefit is estimated to be $454m over 20 years and $251m over 10 years, assuming a 7% discount rate. For New Zealand the net benefit is estimated to be $NZ68m over 20 years and $NZ28m over 10 years, assuming a 5% discount rate. The cost benefit analysis shows the benefits of Proposal 3 greatly exceed the costs of implementing this proposal in both countries.

Other benefits flow from the reinforcement and simplification of the existing regulations, improving their operation and improving the regulatory compliance framework. The benefit to consumers from these regulatory improvements reduced water heater operating costs for consumers when SWHs or HPWHs malfunction, are poorly installed or inappropriately installed. The benefits from these regulatory improvements were not quantified.

Impact - Proposal 4: Streamlining existing regulations and all ESWHs to be treated consistently

As noted in the previous chapter, Proposal 4: Streamlining existing regulations and all ESWHs to be treated consistently, has not been subject to detailed modelling. While consistent treatment of all ESWHs would ensure that comparable heat loss data would be available for all products and that this data could be subject to verification by governments, a significant proportion of the SWH and HPWH market would be removed and buyers who would have purchased these efficient systems may be forced into purchasing less efficient conventional electric storage water heaters. Therefore this option would involve significant industry costs, reduced consumer choice, lower average energy efficiency levels and increase energy usage and greenhouse-gas emissions. As the costs are likely to significantly outweigh the benefits, full modelling of the option was not viewed as being worthwhile.

Impact - Proposal 5: Appliance labelling

Proposal 5, appliance labelling, if agreed, would only provide approval for a labelling proposal to be raised at a future date. Any future proposal presented to decision makers would contain the full cost-benefit analysis and related detailed discussion on this proposal. The estimated benefits of such a scheme being implemented in the EU are provided on page 22.

8. Summary and Conclusions

Summary of key outcomes

Addressing market failures

While ESWHs will always have a degree of tank heat loss, minimising the associated energy wasted can provide reductions in the lifetime costs of the appliance to the consumer. However, due to information failures in the water heater market, the average heat loss levels of water heaters on the market has not improved except for short periods immediately after government intervention though MEPS. By requiring the removal of low efficiency products from the market, the strengthened Australian MEPS presented in Proposal 2 and 3 will most directly address market failures.

While the simplification reforms of Proposal 1 (also included in Proposals 2 and 3) do not directly improve energy efficiency, the reforms will help reduce the level of market failures occurring by ensuring that:

- Loopholes to the current arrangements are removed;
- Testing is standardised;
- Unnecessary government restrictions are removed; and
- Any heat-loss information that is available to consumers will be consistent and allow comparison.

Proposal 2 and 3 would impose costs on suppliers whose current models do not meet new MEPS levels and where the supplier chooses to amend the product rather than withdrawing it from sale. However, there is a demonstrated capacity for more efficient water heaters to be manufactured due to the significant spread in declared heat loss levels of ESWH already available.

For manufacturers and suppliers already producing or marketing conventional ESWHs with superior heat loss characteristics, there will be no additional costs.

A proposed appliance labelling project to cover all water heaters has the potential to more completely address the information failure in the market and allow consumers to choose appropriate water heating options.

Reduce greenhouse gas emissions below Business-As-Usual

Proposal 1 does not directly reduce greenhouse gas emissions, but serves to enhance the existing regulations in order to reduce operating costs associated with SWHs or HPWHs that malfunction or are inappropriately installed, increase access to information which can be used for water heater comparisons, remove regulatory 'loop-holes' and to give greater flexibility to water heater manufacturers to meet MEPS requirements. These changes may drive some reductions but they are assumed to be relatively minor.

Based on the modelling of Proposal 2 and 3, which involve the strengthening of Australia MEPS requirements in addition to the simplification of Proposal 1, significant energy savings and greenhouse gas emission reductions are possible from both proposals. These options result in reduced greenhouse gas emissions below business-as-usual, with benefits exceeding costs for end consumers. The greatest reduction in greenhouse gas emissions are achieved by Proposal 3 followed by Proposal 2.

Evaluation of MEPS options

Proposal 1 will produce no significant energy savings and greenhouse gas emission abatements, but it will address the objective of ensuring that regulations are efficient and effective. The regulatory streamlining contained in Proposal 1 include harmonising of regulations, improving consumers access to comparative performance information on water heaters, closing of compliance 'loop-holes', reducing energy use in poorly functioning or poorly installed SHWs and HPWHs and providing greater design flexibility to water heater manufacturers by the smoothing of MEPS levels.

The impacts of Proposal 2 and 3 were modelled and result in varying amounts of energy savings, greenhouse emission abatements and net benefits. Proposal 3 is similar to Proposal 2, but simply adds additional energy and emission savings by introducing a further increase in the MEPS levels in 2017. The advantage of this proposal is it gives suppliers greater certainty over performance requirements in the future. For Australia the disadvantage is that it potentially imposes two MEPS increases on some Australian suppliers in a three year period. However, as many products will not be affected by the first MEPS and affected manufacturers may choose to implement one, more significant, upgrade. Though the existing range of efficiencies of the ESWHs in the market clearly show there is the potential to meet the first MEPS increase (also used in Proposal 2), there is less certainty about the magnitude of a second MEPS that could be achieved in 2017. As a consequence, any second increase would be subject to a review using data collected from the harmonised and consistent testing arrangements that would apply from 2014.

For New Zealand, the phase out of HCFC insulation in 2015 may present technical difficulties in meeting existing MEPS.

Conclusions

Overall, there seems to be policy options that are capable of meeting the identified objectives of this report. The identified policies include standardising/harmonising heat loss testing, closing emerging compliance loopholes and improving consumer outcomes by strengthening MEPS levels and improving the usefulness of information available to consumers to help them make informed decisions.

After consideration of the policy options, a revised MEPS option combined with appliance labelling project is currently considered the most effective approach to meet all the stated objectives. This is similar to the approach agreed to in the EC, although the EC will have more stringent heat loss requirements and an additional system efficiency MEPS. The US has agreed to a more stringent MEPS approach which will eliminate all conventional ESWHs greater than 200L from the market.

Subject to further consultation, proposal 3 is considered the most effective option, producing more net benefits, energy savings and greenhouse gas emission abatement than any other option. Proposal 3 introduces more stringent MEPS levels in Australia in 2013, and again further strengthens the MEPS levels in Australia and New Zealand in 2017. Proposal 3 also contains the advantages of Proposal 1 in terms of improvements to the current regulatory situation which will result in improvements to customer protection.

However, there is some uncertainty about the actual additional benefits of Proposal 3 versus Proposal 2, as Proposal 3 is based on a future market review. The future market will have changed due to the consistent usage of one Standard and HCFC restrictions impacting the New Zealand market. Consequently, Proposal 2 could also be considered as it appears to provide greater certainty while still producing significant net benefits to consumers.

It is also recommended that Proposal 5, an appliance labelling project, is provided to decision makers as it will assist in addressing information failures.

Consultation will assist in further refining these conclusions.

9. Implementation and Review

Implementation of MEPS

In Australia, the ESWH MEPS would be implemented under the GEMS Act 2012. In New Zealand, MEPS are implemented by the New Zealand Government under their Energy Efficiency (Energy Using Products) Regulations 2002. The implementation of the recommended proposal could be undertaken via two paths:

- Option 1: Changes to the Australia/New Zealand standards with a reference to this standard by a GEMS Determination and the New Zealand Energy Efficiency (Energy Using Products) Regulations; or
- Option 2: A GEMS Determination which lists all the MEPS requirements that are usually found in a Standard. New Zealand regulations would contain similar requirements.

Consultation with stakeholders will be undertaken to ensure the most appropriate path for implementation. Option 1 is the method that has been used to date. Prior to the GEMS Act, a Standard was viewed as the best mechanism to ensure that all jurisdictions implemented the same requirements although interested stakeholders were required to purchase a Standard. However with the enacting of the GEMS Act, a GEMS determination could also deliver consistent jurisdictional implementation and a determination would be freely available to all stakeholders.

General administrative arrangements

The GEMS Act 2012 is administered by the Department of Industry through the Equipment Energy Efficiency (E3) Program. The GEMS Act 2012 establishes the office of, and defines the functions and powers available to, the GEMS Regulator. One of the key functions of the Australian GEMS Regulator is to monitor and enforce compliance with the GEMS Act. The GEMS Act also has general administrative arrangements to provide for product registration, enhanced monitoring, verification and enforcement of the MEPS.

New Zealand has its own regulatory powers contained within the *Energy Efficiency (Energy Using Products) Regulations 2002* and the Energy Efficiency and Conservation Authority (EECA) is the agency tasked with improving the energy efficiency of New Zealand's homes and businesses, and encouraging the uptake of renewable energy.

Further details on the administrative arrangements for MEPS can be found on www.energyrating.gov.au.

Trans-Tasman Mutual Recognition Arrangement (TTMRA)

The 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 regulatory requirement for a given product, the less stringent requirement becomes the de facto level for both countries unless the one with the more stringent requirement obtains an exclusion under the TTMRA.

As the Australia-New Zealand appliance and equipment markets are closely integrated, TTMRA issues arise if one country proposes to implement a mandatory energy efficiency measure but the other does not, if the planned implementation dates are different, or even if the administrative approaches are different (for example, Australian governments may require products sold locally to be registered with regulators, whereas New Zealand may not, resulting in different administrative and compliance verification costs).

The consequences of a more stringent MEPS levels continuing to be implemented in New Zealand than in Australia should, in theory, be generally negative for New Zealand. The TTMRA should allow the lower efficiency Australian registered ESWHs to be imported into the New Zealand market, defeating the intention of their MEPS. However, the requirement in the New Zealand building code, that require either New Zealand MEPS compliant tanks (or an alternative solution) seems be preventing these negative trade outcomes. Certainly the proposed MEPS level changes of Proposal 2 and 3 will not exaggerate any existing difficulties, and the raising of the MEPS level in Australia included in Proposal 2 will reduce any existing differences in the MEPS between the two countries.

General monitoring and benchmarking of impacts and effectiveness

In the past, the E3 Program has periodically commissioned an omnibus evaluation of overall effectiveness and product specific evaluations. The general aims of such exercises are to document expected impacts, estimate costs and benefits, and compare outcomes with earlier projections. The E3 Program utilises the appliance register and survey data, and comparative review of trends in appliance efficiency.

Appendix A – Details of Current Regulations

As previously described, the standards that are used in MEPS regulations generally consist of two parts, a test method, and a MEPS standard.

Currently to register and sell an ESWH in Australia, testing can be undertaken to the joint MEPS Standard, AS/NZS4692.1, or to the Australian 'legacy' Standards of AS1056 or AS1361. If registering products in New Zealand, the testing can be undertaken to AS/NZS4692.1, or the legacy standards (NZS4602 or NZS4606.1) as applicable. These testing standards are listed in the table below.

Table 12: Australian and New Zealand electric storage water heater testing standards

Test Standards	Name
AS/NZS4692.1:2005	Electric water heaters- Part 1: Energy, consumption, performance and general requirements
AS1056.1	Storage Water Heaters- Part 1 General requirements
AS1056.4	Storage Water Heaters- Part 4 Storage water heaters—Daily energy consumption calculations for electric types
AS1361	Electric heat-exchange water heaters- For domestic applications
NZS4606.1	Storage Water Heaters Part 1 – General Requirements
NZS4602	Low pressure copper thermal storage electric water heaters

The Standard AS/NZS4692.2 contains equations and tables that express the MEPS levels according to a variety of test standards. The option to use the alternative testing standards, instead of just AS/NZS4692.1, was introduced due to industry concerns at the time that they needed certainty regarding testing approach, and the AS/NZS4692.1 was not then finalised. The allowance to use a variety of legacy standards in ESWH testing has meant that products are now not tested according to the one standard, which means comparing the heat loss performance of ESWHs is more difficult for consumers, their advisors (plumbers, installers, shop assistances etc.) and suppliers.

Table 13: Australian and New Zealand electric storage water heater MEPS and related standards

Other Key Standards	Name
AS/NZS4692.2:2005	Electric water heaters Part 2: Minimum Energy Performance Standard (MEPS) requirements and energy labelling
AS/NZS4234	Solar water heaters—Domestic and heat pump—Calculation of energy consumption
AS/NZS5125	Heat Pump Water Heaters

A comparison of the main features and requirements of the three main testing standards used, AS1056, NZ4606 and AS/NZS4692.1 are shown in Table 14. Appendix D of AS/NZS4692.2 provides more technical description of the differences between the test methods of these standards and approximate conversion instructions for heat loss results obtained from AS/NZS4692.1 testing to tests conducted under the legacy standards.

Table 14: Comparison of methods of test measurement between standards

Variable	AS1056	NZ4606	AS/NZS4692
Temp – ambient air	20°C	21°C – 32°C	20°C
Variation in T ambient	+/- 3°C	+/- 3°C, Tmax-Tmin <3°C	+/- 3°C, Tmax-Tmin <3°C
Temp tank	Max thermostat setting, or 75°C (whichever is greater).	55.6°C above Tamb	Max thermostat setting, or 75°C (whichever is greater).
Variation in Temp tank	+/- 3°C	Internal thermostat: <100 L, +/- 4°C >100 L, +/- 2.4°C Other controls; +/- 1.4°C	+/- 2°C
Temp sensor position	Single sensor located at centre of gravity of water heater.	2/3 of distance between element and top of tank, in tank centre.	6 sensors positioned in centre of tank, spread vertically at specified locations.
Electric element	Element supplied with tank.	<100 L, 60W >100 L, 300W	Element supplied with tank.
Fittings required	TPR, CWE valves to be installed and not lagged. Other ports plugged and lagged with 12.5 mm of felt.	All ports plugged with 25mm fibreglass blanket.	All fittings to be installed and hot / cold in/outlets and test equipment insulated.
Data collection	At least 24hrs to reach steady-state. kWh consumed taken at first thermostat cut-out after next 24 hours.	At least 24hrs to reach steady-state. 4 readings taken at approx. 24hr intervals, when thermostat temp is reached.	At least 24hrs to reach steady-state. kWh consumed taken at first thermostat cut-out after next 24 hours.
Thermal stratification modifiers	None	Allow for tank averaging where a raised element is used.	Modified element to be used for raised element tanks.
Draw-off test	Required. Volume delivered before Tout (5L) – Tout >12°C.	Not required.	Required. Volume delivered before Tout (5L) – Tout >12°C.
Basis of maximum allowable heat-loss.	kWh / 24hours for the rated hot water delivery of tank.	kWh/24 hours at the nominal volumetric capacity of the tank.	Aust: kWh / 24hours for the rated hot water delivery of tank. NZ: kWh/24 hours at the nominal volumetric capacity of the tank.

The methodology between these three test methods is similar, with the greatest difference concerning the inclusion of valve/test apparatus components in the heat-loss test methodology. It is worth noting that the differences in the legacy testing approaches were considered when developing the joint Standard and the continued use of the legacy testing standards was not intended when the joint Standard was introduced.

The joint testing Standard also includes a difference between Australian and New Zealand methods for determining the capacity of the tank. The differences in the approach to capacity measurement encourage Australian designed tanks to effectively use thermal stratification. Thermal stratification refers to the development of relatively stable layers of water of different temperatures in the tanks with the hottest water layer at the top of the tank.

A comparison of the Australian and New Zealand MEPS levels contained in the joint Standard AS/NZS4692.2 shows that the New Zealand MEPS for conventional ESWHs are more stringent for ESWHs up to approximately 450 litres nominal capacity. Only for tanks beyond 450 litres are the Australian MEPS levels more stringent.

Appendix B – Market Features

General market features

The water heater market is effectively segmented into two parts – purchases of new water heaters for a new home or apartment and the market for replacement hot water systems in existing dwellings. The volume of sales for new homes is tied to the market for new homes which can be quite variable. Generally the sales of water heaters for new homes constitute only around 20% of the total market, with the rest consisting of replacements of water heaters in existing homes.

Regulation and policy initiatives may affect the 'new home' versus 'replacement' segments of the market differently. For example, recent Australian state initiatives requiring the building of more energy efficient housing, which must install low greenhouse gas intensive solar, heat pump or gas water heaters, have affected the mix of sales for the new home market segment but will have had little direct impact on the replacement market.

There is also a market for water heaters which are either gas based or do not use a storage tank (instantaneous or continuous systems) which are outside the scope of this RIS.

Australia

In Australia low pressure or gravity fed electric water heaters were originally installed however mains pressure systems have been the most popular system for several decades.

Conventional ESWHs come in a variety of types and sizes. In Australia there is a mixture of continuous and restricted tariff water heaters. Restricted tariffs units tend to be larger in size and installed in the detached house and townhouse market. The ESWHs on a continuous tariff tend to be much smaller units and are often preferred for flats and apartments.

New Zealand

In New Zealand conventional ESWHs dominate the market. These tanks are generally either 135 litres (30 gallon), or 180 litres (40 gallon) in capacity. Most of these water heating systems used a header tank in conjunction with the storage tank to supply the pressure.

The majority of New Zealand houses still use low pressure (3.6 m head) heated water systems but low pressure systems are gradually being replaced by main pressure systems as sales of these units now comprise over half of all sales. The low pressure tanks are manufactured from copper which generally has a service life of around 50 years. The decision to upgrade from low pressure to mains pressure is generally undertaken when the existing storage tank fails or the house undergoes substantial renovations or an energy efficient water heating system is to be installed.

The vast majority of water heating in New Zealand is provided by conventional ESWHs. However, in recent years increasing electricity prices, some expansion of the reticulated gas supply and the increasing popularity of gas water heating as well as concern about the environment have become factors which have put pressure on the market for conventional ESWHs. Gas water heater sales, in particular, have increased and now stand at approximately half the comparable number of conventional ESWH sales (E3 2012). As a result there is a slow decline in predicted conventional ESWH stock over the next 20 years.

The relatively high average annual proportion of electricity generation from renewable energy sources in New Zealand (largely hydro-electricity) means that there is little impetus for ESWHs to be restricted on a greenhouse gas basis similar to Australia. However the energy usage of ESWHs generally increases in winter due to higher hot water demand, colder inlet water temperatures and lower levels of heating provided by solar and heat pump components. As hydroelectricity is subject to the weather and limitations, a reliance on thermal generation can occur during 'dry winters' (when hydro storage levels drop). As such, minimising the amount of energy lost through ESWH tank heat loss can an important role in mitigating greenhouse gas emissions during these periods.

Most ESWHs are installed within the house (usually in the middle of the house) however the ambient temperature of the house is generally low particularly during winter. As a result the thermal losses of the tanks are estimated to be in the order of 30% of the electricity consumed by the heated water system. For water heaters installed externally the heat losses will be even greater, resulting in high ongoing costs to the consumer.

Water is predominantly heated outside periods of peak transmission loads using a 'restricted tariff'. There are two tariffs within the 'restricted tariff' band. The price differential between cheaper 'night-only' heating tariff and what is known as a 'ripple' tariff is considerable at present. This could result in a gradual shift towards the night-rate heating of hot water, however the use of night tariff based heating will be limited where the capacity of the tank is too small to meet one day of hot water demand. This may lead to New Zealand installing more conventional larger sized ESWH products which are similar to the size of products on the Australian market.

Forecast sales and stock of electric storage water heaters in New Zealand by technology type are shown in Figure 20 and Figure 21.

Figure 20: Forecast sales of electric storage water heaters in New Zealand by technology

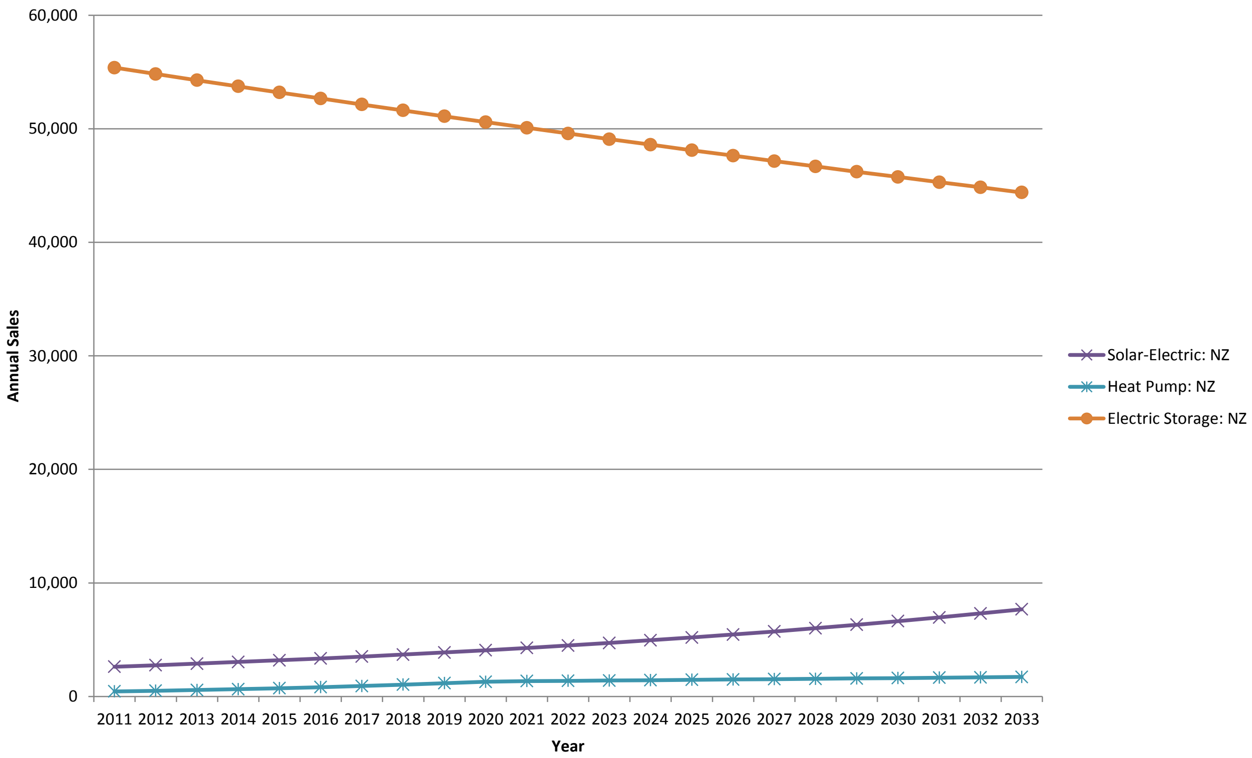
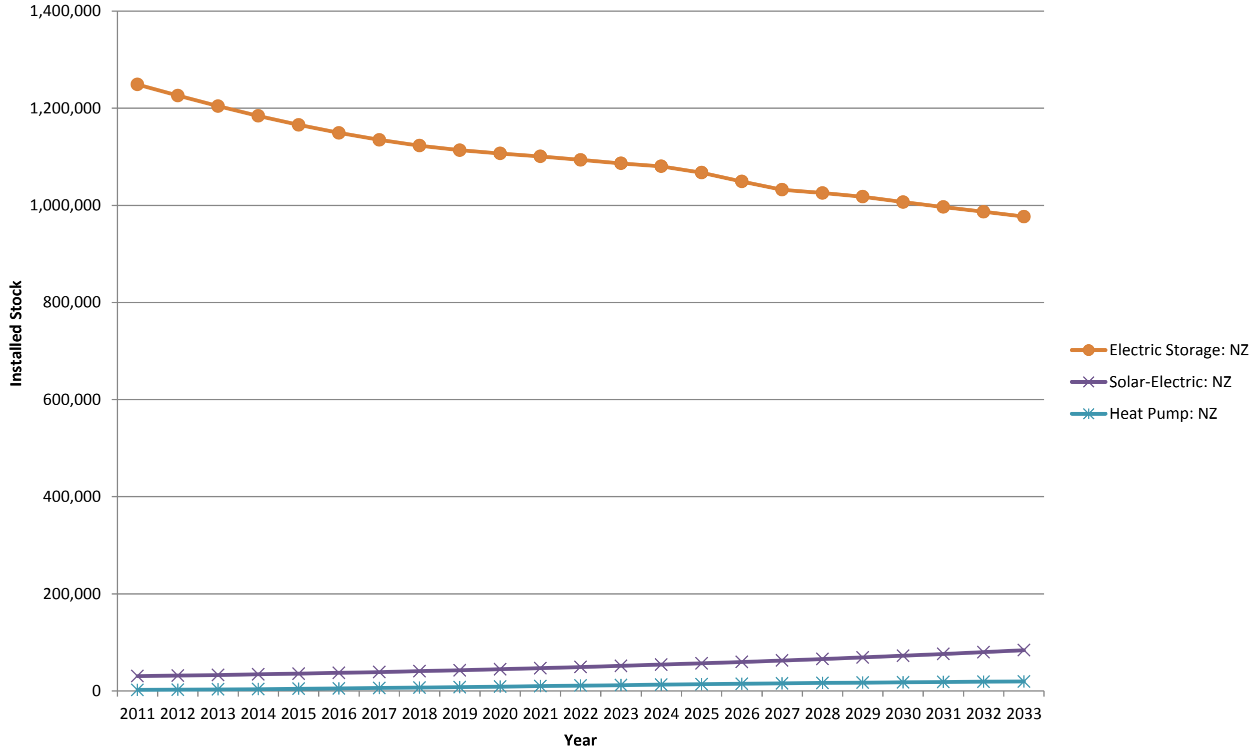


Figure 21: Forecast stock of storage water heaters in New Zealand by technology



Energy consumption projections

A model of the stock and sales, energy consumption characteristics and greenhouse gas emissions from ESWH by technology was prepared for Australia and New Zealand. The assumptions used in the model are explained in Appendix C – ESWH RIS Modelling Summary. Figure 22 shows the resulting forecast of annual energy consumption of electric storage water heaters by technology while Figure 23 provides New Zealand specific results.

Figure 22: Total annual energy consumption of electric storage water heaters by technology

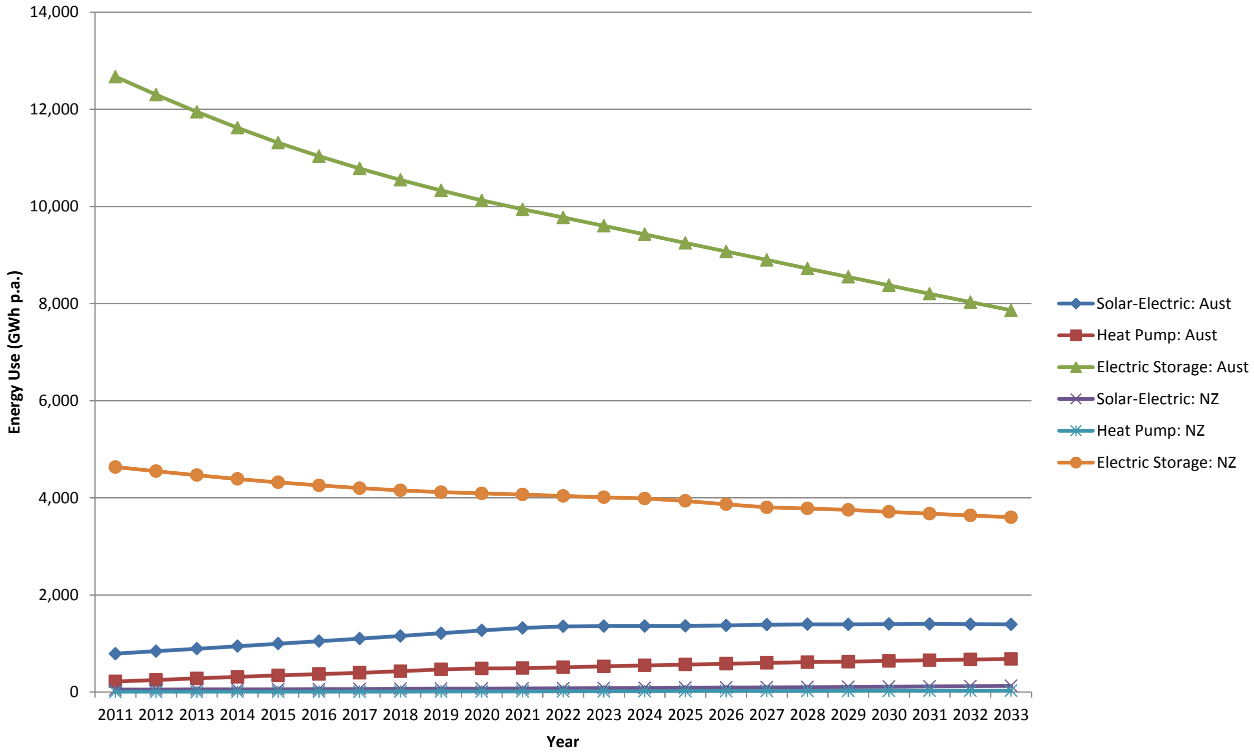
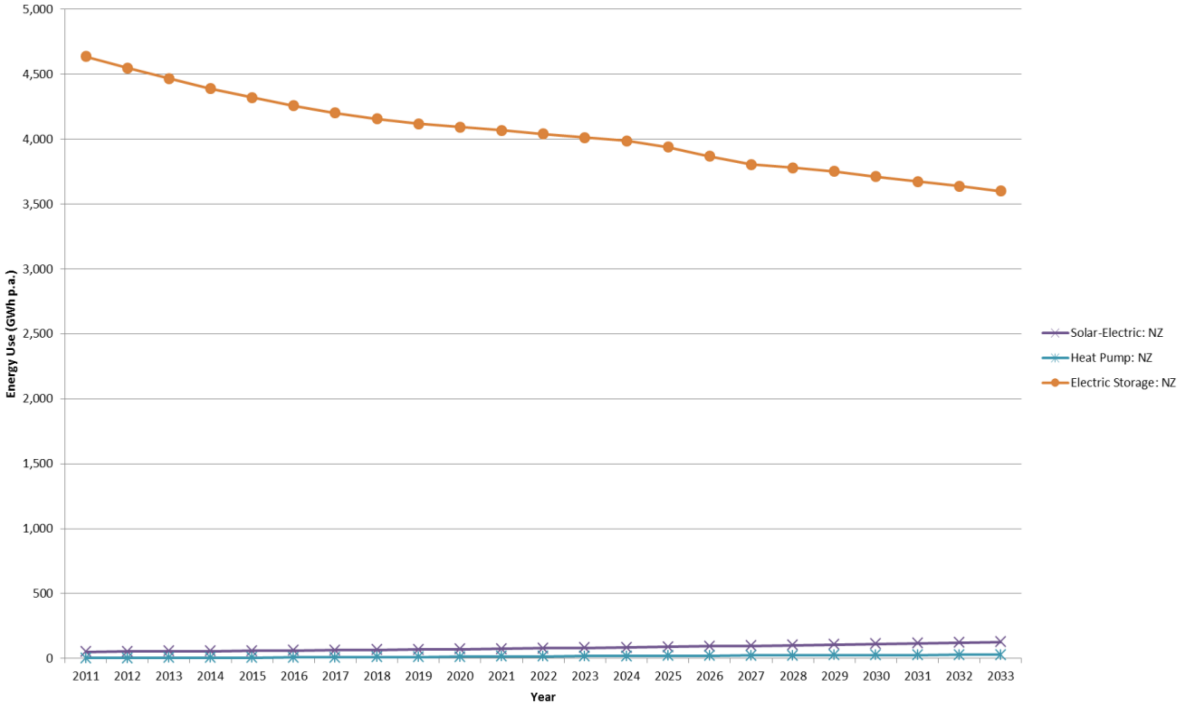


Figure 23: Total annual energy consumption of electric storage water heaters in New Zealand by technology



Appendix C – ESWH RIS Modelling Summary

Cost benefit methodology

A financial analysis has been conducted on the societal cost benefits of the proposals being reviewed, with the analysis conducted at the State and national level. In the analysis the following costs and benefits are included:

Costs:

- to the consumer due to the incremental price increases of product due to the change in Australian MEPS levels;
- to the State and Federal governments for implementing and administering the MEPS program; and
- to the product supply businesses for complying with the requirements of the MEPS program, i.e., testing, administration and training etc. for modified or new products.

Benefits:

- to the State and Federal governments from simplification of the regulatory framework and improvement to the compliance framework which will result in secondary cost savings;
- to the consumer from harmonisation of testing improving the information available for comparing the efficiency of products;
- to the consumer from increased consumer protection from incurring excessive energy costs, when SWHs or HPWHs malfunction, are poorly installed or inappropriately installed; and
- to the consumer from the avoided consumer electricity purchase costs due to the improved average efficiency of EWSHs, improvements which consumers could not otherwise access due to market failures.

The secondary cost savings to the governments, consumer saving from having better product comparison information, potential savings to the electricity grid due to lower electricity demand, and improvements to consumer protection were not quantified for inclusion in the cost benefit analysis, as the information required to quantify these savings was not available.

The benefit to suppliers of a simplified regulatory framework is hard to quantify and has been excluded from the analysis.

Another benefit is the reduced greenhouse gas emissions, due to reduced energy usage, however, the energy prices used for the modelling include the carbon pricing measure. Also, the modelling approach does not include the costs associated with the other environmental impacts of electricity use.

In relation to the potential price increase of ESWHs, the demand for such devices is assumed to be relatively inelastic. All homes will still require a hot water heater. Additionally, the majority of homes only have one hot water heater so there is not a realistic consumer option of decreasing the number of water heaters being used. In some large houses, smaller secondary water heaters are currently used, but these heaters are utilised to ensure timely hot water supply and this source of demand for secondary heaters would remain under the presented policy options (secondary heaters remove the reliance on long pipe runs from the 'primary water heater' - reducing the wait for hot water, reducing water wastage while waiting for hot water and reducing the energy wasted by heat lost in water piping). Additionally other hot water technologies are either regulated or under investigation for regulation and the poorer products for each technology may also be subject to upgrading and associated capital cost effects.

In terms of an approach for the cost-benefit analysis, it is necessary to do this from either a consumer or societal perspective. The social approach is the appropriate methodology for the analysis, but the consumer approach can be used where it approximates the results that would be obtained from the societal perspective. As electricity prices closely reflects the marginal cost of producing electricity, due to generators providing power in response to a competitive bidding system for the wholesale energy market, the market price can be used as a proxy for the resources saved in production. Consequently, the results using a consumer approach should closely resemble those that would be obtained from an analysis from the social perspective.

It should also be noted that if the hot water market is efficient and competitive, all manufacturer and supplier costs will be passed on to the consumer. Government costs are also included in this analysis, although these costs are ultimately borne by all taxpayers, not just those purchasing ESWHs.

The consumer approach is also recommended for the development of RIS's associated with the E3 program (NAEEEP 2005). The alternative analysis approach, of assessing from a resource perspective, would require a new set of factors and assumptions to be introduced to the analysis, particularly regarding manufacturing costs, and would also mean the impact of varying discount rates would be very much more difficult to assess.

An analysis from a consumer perspective involves the use of retail product prices and marginal retail energy prices. Since the objective is to assess whether product buyers (consumers) as a group would be better off, transfer payments such as taxes are included. Retail mark-ups and taxes will be passed onto the consumer and including these in the costs will simplify the analysis process, while still remaining appropriate.

Key assumptions

Key assumptions used in the modelling are shown below

KEY FEATURES	MODEL PARAMETER
Regulation Scenarios	Proposal 1: No Changes To The Efficiency Of ESWH Proposal 2: MEPS Reduces Sales Weighted Heat Losses Compared To BAU (in 2012) by • Australia- Small= 4%, Medium = 13%, Large = 6% • New Zealand- Nil Effect Proposal 3: MEPS Reduces Sales Weighted Heat Losses Compared To BAU (in 2015), by another 10%. Therefore the reduction in heat loss (compared to BAU 2012) is: • Australia - Small= 14%, Medium = 23%, Large = 16% • New Zealand- Small=10%, Medium =10%, Large = 10%
Sales	Sales based industry interviews in 2012 for Australia and EECA collected sales data for New Zealand. Sales were also based on the BAU trends from the 2010 *Decision Regulatory Impact Statement on Phasing Out Greenhouse-Intensive Water Heaters in Australian Homes* (GWA 2010). Trends expected to continue for a slow decline (-1%) in the sales of storage electric water heaters due to replacements and policy parameters to encourage the installation of more efficient alternatives (SWH and HPWH). Sales include the residential and non-residential market. Size Categories are : • Australia- Small up to 80 L, medium 80 to 315 L, large above 315 L delivery • New Zealand- Small up to 80 L, Medium 80 to 200 L, large above 200 L nominal capacity
Projection Period	10 year (2014-2023, cohort ending in 2033) 20 year (2014-2033; cohort ending in 2043) Cohort modelling refers to tracking the effect of the appliances installed up to 2023 or 2033 for their remaining lifespan (12 years). In New Zealand a 25 year median operating life for ESWHs was used as the majority of New Zealand ESWHs are low pressure systems that last much longer than high mains pressure systems which are commonly used in Australia. This approach has been used to capture the ongoing savings of all water heaters installed in the period. As these products have long lifespans and any increase capital costs apply that the point of purchase, failure to provide the cost-benefit ratio under this approach would be an understatement, especially for the 10 year projection period.
Efficiency	Heat losses for Australian ESWH based on model average from registration data in 2012 by size category. New Zealand heat loss data from registration data and weighted by sales from 2000 to 2012. Assume no change to BAU heat loss for forecast period 2012 - 2033. This is discussed in the section '*Suitability of the current MEPS levels*'. No BAU improvement appears to have taken place in the Australian market since the initial MEPS intervention in 1999 (14 years ago) and this is supported by observations in the New Zealand market which shows that improvements in heat loss levels have only occurred with government intervention. Modelled changes in heat loss modelled under Proposal 2 and Proposal 3 are based on the increase in MEPS for each size category (see *'Regulation Scenarios'* above).
Capital Costs	Capital costs of various size categories ESWH are based on builder discounted prices, surveyed by EnergyConsult. Sales weighted average capital costs increase for due to MEPS is: • Proposal 2 = 5%, i.e., $20, $30, $40, diminishing by 20% p.a. • Proposal 3 = 10% i.e.,$40, $60, $80, diminishing by 20% p.a.
Energy Consumption	Total hot water energy use is the sum of heat loss and delivered energy, which is calculated in accordance with AS/NZS4234. Delivered energy is reduced by a factor of 0.6 to 0.8 to account for reduced hot water use by consumers since the 2000's as the Standard is set to specific delivery which over estimates the total energy use of water heaters. Energy Prices • Australia: State tariffs at end 2012 surveyed by GWA, and applied to ESWH as follows: small (continuous tariffs), medium and large ESHW (off peak/controlled as per state tariff). Tariff projection series taken from Decision RIS for Phase-out of greenhouse intensive water heaters (GWA 2010) which were derived from 2008 Treasury modelling of impacts of carbon price. Values at start of series were adjusted to actual tariffs at end 2012. • New Zealand: electricity prices were provided by EECA, dated November 2012.

Greenhouse gas emissions	Australia: • State energy intensity projections taken from Decision RIS for Phase-out of greenhouse intensive water heaters (GWA 2010) which were derived from 2008 Treasury modelling of impacts of carbon price. SA series adjusted down to reflect rapid increase in wind energy production. New Zealand: • The marginal emission intensity for electricity is 0.129 kg CO2-e/kWh in New Zealand. This is different basis for calculating the impacts of programs in Australia. In Australia, policy impacts are calculated with the average emission intensity in each State. In New Zealand, the marginal emission intensity is used, which assumes that an effective ETS scheme will encourage generation investment in renewable rather than fossil generation. See Carbon abatement effects of electricity demand reductions, Ministry for the Environment, November 2007.
Registration Admin costs	Government administration costs assumed to be same as present ESWH MEPS scheme, no additional costs included. New registration costs are now $540 for each model in Australia and nil in New Zealand. Proposal 2 assumes 100 additions registrations will occur in response to new or revised units entering the market post-MEPS.
Industry costs	Re-engineer and re-tooling costs are included in the capital costs, which are passed on to consumers as increased prices. $4,000 testing costs estimated based advice from DCCEE.
Sensitivity Analysis	NPV: • Australia - 7% discount rate, with sensitivity tests at 3% and 10% • New Zealand - 5% discount rate, with sensitivity tests at 3% and 8% Sales weighted average capital costs increases due to MEPS. • Average costs, diminishing by 20% and not diminishing.
Key Assumptions	Increase in efficiency due to MEPS is based on model weighted average efficiency of those models that are available and meet the increased MEPS for each size category. Rebound (take back) assumed to be zero. i.e. it is assumed that people do not use more hot water or undertake other activities that would create additional greenhouse-gas emissions as a result of having lower electricity bills). This assumption is due to the level of energy wastage from heat loss not being visible to consumers as any savings will be hard to distinguish from the 'noise' of the entire household electricity bill. Homes with separate electric connections for the water heater would also have difficulty in separating the heat loss energy savings from the 'noise' of water heating costs that fluctuate according to seasonal conditions and possible changes in household behaviours. The additional significant second order benefits from reduced demand on the electricity grid, from lower levels of greenhouse-gas emissions and improved information available to consumers have not been quantified.

Mapping Australian rated hot water delivery MEPS to nominal capacity

A mapping of the Australian hot water delivery based MEPS to a nominal capacity basis is required to provide an approximate comparison of the Australian and New Zealand MEPS levels. The method used to conduct this mapping is discussed below.

Firstly registration data for Australian unvented ESWHs, registered to either AS 1056 or AS/NZS4692.1 was identified. The data was grouped by the applicable Australian hot water delivery MEPS step e.g. ESWHs of 40L (inclusive) to 50L (exclusive) hot water delivery were grouped against the 40L delivery 'step'. For each group of ESWHs, the average ratio of delivery to capacity was calculated for the MEPS step (for 'steps' with no registered tanks, the average ratios of the steps above and or below were used as a proxy). Using the derived ratios, the Australian MEPS levels (using Table A1 of AS/NZS4692.2, including one adjustment of 0.2 kW/24 hours) were converted to a nominal capacity based MEPS. E.g. the ESWHs of 80 L hot water delivery, had an average nominal capacity to hot water delivery ratio of 1.04 so were mapped to an equivalent nominal capacity step of 83.2 L with an assumed MEPS of 1.73 kW/24 hours.

Appendix D – Jurisdictional Impacts

This appendix provides additional details on Proposals 2 and 3. The impact of these proposals is estimated to vary by jurisdictions due to differences in sales projections and electricity generation emissions factors. Totals may not add due to rounding.

Table 15: Costs, benefits, energy savings and greenhouse gas reductions, by 2033, Proposal 2, by jurisdiction

Impact	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Australia (total)	New Zealand
Total Benefit ($m)	4.9	97.3	3.9	97.7	4.7	18.3	15.6	2.3	**244.9**	**0.0**
Total Cost ($m)	0.4	7.6	0.3	7.5	0.4	2.1	1.5	0.9	**20.7**	**0.2**
Benefit Cost Ratio	*12.8*	*12.8*	*14.8*	*13.0*	*11.2*	*8.8*	*10.7*	*2.5*	***11.8***	***N/A***
Energy Saved (GWh cumulative)	39.4	784.1	35.5	951.4	46.6	214.5	139.7	112.1	**2,323.3**	**0.0**
Greenhouse gas emission reduction (kt CO_2-e cumulative)	33.6	669.1	25.7	827.7	23.2	47.0	93.0	87.3	**1,806.5**	**0.0**

Note: ACT has been calculated based on 4.78% of the combined modelled ACT and NSW impacts, based on household proportion according to ABS statistics.

Note: This table uses discount rates of 7% for Australia and 5% for New Zealand. Period modelled is 20 years (to 2033). The equivalent summary tables in the Impact Analysis chapter in the body of the report are Table 4 for energy and emissions figures and Table 5 for costs and benefits.

Table 16: Costs, benefits, energy savings and greenhouse gas reductions, by 2033, Proposal 3, by jurisdiction

Impact	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Australia (total)	New Zealand
Total Benefit ($m)	10.5	208.8	6.6	181.3	9.6	39.1	35.6	6.6	**497.9**	**78.0**
Total Cost ($m)	0.8	16.3	0.6	16.1	0.9	4.5	3.1	2.0	**44.3**	**9.6**
Benefit Cost Ratio	*12.8*	*12.8*	*11.8*	*11.3*	*10.6*	*8.8*	*11.4*	*3.2*	***11.2***	***8.2***
Energy Saved (GWh cumulative)	82.6	1,646.0	59.5	1,681.4	92.2	450.3	312.2	209.3	**4,533.5**	**423.6**
Greenhouse gas emission reduction (kt CO_2-e cumulative)	70.3	1,399.9	43.0	1,456.4	45.1	100.7	204.5	162.3	**3,482.2**	**54.6**

Note: ACT has been calculated based on 4.78% of the combined modelled ACT and NSW impacts, based on household proportion according to ABS statistics.

Note: Table used discount rates of 7% for Australia and 5% for New Zealand. Period modelled is 20 years (to 2033). The equivalent summary tables in the Impact Analysis chapter are Table 7 for energy and emissions figures and Table 8 and Table 10 for costs and benefits.

Appendix E – Initial Consultation

A Product Profile was developed in 2012, and released for public consultation in July 2012. Following its release, public stakeholder consultation sessions were held during August 2012 in Auckland, Brisbane, Sydney and Melbourne. These sessions were well attended, provided constructive comments and 15 written submissions were received. This feedback has helped to develop the package of policy options presented in this RIS.

In relation to the three broad policy options contained within the product profile, the following feedback was obtained:

- **Reinforcement of regulation/harmonisation of testing standards:** The harmonisation reforms regarding consistent testing to AS/NZS4692.1 requirements generally received strong stakeholder support.
- **Harmonising of MEPS levels:** There was limited support by stakeholders for harmonising MEPS levels between Australia and New Zealand, given New Zealand's colder climate, New Zealand's use of HCFC based insulation (which is banned in Australia) and the small proportion of Australian ESWH models that would meet New Zealand MEPS. Additionally concerns were raised by Australian firms about the potential increase in dimensions that may occur for small water heaters if the New Zealand MEPS level were adopted. Consequently a MEPS harmonisation option is not advocated in the current RIS for implementation in the short term. However, there is still a strong case to increase Australian MEPS, and an option that maintains current Australian water heaters of all sizes has been presented in the current RIS.
- **Including SWHs and HPWHs in MEPS:** The examination of methods by which to remove the MEPS exclusion received 'polarised' feedback – some stakeholders saying that systems already meet current MEPS levels while others viewed any attempt to drive the performance of SWHs and HPWHs via a component MEPS (rather than a system approach) as having a strongly negative outcomes. As a result of these concerns this RIS has adopted an alternative proposal to widen the scope of SWHs and HPWHs being subject to MEPS requirements but reducing the stringency of these requirements.
- **Raising Australian MEPS:** The strengthened MEPS for Australia received mixed feedback, especially the option of moving to the nominally higher New Zealand MEPS levels. Additional information on comparative Australian and New Zealand tank heat loss testing results has been presented in this RIS to improve consideration of Australian MEPS levels. It is also noted that New Zealand currently allows the usage of HCFC based insulation which presents a risk to Australia in moving to New Zealand levels until quality, comparable data is available. A smaller increase in the Australian MEPS level has been modelled in this RIS.
- **Scheduling Future MEPS increases:** Little comment was received in relation to scheduling defined additional future MEPS strengthening. Consequently, the option of increasing MEPS levels (modelled as increasing by 10% in 2017) has been assessed in the current RIS.

Regarding the reinforcement of regulations option, the comments were sought and received on two sub-issues:

- **Nominal capacity:** Currently Australian MEPS requirements are assessed against rated hot water delivery while New Zealand requirements use nominal capacity. There was strong stakeholder feedback for a move to a consistent basis using physical tank size due to size having a direct linkage with tank heat loss. However as physical tank size cannot be easily and independently verified, nominal capacity is a reasonable and recommended 'proxy' to be used for consistent comparisons of water heaters. So the original policy proposal to use hot water delivery in the Product Profile has been changed to nominal capacity. This is also consistent with a number of international regulatory approaches.
- **Grandfathering:** As the potential reforms cover moving to one standard and possibly strengthening some MEPS requirements, stakeholders stated that careful consideration of timeframes and grandfathering options is required. Timeframes, capacity of testing laboratories and costs of re-testing/registration were raised by some stakeholders as important issues. These issues will be able to be better explored in any Decision RIS.

Appendix F – Supplier Compliance Costs

Responsibility for compliance with the MEPS lies with the importer or supplier of the product. The analysis used in this RIS assumes that compliance costs, not associated with any product upgrades, can be calculated with the Business Cost Calculator (OBPR 2012 - 2). The costs of compliance were identified as follows:

- **Education:** This involves maintaining awareness of legislation and regulations, and the costs of keeping abreast of changes to regulatory details.
- **Permission:** This involves applying for and maintaining permission for registration to conduct an activity, usually prior to commencing that activity.
- **Record Keeping:** This involves keeping statutory documents up-to-date.

The Purchase Cost category, which involves the costs of all materials and equipment purchased in order to comply with the regulation, was not included in the business compliance costs. This cost category was interpreted as the cost of design changes to the products to ensure that they meet the required power levels and these costs are explicitly included in the costs benefits analysis as increased purchase costs to the consumer.

The tasks, categories and costing assumptions are provided in Table 17.

Table 17: Business Cost Calculation Inputs

Category	Task	Cost Inputs	Source
Education	Train staff, keep up-to-date with regulations	80 hours/year per supplier	Estimated from other MEPS programs
Permission	Testing each model	$4,000 per model supplied	Based on laboratory costs
Permission	Complete MEPS registration	8 hours per model supplied, plus $540 GEMS registration fee	Estimated from other MEPS programs
Record Keeping	Maintain documents for 5 years	8 hours per 5 years per supplier	Estimated from other MEPS programs
Other inputs:		Staff costs $40/hr	*Australian Jobs 2012* (DEEWR 2012)

The Business Costs Calculator was used to determine the costs per business, and then these costs were allocated on a "per model" basis for the cost-benefit analysis. The RIS cost-benefit analysis models the costs on the basis of each model supplied to the market in a particular year, as this approach provides a greater certainty to the costing of MEPS. The total costs calculated for Australia and New Zealand are shown in Table 18 and Table 19.

Table 18: Business Compliance Costs for MEPS – Australia

Category	Task	Costs / model
Education	Train staff, keep up-to-date with regulations	$160
Permission	Testing of models for energy performance	$4,000
Permission	Complete MEPS registration	$860
Record Keeping	Maintain documents for 5 years	$320
Total/model		$5,000
Total Cost	All businesses (approx 100 models will require re-testing)	$534,000

Table 19: Business Compliance Costs for MEPS – New Zealand NZD

Category	Task	Costs / model
Education	Train staff, keep up-to-date with regulations	$512
Permission	Testing of models for energy performance	$4,000
Permission	Complete MEPS registration	$320
Record Keeping	Maintain documents for 5 years	$320
Total/model		$5,152
Total Cost	All businesses (approx 50 models will require re-testing)	$257,600

These costs represent approximately $534,000 to the Australian suppliers in the first year of MEPS, based on the suppliers registering an additional 100 models. This cost does not vary between the MEPS options being proposed. This cost-benefit assumes that new models are introduced to the market each year and, hence, are already required to be registered. Sensitivity analysis of these estimated costs shows that if these compliance cost increase by 100%, the effect on the cost-benefit is minimal.

For New Zealand, these costs represent approximately NZ$257,600 to the suppliers in the first year of MEPS, based on the suppliers registering an additional 50 models.

Appendix G – Other policy options considered

A range of alternative options were considered but were viewed to be unfeasible due to either already forming part of BAU activities or being less efficient the preceding proposals. Descriptions of these additional options are provided below, along with information on the potential cost-benefit outcomes[33], the risk of failure and the risk of unintended consequences. The information is provided to help inform and encourage stakeholder comment.

Voluntary efficiency standards

Voluntary efficiency standards rely on equipment suppliers being effectively encouraged to meet certain minimum energy efficiency levels voluntarily, that is in the absence of regulation. Stakeholder feedback from suppliers from previous consultations in a range of industries has shown that generally suppliers would not participate in such a scheme where significant market information failures exist, as this would affect their competitiveness and may perversely encourage the use of poorer performing lower cost products.

Establishing and coordinating a voluntary action approach could be a relatively low cost activity. However ESWHs, especially conventional ESWHs, have been in the market for decades and no voluntary scheme has emerged to date. There appears to be a low likelihood of a voluntary scheme, with sufficient coverage of the ESWH market to be effective, now being established.

In relation to the specific ESWH technology types of SWHs and HPWHs, there is a current voluntary scheme which incentivises their purchase set by the *Renewable Energy (Electricity) Act 2000* and administered by the Clean Energy Regulator. This scheme provides a sizable financial incentive in the form of STCs for consumers to purchases these systems[34]. However this scheme does not cover New Zealand, does not provide information about energy use (only energy displacement) and relies on performance modelling based on proprietary information supplied by manufacturers (see *Exclusions based on modelled results* and *Non-validation of claims* from page 37 for the drawbacks of this approach). As this particular scheme has been in place for over a decade and market failures in the water heater market persist in Australia, it is unlikely that this scheme or a similar scheme will address the market failures.

Voluntary certification or labelling program

Voluntary certification would involve suppliers submitting their product to a certification scheme, with high efficiency units being certified as such. However, only high efficiency units are likely to be submitted, so certification is likely to cover only a proportion of the water heaters available which will not provide consumers with adequate information to undertake complete comparisons, including how efficient the water heater may be in their specific climate zone and for their hot water needs. Also, the split incentive issue in the market is not addressed by such an approach.

Voluntary energy labelling could be used to provide information to consumers on the relative efficiency of ESWH, with suppliers volunteering to provide the labels on their products. A similar system is used for gas hot water systems. For a voluntary approach to work there must be almost complete industry wide support for introducing the voluntary standards. This can be achieved in a small market with a few suppliers who all make similar products but would be very difficult in the water heater market due to the range of suppliers operating and due to many suppliers focusing on specific ESWH technologies.

If such a scheme was to be based on tank heat loss level there would be a strong potential for negative consequences. A consumer seeking an efficient hot water system might be influenced to purchase a conventional ESWH with low heat loss levels over a SWH or HPWH that might have higher tank heat loss levels but would be

[33] Everything else being equal, only policies on the 'frontier' of a cost-benefit curve should be considered. That is, if policies with low cost and high benefits exist, they will generally be ideal. In the absence of such potential options, policies with low cost and low benefits or high costs and high benefit should be considered. Policies with high costs and low benefits are generally not favoured where alternative policies are feasible or the BAU situation is acceptable.

[34] The Clean Energy Council estimated the spot price of an STC as at 15 May 2013 to be $36.90. Based on this price, a SWH or HPWH eligible to create 20 STCs would provide the purchaser of the systems with certificates worth over $700. Many SWHs and HPWHs are eligible to create higher numbers of certificates.

more efficient overall. Alternatively a scheme based on existing annual modelled results (see preceding section), would have drawbacks associated with validation on information and a low likelihood of participation by conventional ESWH manufacturers. As conventional ESWHs typically cost more to operate that other water heating technologies such as SWHs and HPWHs, there is a low probability that manufacturers of conventional ESWHs would voluntarily opt into a labelling system that would have a negative effect on their profitability.

Additionally, if gas water heaters were to join the voluntary labelling framework, it would likely involve changing from their current label and test method to a label and test that could be applied to all water heaters to ensure that consumers could fairly compare all water heaters. If gas water heaters did not opt to join this voluntary scheme, consumers could be misled by comparing the 'stars' on the existing gas water heater label with the 'stars' or equivalent symbols on the voluntary ESWH label.

As per the voluntary efficiency standards options, there seems to be a low likelihood of such a voluntary scheme occurring given that no such scheme for ESWHs has emerged to date.

Consumer education campaign:

Such campaigns have already been enacted in different jurisdictions concerning both the importance of energy efficiency to greenhouse gas abatement and methods to reduce consumer energy costs. Such consumer education has been provided by government agencies, community organisations focusing on greenhouse gas issues, and by energy retailers via their energy savings advice and will contribute to the BAU conditions. For example, in Australia advice is available from http://www.climatechange.gov.au/en/what-you-need-to-know/appliances-and-equipment/hot-water-systems.aspx, from state and territory sources, from general websites such as http://www.livinggreener.gov.au/ and in New Zealand from http://www.energywise.govt.nz/how-to-be-energy-efficient/your-house/hot-water. Additionally the Energy Efficiency and Conservation Authority has recently launched a web-based tool for comparing hot water systems. It enables consumers to compare water heating systems based on upfront costs (purchase and installation), running costs, and payback. The tool includes conventional ESWHs, SWHs, and HPWHs, as well as gas (storage tank and instantaneous units) and instantaneous electric water heaters.

Plumber training manuals and courses were developed and released by E3 in 2010 as part of the implementation of water heater elements in the NSEE. The training had a strong focus on informing plumbers of the range of water heating technologies and has been used by registered training organisations in a range of states and territories. These manuals are still publicly available (Plumber Training Handbook) and are considered part of BAU.

As noted in *Consumer preferences* (page 17), the main issues considered by consumers when purchasing a hot water system appear to be capital costs, installation costs and timeframes, 'lifetime costs' especially for efficient systems, the perceived ability of the system to provide sufficient hot water and the time it takes to research a suitable system. While lifetime costs are a consideration, commercial marketing has proved to be unable to communicate the benefits of low tank-heat loss as a way to minimise lifetime costs.

Consumer education campaigns are only able to provide general, rather than product specific advice. So while an impartial and independent consumer education campaign will be able to influence the market to a degree, it is unlikely to be able to highlight the significance of tank heat loss levels (as a key determinate of running costs for otherwise identical ESWHs) when commercial marketing in this area has not been feasible. The current level of general consumer education in Australia and New Zealand is considered part of the BAU.

In summary, there would be additional benefits from increased resourcing of communication activities and such activities are 'scalable' (higher funding levels would likely provide more influence). There could be energy efficiency gains to be had by encouraging a shift to the most efficient water heating options, but without accurate and comparable information sources to inform such a shift, there is the potential for negative consequences such as oversizing of systems or not choosing a system that is suited to a consumers climate conditions. If Proposal 5 (appliance labelling) was agreed and implemented, the case for future consumer education campaigns would be strengthened due to the presence of comparable product information.

Dis-endorsement labelling:

A dis-endorsement labelling scheme involves the assessment of all models and the placement of label on inefficient models informing consumers it is a poor performer. This approach would involve significant compliance and administrative burdens and may be difficult to implement for water heaters which are designed to work well in certain situations, but may operate poorly in others. As the label would need to make assumptions about how an ESWH would be used there is a risk that a dis-endorsement label may negatively influence some consumers (e.g. a small 'dis-endorsed' heater may provide a particular consumer with a better outcome than a larger system that was not subject to dis-endorsement).

An alternative option may be to pursue a dis-endorsement label on the simpler basis of water heaters technology type, such as dis-endorsing all conventional ESWHs on the basis of SWH and HPWH generally being more efficient. However this approach would also risk negative outcomes.

When a dis-endorsement label option, for limited application on HPWHs was raised in recent consultation activities for a HPWH Consultation RIS, strong negative feedback was provided by stakeholders.

Dual or multiple labels:

At the request of the Office of Best Practice Regulation, consideration of alternative labelling regimes that target different classes of stakeholders with different labelling options was required. Such a label regime would be different from the current 'energy rating' label framework used in Australia and New Zealand and would differ from the single, comprehensive water heater label developed recently in the EU after extensive consultation with stakeholders.

It is acknowledged that retailers and wholesalers or appliances currently subject to E3 appliance energy efficiency labels have concerns about the compliance costs associated with the current labels. For example, the labels for whitegoods have been periodically 're-rating' in the past to better demonstrate the spread of efficiencies of current appliances. When this occurred, to mitigate the concerns of sellers about the compliance costs of changing over existing labels, sellers were provided a six-months before the new labels must be used. Due to these concerns about compliance burdens, it is unlikely that sellers would support multiple labelling options being used for ESWHs.

Information on government-endorsed labels needs to be robust. This means that any information on a label would require the manufacturer or importer to provide a formal test report to prove their claims. If new labelling requirements designed to provide tailored information required new information and new tests, this would impose additional costs on industry. If the new information was to be added to the single label, changing the size of the 'current' E3 energy rating label, there would be upgrade costs for manufactures. If separate labels were to be produced there may be additional costs on manufactures in ensuring that their wholesalers and retailers receive the correct labels and are educated on when to use each type of label.

As government energy efficiency policy makers have concerns about the presence of split-incentives in the hot water market, the use of different labelling options may carry the risk of either encouraging or maintaining the presence of split-incentives.

In recent consultation on a HPWH Consultation RIS, there were calls from both installers and manufactures that a single consistent mandatory label should be used in the hot water market. Voluntary labelling received strong negative feedback. The calls for a single label are consistent with the investigative appliance labelling project outlined for stakeholder feedback in Proposal 5 of this d0ocument.

While there is potential for a multiple label framework to provide the most relevant information to each type of stakeholder, this option was viewed as not being feasible. When compared to the simpler label project in Proposal 5, this option would have marginally higher benefits, but substantially higher costs and risks.

Appendix H – References

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