



Australian Government

New Zealand Government



Policy Framework for Hot Water Systems in Australia & New Zealand

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Foreword

Both Australia and New Zealand have committed to reducing greenhouse gas emissions under the Paris Agreement and to achieving affordable, efficient, and low emissions energy use through Australia's National Energy Productivity Plan (NEPP) and the New Zealand Energy Efficiency and Conservation Strategy (NZECS).

The Equipment Energy Efficiency (E3 Program) can help meet these commitments by improving the energy efficiency of products sold in both markets, thereby reducing household energy bills and greenhouse gas emissions. This can be done by applying minimum energy performance standards (MEPS) and energy labelling to new products which are sold. MEPS set acceptable limits for how much energy a product can use to operate, and labelling provides information to consumers on the relative energy efficiency of products (via a Star Rating) and how much energy products use, as a basis for comparing different models and informing purchase decisions.

The E3 Program is a joint initiative between Australian State, Territory and Commonwealth governments, and the New Zealand Government. It is overseen by the Energy Efficiency Advisory Team (EEAT), made up of representatives from each jurisdiction participating in the programme, and this committee reports to the COAG Energy Council for final decision making.

Water heaters are a priority for intervention under the current E3 work programme. They use an estimated 23% and 28% of total household energy¹ use across Australia and New Zealand, account for about 20% of householders' energy costs, and are responsible for around 20% of total Australian residential greenhouse gas emissions and 33%² in New Zealand. Hot water systems are an integral product for heating water in both Australian and New Zealand households for a wide range of activities, including cleaning, washing and cooking.

The EEAT committee has developed a Policy Framework and five-year Roadmap for Hot Water Systems in Australia and New Zealand, identifying how these will be dealt with *within the context of the E3 Program*. This sets out proposed measures for raising the energy efficiency of new water heaters sold, and a proposed approach to developing and introducing these measures over the next five years, in partnership with industry and other stakeholders. The Policy Framework is accompanied by a Five Year Roadmap that lays out the proposed work-streams and timeframes on one page. Our intention for this program of work is getting all products registered, an on-line consumer comparison tool with a label, a common test method, and a MEPS for all types of residential hot water system. Finally, we will review MEPS levels between both countries with the aim of aligning these levels, subject to further investigation of the costs and benefits.

The EEAT Committee is consulting stakeholders on this Policy Framework and five year Roadmap.

¹ DIS 2015, Residential Energy Baseline Study: Australia, Department of the Industry and Science, Canberra, Australia, prepared by EnergyConsult, August 2015

² The share of emissions are higher in New Zealand than in Australia because of higher use of electric hot water systems compared to Australia.

Have your say

We welcome your feedback on the proposed Policy Framework and Five Year Roadmap, and expressions of interest in being involved in the Technical Working Group and Stakeholder Reference Group. Feedback and enquiries can be directed to:

Australia: acrac@environment.gov.au

New Zealand: regs@eeca.govt.nz

Submissions on this document close on: Monday 10 December 2018

Introduction

There are several market barriers to the uptake of efficient water heating technologies in Australia and New Zealand.

Water heaters are largely chosen on their capital cost, without considering the life cycle costs (e.g. initial installation cost plus the cost of energy consumed over a water heater's lifetime). This tends to occur where the purchaser is not the person who will be paying the energy bill, or when water heaters are purchased as emergency replacements and the decision is made by the plumber. Secondly, it is difficult to compare the energy use and running costs of different hot water systems, due to a lack of information and because there is no common test method or metric to provide the basis for comparison.

There may also be untapped potential to use water heaters with smart technology or controls that are inbuilt into the hot water systems to predict water demand in a household, which could influence householders' energy using behaviour, and shift their time of use to off-peak. However, this is dependent on many issues such as, off peak tariffs and the penetration of rooftop photovoltaic panels. It is unknown if a lack of information, and awareness is preventing the widespread adoption of smart technology or controls, which could result in lost opportunities to reduce peak electricity demand, and save householders money by modifying their energy using habits.

Market coverage of MEPS and labelling for water heaters is an issue. Australia and New Zealand apply Minimum Energy Performance Standards (MEPS) to gas water heaters and electric storage water heaters. However, these MEPS have not been updated in many years and do not cover all of the technologies on the market, including solar and heat pump water heaters. They therefore are not serving as well as they could to raise the overall energy efficiency of the water heaters available on the market, and to reduce the associated energy costs and greenhouse gas emissions.

By addressing these issues, Australia and New Zealand will benefit from significant reductions in energy consumption, greenhouse gas emissions, and household energy bills, and do so while minimising the compliance burden on industry. E3 estimates that the combined benefits for Australia and New Zealand across a ten year period to 2030 could be upwards of \$AUD 1,355 million, at a cost of \$AUD 850 million. Upwards of 7,890 gigawatt hours of electricity and 3.67 mega-tonnes of greenhouse gas emissions could be saved³.

The Policy Framework for Hot Water Systems in Australia and New Zealand proposes three approaches to address these issues:

Adopting a technology-neutral method of test and a common energy performance metric: This would make it possible to provide comparative information, and apply common minimum efficiency standards, across different water heating technologies. This approach requires a review of the available representative data on household hot water usage to determine if it needs updating, and may require more research to be

³ See the section on policy options and provisional costs and benefits for a breakdown of these figures and the assumptions used to inform them.

undertaken. A technology neutral test method, which can be used for all water heater types, is a necessary prerequisite to the other measures discussed below, and will be the initial focus of the work program.

Improving information: This involves providing comprehensive and trustworthy information on energy consumption, costs and emissions across different water heating technologies, via an online comparison tool and potentially an energy rating label, based on the technology neutral method of test. This would require industry to register their products and supply information to government for incorporation into the tool. Information on the use of smart technologies or controls that are inbuilt into a hot water system to predict water heating demand could also be provided, as such there is limited information on the potential benefit to consumers but this could be potentially provided via an endorsement scheme or label. This requires further investigation.

Extending/consolidating the coverage of MEPS: This would involve extending MEPS to water heating technologies that are not currently covered, including solar (both electric- and gas-boosted systems), photovoltaic, heat pump, and electric instantaneous technologies, and potentially applying a technology-neutral, 'one-size-fits-all' MEPS.

Principles of Engagement

The E3 Program will abide by the following principles to develop these policy approaches:

- We will be moving all hot water systems to a new method of testing that is technology neutral, to enable direct and fair comparisons between technologies, and to make it possible to develop a technology neutral MEPS in future
- We will work collaboratively with industry and consumer stakeholders to implement energy efficiency measures (MEPS and energy labelling) across all hot water technologies.
- We will only introduce new measures where the benefits of doing so are evident.
- E3 measures introduced *under this work program* will not be designed to remove any existing water heating technologies from the market. States and Territories may choose to develop additional or complimentary measures for hot water such as subsidies, or building/plumbing codes measures, as is already the case.
- We will register all products based on the technology neutral method of test and provide relevant information through a website, online tool and energy rating label that allows consumers to compare water heating options.
- We will look for opportunities to align requirements in both countries (New Zealand & Australia), and base them on international standards, where it makes most sense to.

This document is divided into several sections. It provides an overview of the issues affecting the uptake of energy efficient, low emissions water heaters, and outlines the government policies that currently apply to (or are proposed for) water heaters. It then discusses what approaches we can use under the E3 Program to improve the energy performance of hot water systems and lower their emissions, including approaches adopted in other markets that could be applied here. Finally, it sets out options for intervention and a proposed approach to developing and implementing measures over a five-year timeframe.

The hot water system technologies included for consideration under the Policy Framework are:

- Electric storage
- Gas storage
- Instantaneous gas
- Heat pump technology
- Instantaneous electric
- Solar hot water with electric boost
- Solar hot water with gas boost
- Direct photovoltaic with electric boost.

Market Issues

There is strong potential for Australia and New Zealand to reduce energy demand, peak electricity⁴, greenhouse gas emissions, and energy costs to consumers by adopting energy efficient, low-emissions water heaters and smart controls. However, there are several barriers to realising this potential under the current market conditions.

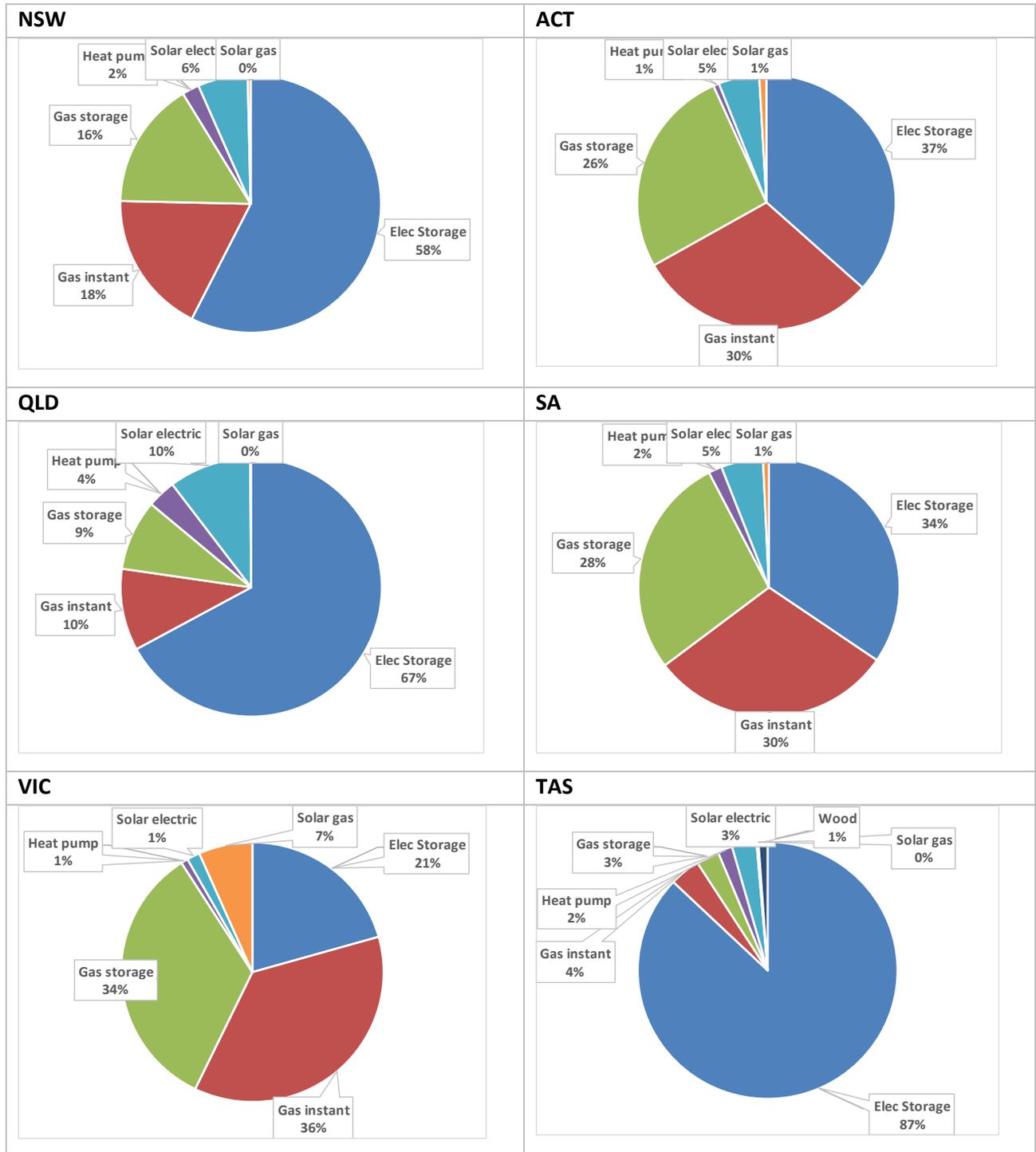
Current market trends

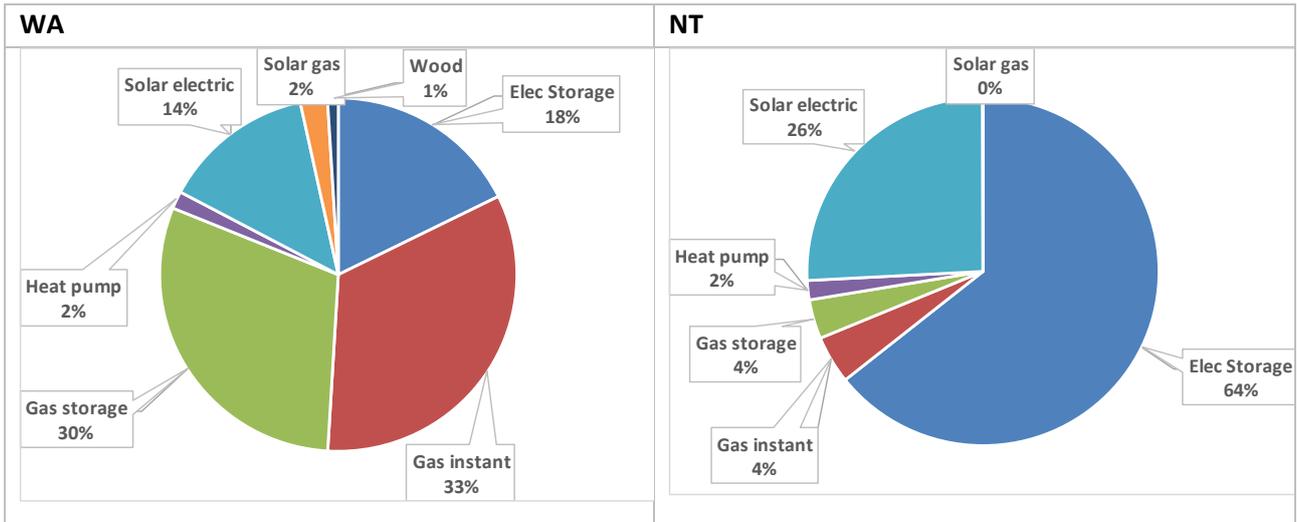
Different States and Territories in Australia have different profiles for the stock of hot water systems, and therefore different sales mixes. However, the increase in sales of solar electric and heat pump water heaters in 2009 was due to the rapid uptake of financial incentives provided by the Renewable Energy Target scheme and government incentives. Trends in the sales of gas instantaneous systems are projected to continue to increase as they replace gas storage and are installed in new homes. Solar gas water heaters are almost all sold in Victoria due to the National Construction Code (NCC) requirements for new homes in that State. Graph 1: details the split of the types of hot water systems being used Australia by State and Territory, and their saturation in the residential market⁵.

⁴ It is important to note, that further investigation will be undertaken across each jurisdiction to establish the extent of peak electricity demand issues resulting from electric water heating and their potential reduction through hot water systems.

⁵ The main source of data is the Residential Baseline Study published in 2015. Comparisons have been made with the latest research from BIS Shrapnel (2016).

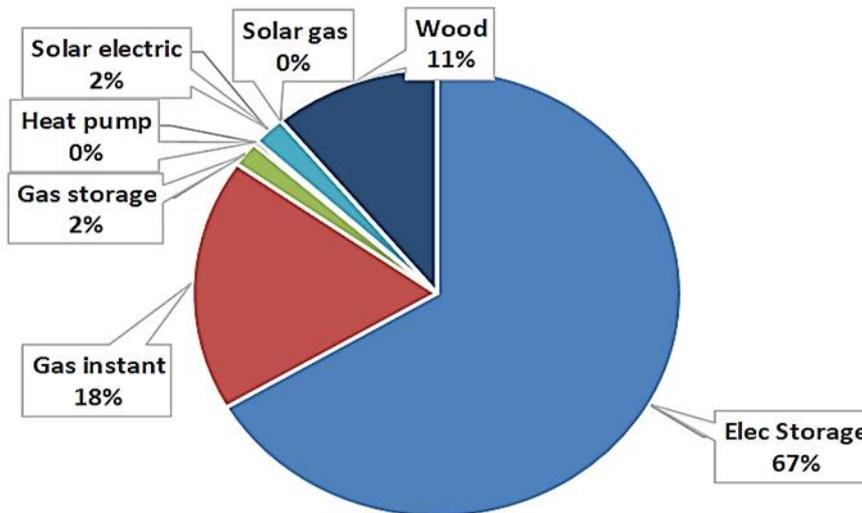
Graph 1: Hot water systems in Australia:





Electric storage hot water systems have been, and remain, the dominant hot water systems in New Zealand, with trends suggesting a greater move towards smaller electric hot water systems uptake, including in Auckland as installations increase with apartment construction. Graph 2 details the split of the types of hot water systems being used New Zealand and their saturation in the residential market:⁶

Graph 2: Hot water systems in New Zealand:



Gas instantaneous is the second most common type of water heating system in New Zealand as there was previously a move towards gas for hot water systems, driven largely by the ability to have unlimited hot

⁶ The main source of data is the Residential Baseline Study published in 2015 and updated with the latest information collected by EECA.

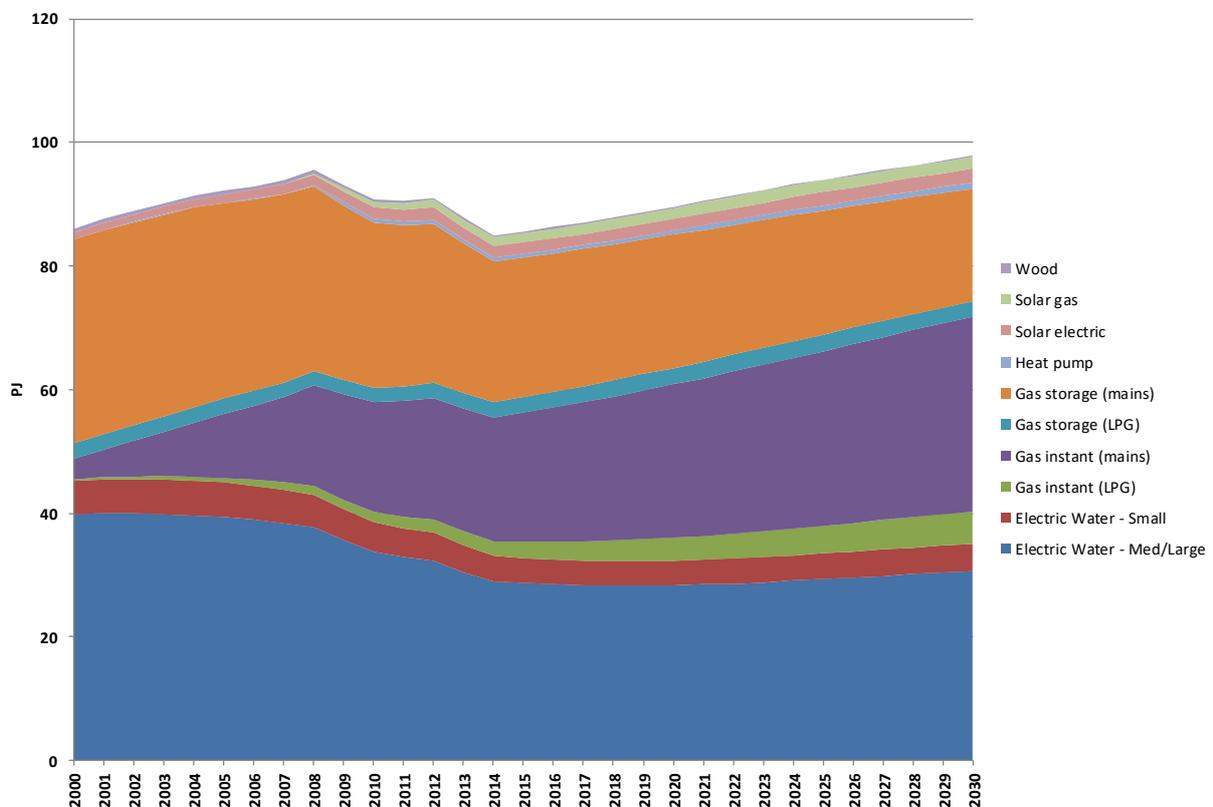
water. The market for gas instantaneous has now stabilised because of the relatively high cost of LPG in the South Island compared with electricity.

Solar electric hot water systems sales were increasing until 2012, but have since slowed, mainly as a result of the removal of Government subsidies of \$500 to \$1000 that were offered from 2007 until mid-2012. The Government’s Kiwi Build programme aims to build 100,000 new affordable homes over the next 10 years. This has the potential to drive demand for water heating systems. For example, at present there are approximately 30,000 new homes built annually in New Zealand.

Energy use and efficiency trends in Australia and New Zealand

In Australia water heating contributes around a quarter (24%) of the overall residential energy consumption of all the end uses. Energy use by residential water heating was estimated to be 85 PJ in 2014, having declined from a peak consumption in 2008 of 95 PJ. However, total water heating energy use is expected to start to increase and grow until it reaches around 98 PJ in 2030, assuming there are no changes in water heater regulations or incentive programs. Graph 3 shows the estimated energy use of each type of water heater and forecast to 2030.

Graph 3: Water Heating Energy Use by Product Group- Australia 2000 - 2030



The main factor contributing to the reduction in energy use for gas water heaters in the second half of the 2000s, has been consumers switching from gas storage water heaters to the more efficient instantaneous gas water heaters. The main factors affecting water heating related electricity consumption have been consumers moving to solar and heat pump water heaters from electric storage water heaters, encouraged by incentives from state and federal governments. Average ownership of electric water heaters declined from 0.62 in 2000 to 0.46 in 2013. In addition, behavioural changes due to an extended drought and rapid take up of water efficient showers have also contributed to significant reductions in energy use per water heater. Research conducted for the RBS, utilising electricity distributor data on off-peak and controlled load water heaters, has found that the decline in hot water use from water efficiency measures and changes in behaviour has contributed to approx. 10% of the reduction in total hot water electricity consumption in Australia.

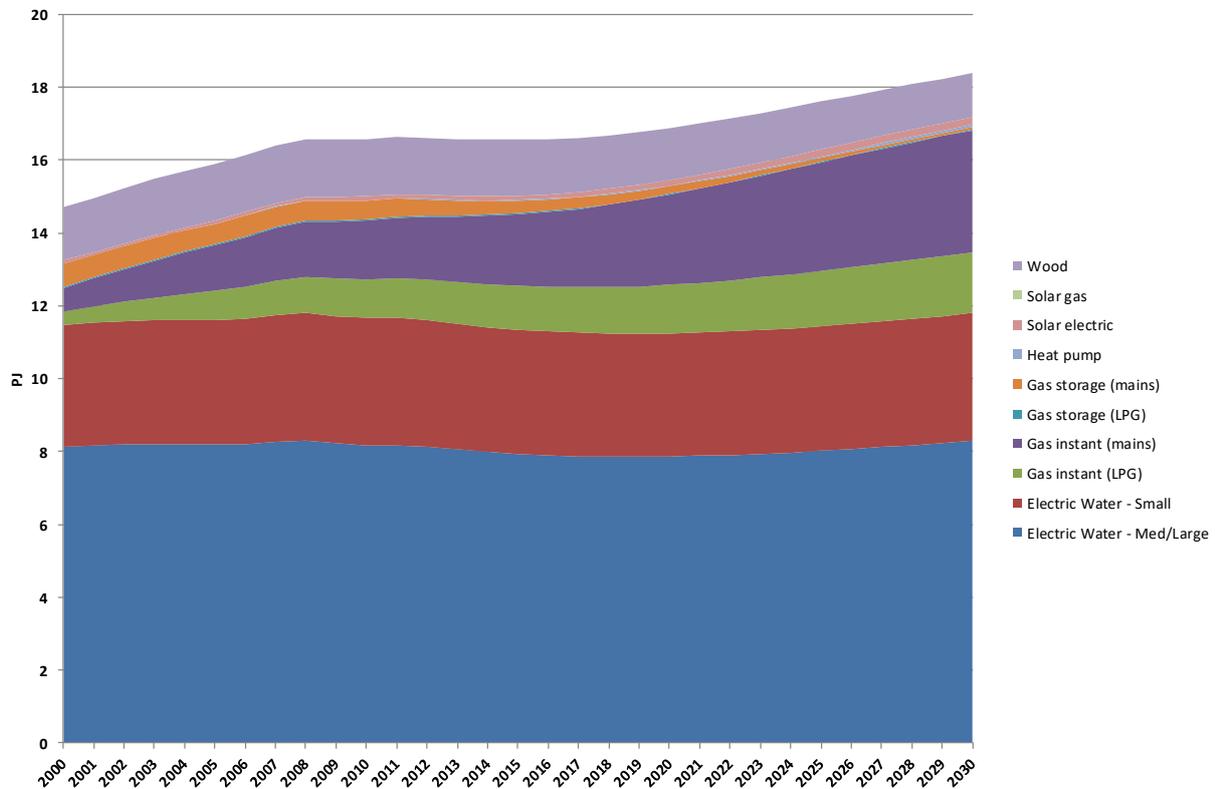
The energy use by electric water heaters is now forecast to increase slightly, as the fuel switching rate declines and no other MEPS or water efficiency measures are planned to be implemented, this is also driven by new builds. The financial and regulatory incentives available for solar and heat pump water heaters have also been significantly reduced, resulting in sales of these heaters reducing to pre-2007 levels.

New Zealand's water heating energy use was 16 PJ in 2014, and is slowly increasing to a projected 18 PJ in 2030, as detailed in the Residential Baseline Study report prepared for the Department of Industry and Science on behalf of the trans-Tasman E3 programme. Electricity use dominates the water heating energy use and contributed 78% of the total use in 2014. However, electricity energy use is stable throughout the study period. In contrast, the use of energy from natural gas increases throughout the study period, as does that from LPG, albeit off a lower base for LPG. This reflects the cost-effectiveness of a gas water heating system both in terms of capital cost and energy cost (North Island mains gas). It is also driven by the convenience of endless hot water and freeing up the space that would otherwise be required for a storage cylinder.

Much higher up-front purchase and installation costs for options such as solar water heating and heat pump water heating can outweigh the benefits from their lower running costs.

Wood's use, via wet-backs, remains very small but steady during the study period. Wetback options continue to be available even as burner emission standards tighten. Graph 4 shows the energy use of each type of water heater and forecast to 2030.

Graph 4: Water Heating Energy Use by Product Group- New Zealand 2000 - 2030



Differences between Australia and New Zealand

Hot water cylinders in New Zealand are generally located in a cupboard (“the cylinder cupboard”) which is centrally located in the home.

In Australia, the majority (61%) of hot water storage cylinders are located outside the house, in the open-air; this ranges from a high 78% in South Australia down to 47% in New South Wales. Thirty per cent of Australian cylinders are located elsewhere inside the house or garage, with the remaining 9% located in the ceiling or roof space.

New Zealand has a natural gas transmission network including pipelines covering 2500km and extending from the New Plymouth area to Whangarei in the north, Taupo centrally, to Gisborne and Napier in the east, and to Wellington in the south.

In other parts of New Zealand gas water heating relies on mainly bottled LPG with some small local LPG reticulation networks.

The availability of gas varies from state to state in Australia with the result that gas water heaters are more popular in VIC, WA, SA and ACT, with moderate penetration in NSW and QLD. Gas water heating is relatively uncommon in NT and TAS.

Electricity generation in New Zealand is largely renewable based (hydro, geothermal and wind) and typically renewable sources represent around 85% of total electricity generation.

Statistics on renewable electricity generation in Australia are essentially the opposite of NZ with 86% of generation being from fossil fuels (mostly coal). Renewable generation comprises the remaining 14%, half of which is from hydro and the balance coming from wind, bio-energy and rooftop solar. This difference in electricity generation has a fundamental impact on the carbon and GHG impacts of different water heating choices in the two countries.

The barriers in Australia and New Zealand

The barrier in both countries are split incentives, where the person making the purchase decision will not be paying the energy bills. This occurs in the new home market where builders tend to adopt water heating options with the lowest capital cost consistent with consumer fuel preferences, without considering the life cycle costs. It also occurs when the home owner defers the choice of water heater to the plumber, which is quite common. The new home owner is responsible for the ongoing operating costs, and the product with the lowest capital cost will typically cost more to operate over its lifetime. This also occurs in rental properties, where the landlord selects the lowest capital cost replacement water heater and the renter pays the energy bills.

Another barrier in both countries is present bias. This is the tendency of consumers to place more value on immediate rewards, at the expense of long-term benefits. Due to limited time or financial constraints, buyers are more likely to make choices that are not in their longer term best interest. This is especially true when a water heater fails, as decisions are made quickly and tend to be based on immediate cost and the need to restore hot water as quickly as possible.

Minimum energy performance standards can reduced these barriers by raising the average performance of water heaters in the market regardless of purchase considerations. However, the existing MEPS apply only to gas water heaters and electric water heaters and have not been updated in some time. Installation requirements under the National Construction Code (NCC) are also a powerful policy tool for addressing these barriers for new houses, however, this program of work will not look at this. In Australia, water heating requirements for new dwellings are contained in the National Construction Code, and some jurisdictions have variations to the national requirements (e.g. Victoria).

Even where the consumer wishes to make a considered purchase, they lack comprehensive information on the running costs, energy performance, and greenhouse gas emissions of different types of water heaters. The Gas Energy Label applies to gas water heaters in Australia (and is often applied to products in New Zealand), and Small-scale Technology Certificates under Australia's Renewable Energy Target serve as de-facto ratings for solar and heat pump water heaters (the more certificates that apply in a particular zone, the better). However, these measures do not apply across all water heating technologies, and do not provide comprehensive information to consumers. It also doesn't allow consumers to compare across the technology types.

Some of the major water heater manufacturers, suppliers and merchants have their own cost comparison tools and guides, but there is no comprehensive listing of these available to consumers. Simple comparison calculators are available in New Zealand on EECA's website and in South Australia (SA) on the SA Government's website, which allow users to enter different search parameters but cannot provide

information specific to individual models. Ideally, consumers should be able to search by different models and factor in such variables as household size and hot water usage details, energy tariffs and climate zone to get tailored information on what option best suits their household.

There is potential of smart technology or controls to promote energy conservation and reduce peak demand is largely untapped (this will need further investigation of peak demand in different jurisdictions and the cost and benefits of reduction). In this context smart technology or smart controls are inbuilt into a hot water system and can predict demand, and service demand in a household in the most cost effective and efficient way. This could range from algorithms that can predict demand for hot water, and heat just enough water, or intelligent thermostats that could adjust thermostat settings to reduce standing losses where possible, and possibly even water heaters with a demand response interface on the system itself. Understanding the commercial context and viability of smart technologies or controls will need further investigation.

There may also be a lack of understanding about how consumers can best utilise smart technology or controls to save on energy costs. An endorsement scheme or label for water heaters with smart capabilities could go some way towards addressing this, however, at this stage information is limited on this potential. There will be further investigation into the potential of smart technologies or controls for hot water heaters (e.g. what are they, what is commercially available or in development and what are cost and benefits to their uptake) to be considered or included as a potential option.

Existing policies relating to water heaters

Standards and labelling regulations in Australia and New Zealand

Electric water heaters

MEPS for water heaters started with the introduction of MEPS for electric storage water heaters in Australia in 1999, and in NZ in 2002. MEPS for small electric water heaters were made more stringent in 2005. Different requirements were applied in each country, due to market differences. In 2013, changes were proposed to move Australia and New Zealand to a single method of test and MEPS level, but this work ceased in 2014, in accordance with E3 Program prioritisation. Significantly, the common standard (*AS/NZS 4692:2005 Electric water heaters Energy consumption, performance and general requirements*) is used only for performance measurement of Electric Storage Water Heaters. Australia also applies a less stringent MEPS threshold than New Zealand. This has led to some non-compliant products being imported into and sold in New Zealand under the provisions of the Trans-Tasman Mutual Recognition Arrangement (TTMRA), which allows for products that are legal for sale in Australia to be legally sold in New Zealand (and vice versa), unless an exemption is applied. In addition, there is currently no labelling requirements for electric water heaters, therefore making it difficult for consumers to compare efficiency across electric water heaters.

Gas Water heaters

MEPS under the E3 Program were introduced for gas water heaters in 2011 in New Zealand and 2013 in Australia. These MEPS levels and coverage have not been subject to review, but work has begun to resolve issues with the performance measurement standard, including problems with its repeatability (i.e. its ability

to produce consistent results) and the need for more realistic domestic water heating loads for Australia and New Zealand.

This work may also resolve similar issues with how the energy performance of solar water heaters is modelled. The scope of the test for gas water heaters could be extended to other water heater types and thereby form the basis of a common framework for measuring the energy performance of all water heater product classes. However, it is important to note that this might require some physical testing of components, and then modelling of solar water heater performance based on the same hot water usage profile as is used for the “black box” test.

Gas water heaters have been subject to an industry-based energy rating label in Australia since 1987. The Gas Energy Rating is specified in the *Australia/New Zealand Standard AS/NZS 5263.1.2:2016: Gas appliances Gas fired water heaters for hot water supply and/or central heating*. The requirements for testing and labelling sit in this standard, and in Australia are given effect by the gas certification scheme.

Solar and heat pump water heaters

The E3 Program consulted on MEPS for heat pump water heaters, electric-boosted solar water heaters and gas-boosted solar water heaters in 2013 (having added these products to its work programme in 2008). This work was stopped in 2014, due to a change in priorities. As touched on above, a key issue for solar and heat pump technologies is the need for realistic domestic water heating loads for Australia and New Zealand (i.e. amount of hot water households use) in order to accurately calculate or model their performance (i.e. cold and hot weather performance), and to allow a fair comparison between different water heater types and models.

For newer technologies, such as systems that make direct use of photovoltaic energy, an appropriate product measurement method needs to be developed.

The table below provides a summary of hot water technologies, and the product measurement standards that apply.

Coverage of hot water technologies under the current E3 Program

Product	MEPS	Energy labelling	Product measurement standards
Electric storage water heaters	Yes	No	AS/NZS 4692:2005 Electric water heaters Energy consumption, performance and general requirements
Gas water heaters	Yes	Yes (industry label)	AS/NZS 5263.1.2:2016: Gas appliances Gas fired water heaters for hot water supply and/or central heating
Heat pump & solar water heaters	No	No	AS/NZS 2535.1:2007: Test methods for solar collectors Thermal performance of glazed liquid heating collectors including pressure drop
			AS/NZS 5125.1:2010: Heat pump water heaters - Performance assessment
			AS/NZS 4234:2008 Heated water systems —Calculation of energy consumption
Photovoltaic	No	No	Nil

Building and Plumbing Regulations in Australia and New Zealand

Building regulations apply to the construction and alteration of homes, under Australia’s National Construction Code (NCC) (which includes some State and Territory specific requirements) and the New Zealand Building Code. Under the NCC, minimum performance requirements apply to all water heaters, expressed in terms of their greenhouse gas emissions, and calculated either in accordance with *AS/NZS 4234:2008 Heated water systems —Calculation of energy consumption* or by reference to the number of Small-scale technology certificates (STCs) awarded to them (see below). Minimum requirements for the installation of solar collector panels (orientation and tilt) are also specified, as set out in the Australia/New Zealand Standard *AS/NZS 3500.4 Plumbing and drainage, Part 4: Heated water services*.

Victoria currently has a variation in the NCC applying to water heaters in class 1 dwellings – either a rain water tank plumbed to sanitary fixtures, or a solar water heater (must be gas-boosted solar in gas reticulated areas). This has resulted in significant uptake of gas boosted solar water heaters in new class 1 dwellings since 2005. Victoria is considering measures on hot water requirements but no decisions has been taken.

Other Australian Government Programs

A big influence on the choice of water heaters in Australia include the Small Technology Certificates (RECs) created by solar and heat pump water heaters, and these are legislated to continue until 2030 (although the number of Small-scale Technology Certificates (STCs) and hence value of incentive received will decrease from 2022). Suppliers register their products with the Clean Energy Regulator to be eligible to create STCs. The register lists the STCs available for that product by one of five climate zones across Australia), and the market value of the STCs is used to provide a financial incentive to consumers. This is

determined using the Standard AS/NZS 4234 and parameters published by the Clean Energy Regulator. Compliance is monitored by auditing the submitted information.

State Governments also provide incentives for the replacement of electric and other less efficient water heaters, with less greenhouse intensive water heaters (solar, heat pump or gas water heaters). These programs include the Victorian Energy Upgrades program, South Australian Retailer Energy Efficiency Scheme and the ACT Energy Efficiency Improvement Scheme. These programs specify eligible products (i.e. solar and heat pump water heaters) according to *AS/NZS 4234:2008* or by reference to the number of STCs. More recently the Victorian Government also introduced rebates for solar water heater installation through its Solar Homes Program. For gas water heaters eligibility is based on the gas water heater test standard.

Coordination issues across government

Testing and performance measurement

Separate, technology-specific standards currently apply to the different types of water heater. These use different metrics and methodologies, and responsibility for them is spread across three different standards committees that operate in two different sectors of Standards Australia⁷. Aligning or integrating these standards to produce a common energy performance test standard could provide the basis for valid comparisons of energy performance between different technologies. This requires a coordinated effort between the responsible standards committees.

Measures that apply in other markets

Europe

The European Union (EU) has introduced a complex but comprehensive label that can be used to compare all water heating technologies. Having all technologies laid out on the same scale provides some difficulty differentiating performance within classes of products, but it does provide clear indications of which types perform better.

The EU label is based on nominal primary energy consumption rather than secondary energy consumption (on which the US label is based). Primary energy is used in the label to facilitate comparison of products that use electricity and gas. (Primary sources of energy can be used directly, as they appear in the natural environment e.g. natural gas, while secondary sources of energy derive from the transformation of primary energy sources e.g. electricity generated from the combustion of coal or gas.)

The methodology used to determine ratings features ten separate tapping profiles (i.e. daily hot water usage profiles) that could be used, although three tapping profiles cover the most likely uses.

The EU has been able to raise minimum performance requirements through the label. In 2017 Class G was removed from the label, thereby pushing up the minimum performance required for water heating systems to be sold in the EU.

⁷ Committee AG-001 Gas Appliances and Committee EL-020 Electric Water heating Appliances are in the Energy and Electro technology Sector and Committee CS-028 Solar Water Heaters is in the Manufacturing and Processing Sector. The three committees have some common membership, but there is no formal liaison path between the three.

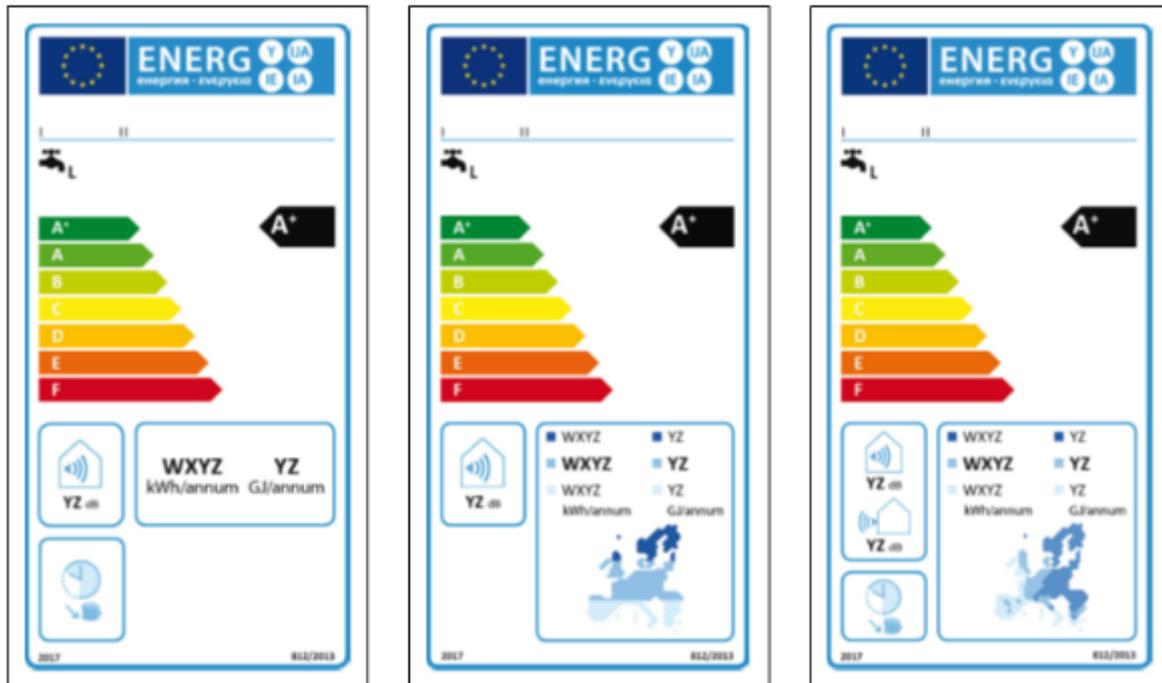
As yet no study has been undertaken to investigate whether the label is influencing purchase decisions. However, audits indicate that compliance rates are high for both labelling and testing compliance. The EU is reviewing the labelling programme to decide if revisions are necessary. It is possible that a label specific to solar water heaters may be introduced.

Examples of the European energy label for water heaters

Conventional water heater

Solar water heater

Heat pump water heater



The United States

The United States (US) requires different water heating technologies to meet different minimum efficiencies, known as Uniform Energy Factors (UEF), in order to be sold.

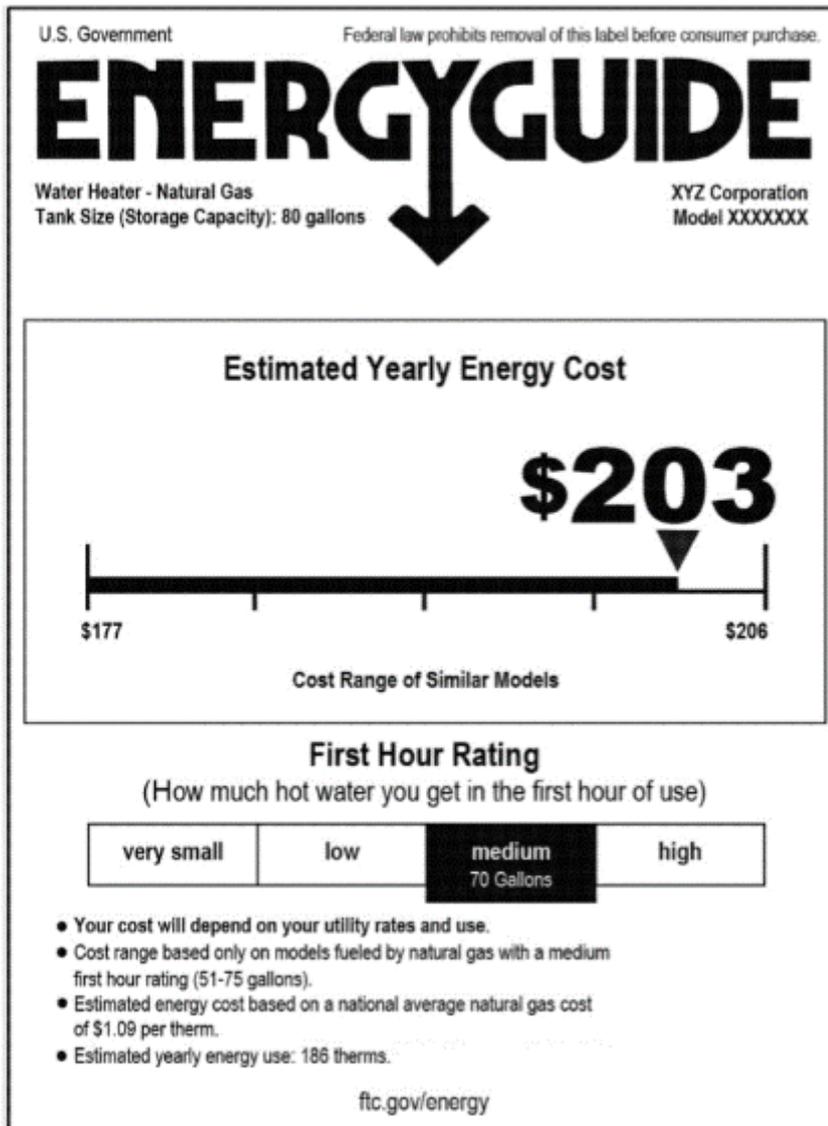
The Energy Guide label shows consumers the estimated yearly operating cost of a water heater based on the national average cost of energy and the product's UEF.

The UEF can be based on one of four loads, which were introduced in 2015 to replace a single large load that had only six draw-offs (i.e. separate usages).

There are some concerns from the industry that these 2015 requirements are too high, resulting in additional costs for consumers. In particular, larger electric storage water heaters need to utilise some heat pump heating to displace some of the energy used in a resistance element, in order to meet the minimum UEF. This has led to some unforeseen outcomes, such as multiple small, lower efficiency water heaters being installed rather than a single high efficiency unit.

The Energy Star endorsement label also makes use of the UEF values to designate high efficiency levels for all water heating technologies, except for resistance electric water heaters. Suppliers whose products meet the level designated for their technology can opt to display the Energy Star mark on their products.

Example of the US Energy Guide label



Comparing the two approaches

There is no international consensus on whether it is more effective to use nominal primary energy consumption (like the EU) or energy costs (like the US) as the metric on comparative labels.

Primary energy was adopted as a comparator on the EU label to provide a method of comparison between electric and gas fuelled water heaters, because the combustion losses occur on different sides of the meter with these two fuels, at least where the electricity has been sourced from fossil fuels. This approach has some unresolved issues but is generally well received across the EU despite the diversity of primary electricity sources among its members.

Both the US and European approaches to energy labelling are different to those of Australia and New Zealand, so considerable analysis would be required before deciding to fully or partially replicate either approach locally. However, an approach that allows for comparisons across technologies is preferred.

The proposed way forward to address these issues

Work undertaken to date

This Policy Framework and the accompanying Five Year Roadmap have been informed by:

- meetings with Government officials in Australia and New Zealand;
- interviews with various stakeholders, including key participants in the water heating industry;
- review of the E3's water heating work programme to date;
- review of water heating policy initiatives overseas;
- review of new technical developments likely to have an impact on water heating systems; and analysis of policy options that will most effectively deliver on the objective to cost effectively raise the energy efficiency and lower the energy costs and greenhouse gas emissions of hot water systems in Australia and New Zealand.

Consultation commenced in 2017 to inform this Policy Framework and will be ongoing throughout the proposed five-year work programme. Consultation to date has focussed on reviewing assumptions around market size and trends, and seeking general feedback on existing MEPS and gas labelling of hot water systems, as well as international programmes.

It is important to note that the E3 program is a trans-Tasman program that addresses the energy performance or information disclosure requirements of all regulated equipment sold in Australia and New Zealand. In Australia, the National Construction Code applies a greenhouse benchmark to water heaters installed in new class 1 dwellings, with some state variations to these requirements, and individual state and territory governments may use other policy tools, such as plumbing installation standards and incentives to address state and territory specific issues. In New Zealand other government interventions such as, building codes may be considered. The testing and information disclosure requirements implemented through the E3 program can help to underpin other regulations and incentives, which may lead to efficiencies for industry and government.

The proposed Policy Framework will provide various opportunities for consultation, as well as opportunities for stakeholders to participate in the working groups being established (see "Proposed work programme" below).

Policy options and provisional costs and benefits

Policy options are outlined below along with a high-level indicative cost and benefit assessment. Costs and benefits have been forecast over ten years out to 2030 and are shown in Australian Dollars (AUD), with discount rates of 7% (Australia) and 5% (New Zealand) applied. Energy savings are shown in gigawatt hours (GWh) and reductions in greenhouse gas emissions are shown in mega-tonnes (Mt) and kilo-tonnes (kt) of carbon dioxide equivalent (CO₂-e).

The analysis of MEPS for solar and heat pump water heaters is drawn from an E3 Consultation RIS developed in 2015, which applied a twenty year assessment period. It is important to note that these figures need updating and are indicative only at this stage.

Adopting a technology-neutral test method and energy performance metric

This is a necessary prerequisite to developing information tools that enable comparisons between technologies, and minimum energy performance standards and energy labelling that are common to all technologies. Identification and development of a suitable test method will be a time consuming exercise that will rely on extensive stakeholder input and a coordinated work programme across the three standards committees responsible for water heating standards. The EU approach to energy performance measurement has potential to provide a basis for the Australian and New Zealand method to be developed, along with the work that has commenced to update energy measurement protocols for gas water heaters. Alignment or convergence of test methods and energy performance measurement can potentially benefit industry by reducing their compliance burden.

It will be necessary to review and update, if necessary, the parameters for household hot water usage (i.e. typical household load and draw-off profiles) that are used to test, model and calculate energy performance. This will require a review of the available evidence on household hot water usage and a decision on whether more research is required. Research of this nature would involve monitoring hot water use in a representative range of households (of varying sizes, locations, etc.). Actual field measurement may be required to find out how much hot water people actually use.

Costs and benefits

The costs and benefits of developing a technology neutral test method have not yet been assessed and will need to be explored in more detail.

Improving Information

Consumers will be able to make more informed purchase decisions if they are provided with comparative information on the energy use, annual energy costs and greenhouse gas emissions of water heaters. This could be achieved by testing to a common standard (see above) and registering water heaters to the E3 Program's online Energy Rating database. The data supplied can then be used with online tools such as search filters and calculators to enable consumers to make a fair comparison of water heater types/models for their location and household, and to generate energy ratings and labels to improve the information available to consumers.

To develop a common energy rating label, work would be required to identify the appropriate performance parameters, metrics and design. Decisions would need to be made on how much information to display on the label, whether or not it could include information specific to different climate zones, and whether to rate models in terms of their emissions, energy costs, or primary or secondary energy use. Design concepts would need to be tested with consumers. Given the different energy supply mixes across Australia and New Zealand, it may be that ratings would have to be based on a ratio of energy used (at this stage we need further investigation on whether this would be based on primary or secondary energy use, the work program will

seek to establish this) to hot water delivered, and that other comparisons could be made using an online tool that has the capacity to plug in different usage parameters.

Research to understand the benefits of smart technology and controls will need to be undertaken, and EEAT will make a decision on how to proceed based on evidence. If the benefits of smart technologies or control capability are deemed to be influential to reducing cost and greenhouse gas emissions then they could be included in the information captured, however, defining the parameters of smart controls and its benefits will need to also be undertaken by the work program.

Costs and benefits

Developing an online comparison tool and database would involve combined costs to Australia and New Zealand of approximately at \$180M (There may be some overlap between the costs attributed to online information and those attributed to the energy rating label) over a ten year period to 2030, and provide estimated \$320M in combined benefits (\$140M net benefit). The costs include testing and registration, but are mainly made up of the capital cost of more efficient water heaters, which are assumed to be bought.

Energy savings are estimated at 300 GWh (annual) and 1,300 GWh (cumulative) in Australia, and 42 GWh (annual) and 190 GWh (cumulative) in New Zealand by 2030. Cumulative emission reductions by 2030 have been estimated at 1.08 Mt of CO₂-e in Australia and 24 kt of CO₂-e in New Zealand in total. These figures are based on solar and heat pump water heaters replacing 12% of electric storage water heaters annually by 2025.

It is important to note that this replacement rate is based on an indicative estimate. Estimated costs are mainly attributed to increases in the capital cost of water heaters. These costs and benefits are indicative and as the work program commences there will be more clarity on figures.

This measure would enable the future development of MEPS and labelling initiatives, as well as assisting other government initiatives and building codes by creating a consistent registry of information that is subject to compliance assessment.

The costs of applying a common energy rating label to all water heaters have been estimated at \$580M (There may be some overlap between the costs attributed to online information and those attributed to the energy rating label) for Australia and New Zealand combined, over a ten-year period out to 2030. The benefits are estimated at \$835M (\$255 net benefit).

Energy savings by 2030 could amount to 780 GWh (annual) and 4,100 GWh (cumulative) in Australia, and 110 GWh (annual) and 500 GWh (cumulative) in New Zealand. Cumulative greenhouse gas emissions could be reduced by a total of 2.5 Mt CO₂-e in Australia and 65 kt CO₂-e in New Zealand over the period. These figures are based on solar and heat pump water heaters replacing 25% of electric storage water heaters annually by 2025. It is important to note that this replacement rate is based on an indicative estimate. Estimated costs are mainly attributed to increases in the capital cost of water heaters.

The costs and benefits of applying smart technology or control endorsement scheme, or label have not been assessed, further work on this will be required to confirm whether there is a strong case for an endorsement scheme or label to be developed by Government. This work will need initial scoping on benefits to consumers to provide an evidence base for its inclusion in the work program.

Extending and consolidating the coverage of MEPS

Extending MEPS to technologies that are not covered, including heat pump and solar water heaters, could capture additional cumulative energy savings and emission reductions at marginal extra cost. This could involve putting stand-alone MEPS in place for each of these technologies or developing a single, technology neutral MEPS to apply to all water heating technologies. However, the immediate priority is to extend MEPS coverage to those water heater types not currently covered, and then review the existing MEPS.

MEPS compliance could be established through registering products to the same Energy Rating database used for existing MEPS registrations. The data captured could be used in consumer information measures, such as online comparison tools and energy rating labels. As with information and labelling measures, MEPS development cannot begin until an appropriate method of test has been identified to establish the basis for a fair and consistent comparison between different water heater technologies.

Costs and benefits

Extending MEPS to heat pump and solar water heaters could result in up to 1800 GWh of additional energy savings and benefits valued at \$200M (\$110M net benefit) over twenty years, at a cost of up to \$90M. (This is sourced from the E3 Consultation RIS developed in 2013 to consult on proposed MEPS at that time and is based on setting MEPS at a level that would increase energy savings by 65% above business as usual.)

The cost and benefit of introducing a single MEPS for all water heaters is yet to be assessed and would depend on the metric and level applied.

Summary of provisional cost and benefits of the different policy options⁸

Measure	Cost (AUD)(\$M)	Benefit (AUD) (\$M)	Energy savings (GWh)	GHG savings (Mt/kt CO ₂ -e)
Test method development Standards development Domestic hot water use research	Not assessed			
Online comparison tool & database	\$180 M	\$320 M (net: \$140 M)	Australia: 1300 GWh New Zealand: 190 GWh	Australia: 1.08 Mt New Zealand: 24 kt
Energy rating label	\$580 M	\$835 M (net: \$255 M)	Australia: 4,100 GWh New Zealand: 500 GWh	Australia: 2.5 Mt New Zealand: 65 kt
Smart capability endorsement	Not assessed but would likely involve low costs to the government and participating industry members			
Solar water heaters MEPS Heat pump water heaters MEPS	\$90 M	\$200 M (net: \$110 M)	1800 GWh	Not assessed
Technology neutral MEPS	Not assessed: would depend on the metric and level applied			

Proposed work programme

A five-year work programme is proposed to develop and implement measures in close partnership and consultation with stakeholders. This will be spread across two work-streams and three phases of development, as set out below and in the accompanying Five Year Roadmap. This work will be undertaken

⁸Note that cost and benefits are provisional and there is overlap between the online comparison tool & database and the energy rating label with cost and benefits. Smart capability has not been defined, and this may be subject to change.

under the E3 program, under the guidance of EEAT. Final regulatory decisions will be made by COAG Energy Council.

Phase One

Phase One would proceed over 2018-19 and begin with the Hot Water Project Team establishing:

- A Hot Water Technical Working Group of technical experts that include government officials and sector representatives to advise on measurement standards and testing, and
- A Hot Water Stakeholder Reference Group that includes industry and consumer stakeholder groups, in the hot water sector to provide feedback to the Hot Water Project Team, as and when it is required on relevant information or documents.

The Hot Water Project Team will use the input from both the Technical Working Group and Hot Water Stakeholder Reference Group to develop measurement standards and testing, and policy options for EEAT to consider and approve.

The Hot Water Technical Working Group will make technical recommendations to the Hot Water Project Team, which will then be presented to EEAT for consideration and approval.

The Hot Water Technical Working Group, under the guidance of the Hot Water Project Team, will report to EEAT.

The Hot Water Technical Working Group during Phase One will be tasked with:

- Reviewing current data for the Hot Water Project Team on hot water usage in households, and identify whether, and what further research is needed to develop hot water usage profiles for use in a common measurement standard. The Hot Water Project Team will then presents any findings to EEAT for decisions;
- Reviewing the approach for developing common testing requirements to apply across hot water technologies, and identify whether, and what further research is needed to develop a common test method. This will include, reviewing test methods, and assessing their capability in providing a technology agnostic test methodology. The Hot Water Project Team will present these findings to EEAT for decisions.

Detailed research will be required into options for testing that cover conventional and renewable fuelled water heaters, including potential new types of water heater (e.g. solar (PV) electric water heaters). The initial focus will be on the existing commercially available water heater types.

This may take into account existing methods and new options. Test methods need to be capable of check testing to ensure that compliance in the market can be verified. This may include cover tank heat losses; demand algorithms; and heat pumps, collector or performance characteristics.

It may also be important to note the installation and programming of Smart/PV connected products when developing test methods.

A further requirement will be to develop a method to evaluate the annual performance of the water heater in different climates and usage patterns. This could be done by simulating the performance of the system over a representative year, along the lines set out in *AS/NZS4234*. Sufficient expertise will be needed to audit the simulation and verify the results.

Phase One will see the Hot Water Project Team being responsible for developing an approach to testing all hot water systems through a technology agonistic test method, and exploring the policy options in greater detail. It will also provide advice and information to EEAT for evidence based decision making and formal approval.

In Phase One the Hot Water Project Team will be tasked with:

- Coordinating and providing guidance to the Hot Water Technical Working Group,
- Coordinating and providing guidance to the Stakeholder Reference Group,
- Development and coordination of a five-year work plan for development and implementation of measurement standards, testing and policy options. There will be two work plans to represent the two work streams of test method and policy development,
- Research to inform the design of an online tool and registration system (e.g. consumer research) and labelling design and parameters (this will continue into Phase 2);
- Research to identify requirements for potential options, including testing and registration, labelling and information, and MEPS (this will continue into Phase 2),
- Research and development on an approach to testing (new test method that is technological agonistic, if possible), and
- Providing information to EEAT for decision making and approvals.

During Phase One there will also be a Hot Water Stakeholder Reference Group which will include industry and consumer stakeholders, and this group will be tasked with:

- Providing feedback to the Hot Water Project Team on any relevant information or documents that are shared, as and when it is required.

The Hot Water Project Team will manage the technical and policy work plans in Phase One. EEAT will direct, consider and approve the technical and policy work plans. EEAT will also have final decision on the Hot Water Project's work plans, its scope, budget and priorities, and issues relating to the standards process.

Phase One will culminate in public consultation on the planned approach for developing common testing requirements and policy options, along with any further research to be undertaken. This will inform decisions by government on how to proceed.

Phase Two

Phase Two is expected to proceed over 2019-21. Technical development during this phase would include:

- Developing and road testing the agreed test method,
- Drafting the technical requirements for standards,
- Developing and consulting on draft standards,
- Publishing final standards,
- The new test method will need to be approved by EEAT.

In Phase Two the Hot Water Project Team would manage the technical development. The Hot Water Technical Working Group and the relevant standards committees would input their expertise towards the development of test methods and measurement standards. EEAT will direct the Hot Water Project Team to manage the technical development work plan, along with considering and approving the new test method and measurement standards.

Policy development during Phase Two would also be managed by the Hot Water Project Team, which will include:

- Developing a comprehensive cost and benefit analysis of the proposed measures, and undertaking public consultation
- Obtaining final policy approval on proposed measures (i.e. a decision to proceed to implementation)
- Drafting and publishing the necessary regulatory requirements, in accordance with the regulation development processes in New Zealand and Australia, including for:
 - the registration of hot water systems,
 - provision of information about their performance and characteristics, and
 - energy performance and labelling requirements that must be met.

The Stakeholder Reference Group would input feedback to the Hot Water Project Team, as or when it is required. During Phase Two the Hot Water Stakeholder Reference Group will include industry and consumer stakeholders and will be tasked with:

- Providing feedback to the Hot Water Project Team on any relevant information or documents that are shared, as and when it is required.

In Phase Two EEAT will direct the Hot Water Project Team to manage the policy development work plan, along with considering and approving policy options. However, this work cannot commence until standards development (particularly the test method) is well underway, and cannot be completed until after the final standards have been published.

Phase Two will culminate in public consultation on proposed measures (i.e. a decision to proceed to implementation) this will inform decisions by government on how to proceed.

Phase Three

Phase Three is expected to begin in 2021 and cover implementation of the approved measures (MEPS and labelling). The commencement of this work may overlap with the conclusion of Phase Two. Implementation activities could include building the required online database and tools; helping industry gear up for new requirements; and educating consumers, retailers, landlords, and plumbing and building professionals about the new information tools and labels. The Hot Water Project Team will manage implementation as directed from EEAT.

EEAT will direct the Hot Water Project Team, along with considering and approving implementation where it is needed. However, new measures would be phased in, based on how long they take to implement and what

introductory timeframes and transitional arrangements are agreed with industry and consumers during consultation.