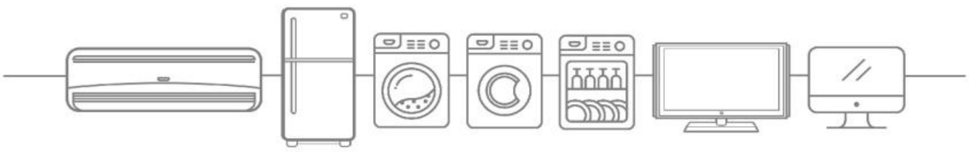
Regulation Impact Statement for Consultation: Energy Efficiency Policy Options for Heat Pump Water Heaters

October 2025



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

This document is available at the Energy Rating website.

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Executive Summary

This Consultation Regulation Impact Statement (CRIS) assesses regulatory policy options to improve the energy efficiency of heat pump water heaters (HPWH) installed in Australia and New Zealand and support their uptake. Options considered include voluntary or mandatory information provision or labelling and the provision of minimum performance benchmarks for HPWH in the form of minimum energy performance standards (MEPS).

Water heating accounts for about a quarter and a third of household energy use in Australia and New Zealand respectively, so small improvements in energy efficiency for water heating can lead to large energy savings. As heat pump water heaters (also known as hot water heat pumps) can offer substantial energy efficiency improvements over traditional (i.e. electric storage and gas) water heaters, increasing their uptake in the market (and installed performance) will improve the overall energy efficiency of water heating.

Improving the energy efficiency of water heaters is a key measure in current Australian and New Zealand legislation and strategies. This measure potentially can include initiatives to increase the uptake of more energy efficient water heaters through introducing minimum requirements for HPWH and can include ensuring consistent information on HPWH performance is available to consumers and installers. Information could be provided either voluntarily by suppliers or by introducing mandatory energy labels or information provision. The introduction of such options to improve energy efficiency is subject to a CRIS process.

Technology overview

Heat pumps can be designed to extract heat from a range of ambient heat sources including air, water or the earth. This CRIS deals only with 'air-source' HPWH for residential purposes such as washing and showering. Heat pumps used wholly for hydronic heating and cooling are not covered by this CRIS.

An air-source heat pump uses a refrigerant (fluid), such as CO_2 (R744), Propane (R290), R134a, R410a or R32, which is circulated around the heat pump unit to transfer heat to water in a cylinder.

A properly designed and installed HPWH should use, at a minimum, 60% less electricity in actual operation (CER, 2016) in most climates compared with a traditional electric resistance storage water heater (ESWH).

Water heater market

Historically ESWHs and gas water heaters have dominated the water heater market. This has been due to many factors including the convenience of these water heaters, their relatively low purchase and installation costs, and the relatively low cost of the energy they use.

HPWH sales currently represent 12% and 2% of hot water system sales in Australia and New Zealand respectively. HPWH's share of the installed stock in both countries has increased over recent years and this trend is expected to continue, particularly as households transition away from gas water heaters.

While there are no current MEPS or labelling requirements for HPWH, the market in certain states in Australia has been influenced by factors such as Small-scale Technology Certificates (STCs), State energy efficiency and incentive schemes, by restrictions on the installation of gas water heaters in some states and by the National Construction Code/state regulations on energy performance requirements for homes.

Sales of HPWH in NSW and Victoria are substantially higher than in other states, territories and New Zealand primarily due to the existence of incentives and rebate schemes available in these two states.

Market failures and customer concerns

There is evidence of market failure in the HPWH market, stemming from split incentive issues. Split incentives arise from the high level of influence that building companies, plumbers, suppliers, landlords and property managers have on many water heater purchase decisions. These stakeholders, who do not pay the energy bill, may be motivated by a cheaper purchase price and ease of installation rather than choosing a water heater with low running costs.

There is a range of other information issues concerning HPWH which affect consumer satisfaction and HPWH take-up. These issues include consumer confidence in claimed HPWH performance with regards to:

- Energy efficiency
- The volume of hot water delivered in a given time period
- How long it takes to reheat the water
- Noise.

Test methods

The implementation of any MEPS and/or information provision options would need to consider what testing method would be used to determine HPWH efficiency and the information that could be required to be conveyed to consumers.

There are several different test methods in use globally (EU and US regulation), and locally in Australia and New Zealand. Each of these has its own benefits and disadvantages. The CRIS presents several options for use of test method including both local and international options, and a new local test method currently being developed.

In parallel with the development of this CRIS, work has been carried out by technical experts working with industry representatives to review international testing approaches and develop an efficient and repeatable testing standard that is more applicable to Australian and New Zealand conditions.

This new AS/NZS test method (‘Appendix H of AS/NZS 5125.1: 2014 Amd 1, Performance Test Method for Heat Pump Water Heaters’) has been drafted by Standards Australia and completed its public comment period. The technical committee is now in the process of finalising the standard.

Policy options to improve uptake of efficient HPWH

This CRIS proposes 3 options[1], namely:

1. Business as Usual (BAU), i.e. no regulatory interventions
2. Develop a MEPS and voluntary information provision in 2026
3. Develop a MEPS and voluntary information provision in 2026 and mandatory information provision in 2028.

The MEPS will be set at the equivalent of the current minimum requirements for STCs in Australia (equivalent to 60% energy savings in Zone 3). HPWH offer a significant improvement in energy efficiency over traditional ESWH and GWH, and it is important that any intervention (including MEPS level) does not unnecessarily slow the uptake of HPWH. The level of the MEPS will be reviewed after 3 years.

Information to be provided could include:

- Reheat rate
- Hot water delivery
- Co-efficient of performance
- Noise
- Heating capacity.

For HPWH, all of these metrics may depend on air and water temperatures, and the standardised way in which they are measured will need to be defined.

A cost benefit analysis has been completed for policy Option 2 and Option 3. The cost benefit analysis compares these options with BAU (Option 1), and includes the following costs and benefits:

Benefits

- Energy saving for consumers/the economy due to improved efficiency of HPWH.
- Energy saving for consumers/the economy due to consumers using information to select and install HPWH instead of less efficient gas and electric water heaters.
- Value of reduced emissions occurring as a result of energy savings from the policy.
- In Australia, regulatory benefits to industry and government including any saved administrative resources, test costs and registration costs resulting from changed regulatory settings.

Costs

- Incremental capital cost of more energy efficient HPWH.
- Incremental capital costs for consumers/the economy due to consumers using information to select and install HPWH instead of less efficient gas and electric water heaters.
- Regulatory costs to industry and government including any additional administrative resources resulting from the new regulatory settings.

Table 1 shows a summary of the costs and benefits of the two MEPS/information/labelling options in comparison with business as usual, for Australia and New Zealand.

[1] Note that the proposed implementation timeline applies to Australia only, as regulatory updates in New Zealand follow a separate domestic process and the timeline might be beyond 2027.

The breakdown of the costs of the policy options (see Table 7 and Table 9) shows that over 90% of the cost of implementing the options is due to consumers selecting efficient HPWH instead of less efficient water heater technologies. So a large majority of the costs of implementing these policy options is being paid by the consumers who freely choose to pay more upfront in order to reduce long term costs.

Table 1: Summary of costs and benefits of Options 2 and 3 relative to BAU (Option 1)

Option 2 (MEPS and voluntary information)	**Australia (AUD)**	**New Zealand (NZD)**
Total Benefits (NPV, $M)	$611	$86.9
Total Costs (NPV, $M)	$216	$36.5
Net Benefits (NPV, $M)	**$395**	**$49.4**
Benefit Cost Ratio	**2.8**	**2.4**
Cumulative Electricity Energy Savings (GWh)	1,402	317
Cumulative Gas Energy Savings (PJ)	6	0.2
Cumulative GHG reduction (kt CO_2-e)	509	29
Option 3 (MEPS and mandatory information)	**Australia (AUD)**	**New Zealand (NZD)**
Total Benefits (NPV, $M)	$1,494	$361
Total Costs (NPV, $M)	$805	$159
Net Benefits (NPV, $M)	**$689**	**$202**
Benefit Cost Ratio	**1.9**	**2.3**
Cumulative Electricity Energy Savings (GWh)	2,391	1,051
Cumulative Gas Energy Savings (PJ)	20	0.7
Cumulative GHG reduction (kt CO_2-e)	1,503	96

Note: Financial impacts are evaluated with a discount rate of 7% for Australia and 2% for New Zealand, and modelled to 2060 (installed stock and cumulative savings to 2040)

Option 3 yields larger benefits than Option 2, although it comes with higher costs, meaning that the benefit cost ratio of Option 3 is not as high as for Option 2. However, the benefits are nearly double the costs for Australia, and slightly over double the costs for New Zealand.

Implementation of Options 2 or 3 would lead to reduced energy consumption for water heating, meaning lower energy bills for householders and reduced greenhouse gas emissions.

Recommendation

This CRIS recommends that Option 3, MEPS with mandatory information provision/labelling policy option, be implemented. This option will deliver the largest net economic benefits of the options examined, the largest energy and GHG savings, and will result in benefit cost ratios of 1.9 for Australia and 2.3 for New Zealand.

It is recommended that the policy option should be implemented as follows:

- Develop a MEPS to be set at the equivalent of the current minimum requirements for STCs in Australia (equivalent to 60% energy savings in Zone 3), and voluntary information provision, to be implemented in 2026, with a review of the MEPS level after 3 years
- Add mandatory information provision in 2028.

Have your say

The release of this Consultation Regulation Impact Statement (CRIS) marks the beginning of a public consultation period. Questions for stakeholders on page 48 lists specific questions to which stakeholders are invited to respond.[2] The responses will assist with the preparation of a final Decision RIS to be submitted to Ministers.

Submissions and enquiries can be directed to:

Australia: GEMSProductReview@dcceew.gov.au

New Zealand: star@eeca.govt.nz

Submissions on this document close on: 31 October 2025.

It is envisaged that information sessions will be held (by videoconference) in October. Please contact GEMSProductReview@dcceew.gov.au to register for the Australian information session and star@eeca.govt.nz to register for the New Zealand information session.

[2] This CRIS has been prepared in accordance with the *Regulatory Impact Analysis Guide for Ministers' Meetings and National Standard Setting Bodies, Sep 2024*.

1. Background

Australia and New Zealand are committed to improving energy efficiency and reducing consumer energy bills. They have separate energy efficiency strategies; the National Energy Performance Strategy (NEPS) in Australia and New Zealand's Energy Efficiency and Conservation Strategy (NZEECS). These strategies note the substantial reductions in energy use and greenhouse emissions that can be made by improving the efficiency of appliances, such as water heaters.

Australia's *Greenhouse and Energy Minimum Standards (GEMS) Act 2012* establishes a national framework for appliance and equipment energy efficiency, setting minimum efficiency standards and labelling requirements to reduce energy consumption. New Zealand has similar legislation which includes the Energy Efficiency and Conservation Act 2000, and Energy Efficiency (Energy Using Products) Regulations 2002.

MEPS and labelling requirements support the uptake of efficient products through removing products with poor efficiency from the market and providing consumers with energy performance information to make informed choices. The provision of verifiable and publicly available product performance information can also increase consumers' confidence in products and increase the uptake of efficient products.

Water heating accounts for about a quarter and a third of household energy use in Australia and New Zealand respectively (EnergyConsult, 2021), so small improvements in energy efficiency for water heating can lead to large energy savings. As heat pump water heaters (also known as hot water heat pumps), can offer substantial energy efficiency improvements over traditional water heaters (i.e. electric storage and gas water heaters), increasing their uptake in the market will improve the overall energy efficiency of water heating.

Improving the energy efficiency of water heaters is a key measure in the above Australian and New Zealand legislation and strategies. This can include initiatives to increase the uptake of more energy efficient water heaters through introducing minimum requirements for HPWH, and to ensure consistent information on HPWH performance is available to consumers. The introduction of such options to improve energy efficiency is subject to a consultation Regulation Impact Statement (CRIS) process. The Energy and Climate Change Ministerial Council agreed to work together to expedite the implementation of MEPS for heat pump hot water systems as a high priority, recognising the urgent need for objective performance standards for this rapidly growing technology (ECMC, 2024). Several governments in Australia are already actively driving uptake of heat pump water heaters via a combination of voluntary and mandatory policies.

This CRIS focuses on assessing options to improve energy efficiency information (e.g. by mandatory or voluntary information provision or labelling) and to provide minimum performance benchmarks for HPWH in the form of MEPS. The introduction of MEPS for HPWH is the first priority. The type of information required, such as a label and its design, and the requirement to provide information in online advertising, is still to be decided through further work.

1.1 Energy use in water heating

In both Australia and New Zealand, water heating is the second largest contributor to household energy use, after space heating.

There is a variety of water heater types or technologies, and they can be divided into the following broad groups shown in Table 2.

Table 2: Summary of water heating technology types

Technology type	Description	Typical energy efficiency
Electric Storage Water Heaters (ESWH)	Uses electricity and an electric resistive element to heat water and store it in a storage tank	90%
Gas instantaneous water heater (GIWH)	Uses gas (LPG, or natural gas) and a burner to heat water on demand	78%
Gas storage water heater (GSWH)	Uses gas (LPG, or natural gas) and a burner to heat water and store it in a storage tank	55%
Solar thermal water heater	There are several different technology combinations, but they can be broadly divided by the fuel source for boosting the water temperature as follows: • Solar-gas • Solar -electric	Solar-gas >140% Solar-electric >205% Efficiency is dependent on type and climate
Heat pump water heater (HPWH)	Uses electricity and a heat pump to transfer energy from the environment to heat water and store it in a storage tank	>205% Efficiency is dependent on type and climate

Sources All efficiency values are for Zone 3 climate zone and AS/NZS 4234, medium load. For solar and HPWH, the typical energy efficiencies correspond with the minimum 60% energy savings in zone 3 compared to a reference ESWH with an efficiency of 82%, and a reference GSWH with an efficiency of 55%. For ESWH, GIWH and GSWH, the efficiency is found from AS/NZS 4234 of modelling of typical products (SET, 2019).

Traditionally ESWHs and gas water heaters have dominated the water heater market. This has been due to many factors including the convenience of these water heaters, their relatively low purchase and installation costs, and the historically low cost of the energy they used. ESWH energy costs were also significantly reduced due to the availability of off-peak electricity tariffs. However, the cost advantage of these off-peak tariffs has decreased and off-peak tariffs are now only 30% to 40% lower than standard tariffs, which has increased the running costs for ESWH. In addition, ESWHs and gas water heaters were popular as for many years alternative water heaters such as solar water heaters or HPWH were not available, were expensive or considered unreliable.

The higher relative efficiency of HPWH and solar water heaters indicates that replacing gas water heaters or ESWHs with HPWH (or solar water heaters) will lead to a significant improvement in the average efficiency of water heating and, in most cases, a significantly lower annual water heating energy cost.

In Australia, about 39% of the energy used for water heating comes from electricity and around 61% comes from natural gas or LPG. In New Zealand, electricity supplies 76% of water heating energy and the remaining 24% is almost entirely from natural gas and LPG (RBS2.5, 2025).

Electricity is the most greenhouse intensive form of delivered energy in Australia where it accounts for about 68% of the emissions from water heating, despite being the minority energy source, while in New Zealand electricity is considerably less greenhouse intensive, as 84.5% (MBIE (NZ), 2024) of electricity is generated from renewable energy. In Australia, the rapid transformation of Australia's electricity generation means that nationally, greenhouse emissions from electricity will be close to zero by the mid-2030s (see Table 25).

Electricity powered water heaters can be divided into electric storage water heaters (ESWHs), which are the predominant form of electric water heater, electric instantaneous water heaters, electrically boosted solar water heaters and HPWH. Traditionally, ESWHs have been the 'go to' electric water heater but gradually HPWH are becoming more popular.

1.2 Heat pump water heaters

Electricity can be used to heat water in different ways, with different energy efficiencies and associated greenhouse gas emissions. The most common type, which is used in ESWHs, is the use of electric resistance technology. This involves the water being heated entirely by an immersed electric element and involves a relatively high consumption of electricity. In comparison, HPWH take a more efficient approach and instead use refrigeration technology to extract heat from an ambient source. The heat is then transferred to a tank of water which can be used to supply a household with hot water.

Heat pumps can be designed to extract heat from a range of ambient heat sources including air, water or the earth. This CRIS deals only with 'air-source' HPWH used for residential purposes such as washing and showering. Heat pumps used wholly for hydronic heating and cooling, or for pool heating, are not covered by this RIS.

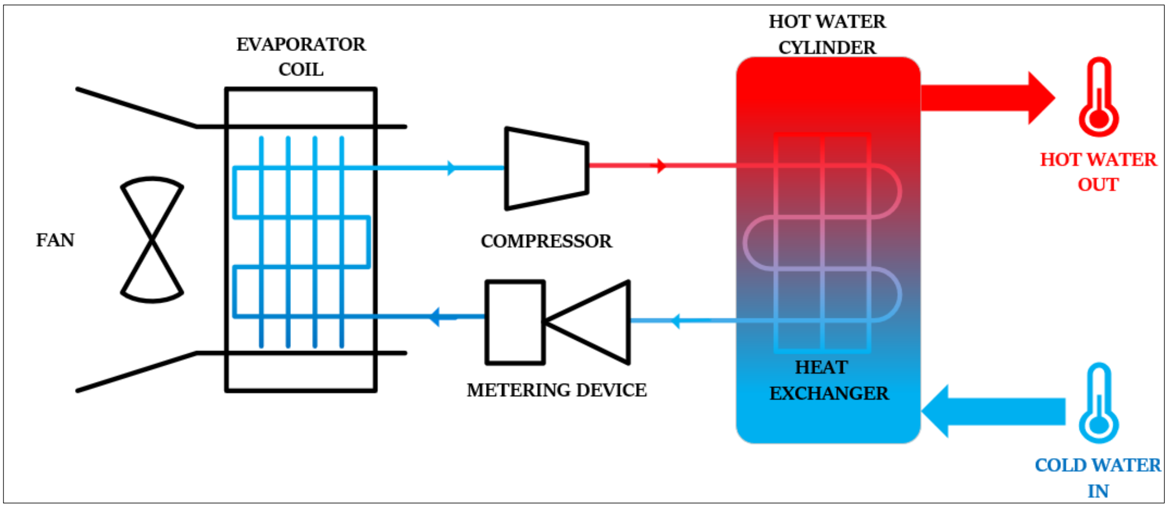
An air-source HPWH uses a refrigerant (fluid), such as CO_2 (R744), Propane (R290), R134a, R410a or R32, which is circulated around the cycle from the:

1) **evaporator**, where a fan is used to draw air across the heat exchanger (HX), transferring heat energy to the cold, low-pressure liquid refrigerant, enabling it to boil from a liquid to a gas, absorbing heat from the surroundings; to the
2) **compressor**, where the gas is compressed to raise the pressure and (as a side effect) raise the temperature; to the

3) **condenser**, where heat is transferred from the hot gas to the water via a heat exchanger (and optionally using a pump to circulate the water), and the refrigerant gas condenses to a liquid; to the
4) **expansion valve**, which controls the amount of refrigerant released into the evaporator and reduces its pressure.

A schematic diagram of the process used by a HPWH is shown in Figure 1. The efficiency, thermal capacity (output) and input power of a heat pump may vary significantly depending on both the ambient air and water temperature across the condenser, both of which will vary throughout the day and seasons. The wide range of temperatures can result in the capacity and efficiency (or Coefficient of Performance, COP) varying by factors of 3 to 6 across the operating range of the product, as described in more detailed in Appendix E – Detailed Information on HPWH Technology. This will result in significant differences in thermal performance, average efficiency and operating costs depending on climate and how the product is used. This makes it difficult to compare products if they are not tested under exactly the same conditions.

Figure 1: Schematic diagram of an air-to-water heat pump



Source (EECA, 2025c)

Types of heat pump water heaters

There are different types of HPWH available, and different systems may be more suited to certain homes and circumstances.

Most systems fall into one of four types, as follows (EECA, 2025c):

- **All-in-one HPWH**: where the entire HPWH is contained in one housing. Within the housing the condenser may be **integral**[3] to the cylinder (i.e. no circulation of water is required), or **stand-alone**

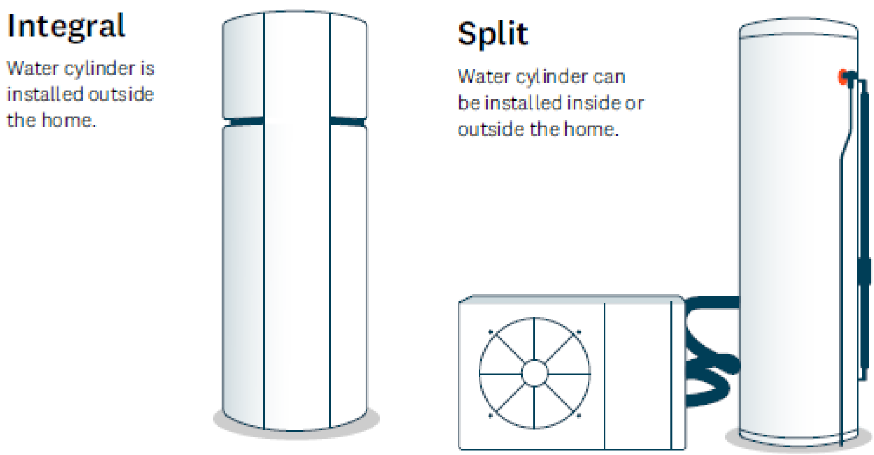
[3] AS/NZS 5125.1 defines HPWH to be "**Integral**" if the condenser is an integral part of the tank or mounted inside the tank, and heat is delivered to the water in the tank by free convection over the tank wall or condenser tubing inside the tank; and "**Stand-alone**" if the water flows through the condenser. There are multiple ways in which a condenser can be integral with the storage tank, including wrap-around coil, wrap-around microchannel, or coil-in-tank heat exchangers. More examples are provided in Appendix E – Detailed Information on HPWH Technology.

(requiring a circulating pump to move water from inside the cylinder to the condenser (heat-exchanger) and back). These systems may also be referred to as 'integrated' or 'monoblock' systems.

- **Split – refrigerant loop HPWH:** Where the refrigerant is circulated between the outdoor unit (containing the compressor and evaporator) and the condenser which is integrated to the cylinder.
- **Split – water loop HPWH**: where water is circulated between the outdoor unit (containing the compressor and evaporator) and the cylinder.
- **Split – refrigerant and water loop HPWH**: Where the refrigerant is circulated between the outdoor unit (containing the compressor and evaporator) and the condenser (which is separated to the cylinder). Heat energy is then transfer from the condenser to the cylinder using a water loop.

All-in-one (or integral) products are typically a tall cylinder, requiring less footprint to install and can be faster and cheaper to install than split-systems. An illustration of an all-in-one system (on the left) and a split systems (on the right) is shown in Figure 2.

Figure 2: Illustration of a typical integral (also known as an all-in-one-system) and a split system



Source (EECA, 2025b)

The advantages of split systems are that they, in some cases, enable heat pumps to be added to existing, installed water tanks which reduces costs, and also, they enable the heat pump (or part of the heat pump) to be placed outside the house while the water tank is installed inside.

In New Zealand ESWHs are typically located inside the house, which has led to a higher proportion of split models of HPWH installed, when compared to the Australian market.

Heat pumps have a key energy efficiency advantage over electric resistance technology in that they are capable of supplying the same amount of hot water while using 60% to 82% less electricity[4] compared with ESWHs. This percentage energy saving varies depending on the climate zone, hot water draw-off profile, type of refrigerant and the use of advanced technology such as smart controls. Even a relatively low energy

[4] Range of % energy savings for Zone 3 – NSW ESS products registered – March 2025

efficiency HPWH model will achieve significant energy savings over an ESWH in most circumstances. However, HPWH technology is still evolving, and the actual energy efficiency varies widely from model to model. Appendix E – Detailed Information on HPWH Technology gives additional information about HPWH technology.

HPWH have the following advantages over ESWH technology:

- They transfer more heat energy to the water than the electrical energy they use, leading to lower electricity use and costs. A properly designed and installed HPWH should use, at a minimum, 60% less electricity in actual operation (CER, 2016) in most climates compared with an ESWH.
- This higher efficiency of HPWH creates an ongoing electricity demand reduction, which may contribute to reduced demand pressures where electricity systems are constrained.
- In Australia, where ESWHs are typically installed outside, a HPWH can often be located in the same position, using the same electricity source as an external ESWH, so replacing an ESWH with a HPWH is relatively simple. Care needs to be taken with air flow near the HPWH and considerations of the noise generated by the HPWH.

Their disadvantages include:

- Their installed capital costs are nearly three times that of ESWHs (Oxford Economics, 2024), but vary based on many factors;
- Their operation involves noise, since the heating process depends on the operation of moving parts (electric motors, compressors and fans). Some models are alleged to create excessive noise which may annoy owners or their neighbours.
- They are more complicated than ESWHs which can lead to issues with durability and reliability. This may also increase the difficulty of obtaining skilled labour and parts to maintain them including more frequent maintenance or even professional servicing.
- Their performance is strongly influenced by climate. In colder ambient air temperatures, some models have significantly lower energy efficiency and slower rates of water heating, and they may need to operate defrost cycles which reduce efficiency. Some HPWH have been designed to operate in colder temperatures.
- Some models require a continuous connection to an electricity supply in order to defrost and protect system components in low air temperature conditions, or to allow for longer heating times if they have a relatively low thermal capacity. Such models may not be able to make use of off-peak tariffs. However, many models are now supplied with in-built timers enabling heating times to be restricted to fixed hours of the day in order to align with PV generation or cheaper off-peak tariffs, which significantly lower their operating costs for the consumer.
- The evaporator component of the heat pump needs to be installed outside or in a very well-ventilated space. In New Zealand the majority of ESWHs are located inside the home, so replacing these with HPWH may involve additional plumbing costs or use of 'split system' HPWH which also can be more expensive.

1.3 Water heater market

There are approximately 11.5 million residential water heater systems installed in Australia (RBS2.5, 2025) and approximately 2 million residential water heater systems installed in New Zealand. These are principally installed in houses and apartments, plus in addition a minority of apartments are served by central water heating systems. There are also a smaller number of residential water heaters installed in business premises to provide hot water for customers and staff.

The number of water heaters sold each year depends on the rate of dwelling construction and the rate of failure and retirement of old water heaters. Rheem Australia (Rheem Australia Pty Ltd, 2023) estimated that the total Australian market in 2023 was about 750,000 units, of which 75%-80% were replacements of a previous water heater. It is estimated that approximately 135,000 units are currently sold annually in New Zealand (RBS2.5, 2025).

The breakdown of installed water heaters by type is presented in Table 3 for Australia and Table 4 for New Zealand. Based on the updated Residential Baseline Study data (RBS2.5, 2025), this shows the much greater reliance on gas water heaters in Australia compared to New Zealand and the currently small market share of HPWH.

Table 3: Estimated breakdown of installed Water Heaters in Australia in 2015 and 2025

Hot water heaters	**2015**	**2025**
Electric Water Heater	46%	40%
Mains Gas Instant	21%	26%
Mains Gas Storage	19%	16%
LPG	5%	6%
(All Gas)	44%	*47%*
Heat Pump	2%	6%
Solar electric	7%	4%
Solar gas	2%	3%
Wood[5]	0.5%	0%

Note: Individual values are rounded and may not equal 100%

Table 4: Estimated breakdown of installed Water Heaters in New Zealand in 2015 and 2025

Hot water heaters	**2015**	**2025**
Electric Water Heater	67%	65%
Mains Gas Instant	11%	16%
Mains Gas Storage	2%	1%
LPG	6%	7%
(All Gas)	19%	24%
Heat Pump	0%	1%
Solar electric	2%	2%
Solar gas	0%	0%
Wood	11%	8%

[5] Wood water heaters are electric water heaters boosted by a "wetback" heat exchanger in a combustion space heater.

These results suggest that in Australia the installed market share of electric water heaters had been slowly declining while the share of gas water heaters has been increasing, mainly due to the installation of instantaneous gas water heaters. The installed market share of electric solar water heaters has been declining while the share of solar gas and heat pump water heaters has been slowly increasing. The increase in HPWH has occurred particularly in Victoria and New South Wales. This increase has been encouraged by higher energy prices along with significant incentives being provided by the Clean Energy Regulator and the Victorian and New South Wales state government energy efficiency schemes. The Victorian government has announced in June 2025, that gas instantaneous water heaters in an existing private dwelling will have to be replaced by an electric water heater at end of life from March 2027. More details on these schemes are provided in Appendix C – Summary of Government Incentive Schemes and Regulations related to HPWH.

In New Zealand, it appears the installed market share of electric water heaters has been slowly declining, while the share of gas water heaters is increasing, mainly due to the uptake of instantaneous gas water heaters. However, this trend towards GWHs is not expected to continue. Sales data collected by Energy Efficiency and Conservation Authority (EECA) under the Energy Efficiency (Energy Using Products) Regulations 2002 (EECA, 2025d), shows from 2020 the sales of GWHs have declined year on year from a peak of 56,020 to only 39,639 sold in 2023. At the same time ESWH sales have increased. There are many reasons for the decline in GWH sales but include cost increases for gas (including line fees). The share of HPWH and solar electric water heaters has slightly increased but remains small, due to their large upfront cost, and emerging market.

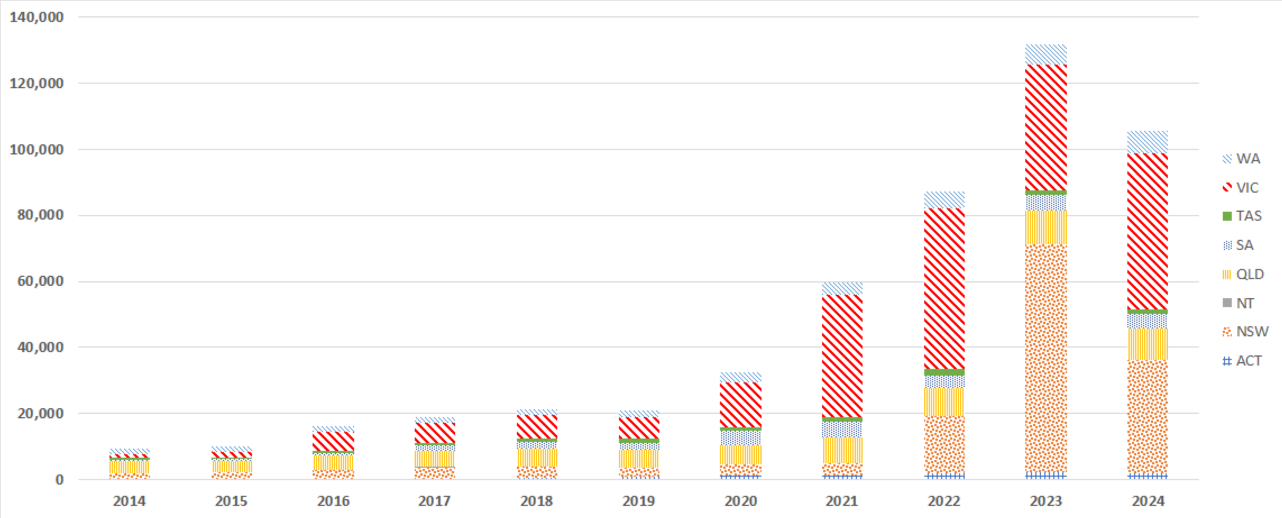
1.4 Government interventions affecting the HPWH market

The HPWH markets in Australia and New Zealand are very different, with a much stronger uptake of HPWH in Australia. This has a direct correlation to the current and historical government incentives that have been offered in Australia to reduce the upfront cost of HPWH. These interventions are discussed further in the following sections and include:

- financial drivers such as rebates and incentives via Small-scale Technology Certificates (STCs) and State energy efficiency schemes and solar rebate schemes.
- restrictions on the installation in new homes of greenhouse gas-intensive water heaters introduced in some States.
- the National Construction Code (NCC) and related state regulations which have minimum overall energy performance requirements for homes, which in turn encourage the use of more efficient water heaters such as HPWH.

These measures aimed to increase the market share of more efficient water heaters, including HPWH. The measures at times appear to have been quite effective in Australia and continue to influence the HPWH market. There was a rapid increase in the sale of HPWH in 2009, when HPWH represented about 10% of Australian water heater sales. After this period incentives were reduced and by 2011 sales had dropped back to less than 3%, but in the last few years sales of HPWH have grown again to around 15% in 2023 (12% in 2025). Figure 3 shows the number of air source HPWH that have been registered for STCs by the Clean Energy Regulator in Australia. These STC registrations provide a source of data to estimate the sales/installations by Australian State/territory, however not all installations (mostly commercial) are eligible to apply for STCs, and hence this data will underrepresent the total number of HPWH installations.

Figure 3: Annual Australian HPWH installations by State, 2014 – 2024 (CER, 2025a)



Australian incentive programs

The main Australian incentive program affecting HPWH is currently the Small-scale Renewable Energy Scheme (SRES). The Small-scale Technology Certificates (STCs) incentives are a product of the SRES and currently reduce the retail capital cost of HPWH by around an average of $665. However, the scheme is designed so the number of STCs produced per HPWH installation declines each year from 2020 to 2030 and STCs will no longer be created after 2030 (CER, 2025b). It is estimated that HPWH suppliers will disengage from the STC scheme after 2028, as the regulatory costs will start to outweigh the financial benefits from creating STCs.

The presence of the STC incentives for HPWH has effectively created an efficiency floor for HPWH in the Australian market, where HPWH products were required to produce a minimum energy saving of 60% in climate Zone 3. The STC incentives also initially created a motivation to provide higher efficiency products throughout the national HPWH market but as the number of STCs created per HPWH installation declines, the incentive from STCs to supply higher efficiency HPWH has decreased. (Incentives to provide higher efficiency HPWH remain in those Australian States with energy efficiency schemes or other relevant incentive programs).

The STC incentives have not regulated the HPWH market, and have not imposed a MEPS, but they have effectively required suppliers to meet a minimum performance requirement for financial reasons. As the allocation of STCs per HPWH installation declines each year, their ability to incentivise the market to maintain a minimum 60% efficiency floor in the market will decrease over time and the STCs' role in creating a de-facto MEPS will decrease. The cost to consumers of HPWH will rise as the STC incentive decreases and this is likely to drive suppliers to seek and supply lower-cost HPWH, even if these are less energy efficient.

In addition, these changes to the STC allocations mean the information publicly available on the relative efficiency of HPWH, given by their STCs, will also decrease and probably disappear post 2028. Though the number of STCs produced by a product will generally have been rarely understood and of limited use to consumers, even this information is disappearing. This means that potentially no verified information will be publicly available (Australia wide) on product efficiency for consumers to use to compare HPWH.

Australian State energy efficiency schemes and hot water rebate schemes are another source of incentives to install HPWH as replacement water heaters. For example, Victoria offers a Solar Victoria hot water rebate of up to $1400 for the replacement of an existing water heater with a HPWH, plus an additional $900 (assumes 10 VEECs at $90 per VEEC) under the Victorian Energy Upgrade scheme. The $1000 Solar Victoria rebate was increased by an additional $400 for locally manufactured HPWH from 1 July 2025. The NSW Energy Saving Scheme also offers incentives ranging from $190 to $670 when an inefficient existing water heater is replaced by a HPWH.

These State incentives can significantly reduce HPWH costs to consumers and they have encouraged HPWH suppliers to supply higher efficiency products to the Australian market, as higher efficiency products receive higher incentives, which makes it easier to sell the products. With the decrease in the STC allocation for HPWH, the State schemes will have an increasing role as drivers of the HPWH market.

The State energy efficiency schemes have their own energy efficiency measurement/modelling and registration requirements for HPWH models that want to gain incentives under the schemes. The version of the testing standard AS/NZS 4234 which the States have used has changed over time, and not always consistently between States, while the standard used for STC calculations has not been varied. This means multiple different modelling/measurement and registration processes need to be met by suppliers in order to meet the compliance needs of the different schemes, which increases the regulatory burden for suppliers. Introducing a MEPS with a measurement approach that could be used by the incentive schemes could potentially lower the regulatory burden and costs to HPWH suppliers and government schemes in the long term. There may be a short term increased testing and administration cost for suppliers.

Australian regulatory influences

There are both state and national regulations which influence the installation of HPWH.

The National Construction Code (NCC) 2022 requirements for new homes and major renovations to be energy efficient and meet ‘7 star’ requirements except in Northern Territory, encourages the installation of high efficiency water heaters. As HPWH are high efficiency water heaters, the NCC is increasing pressure on the market to adopt HPWH. Under the NCC whole of home (WoH) energy requirements, new homes are required to be assessed for the energy efficiency of fixed appliances and systems within the dwelling. This includes heating and cooling equipment, hot water systems, lighting, and pool and spa pumps. Effectively, this requirement means that a solar or heat pump heated water system are likely to be required if rooftop solar PV is not used (ABCB, 2024).

The NCC has two ways of assessing whether new homes will meet energy performance requirements, and the method that uses NatHERS to rate homes involves entering the number of STCs that a HPWH would receive under the SRES. This means that as the number of STCs being allocated per HPWH installation declines and suppliers no longer participate in the scheme, then in the near future NatHERS will no longer have the HPWH performance data it requires to rate home energy efficiency. This may mean NatHERS in the future will need to rely on default values to assess HPWH, reducing its accuracy, and reducing the incentive for developers, builders and homeowners to install higher efficiency HPWH.

Australia does not have mandatory MEPS or energy efficiency labelling for HPWH, though it has regulated ESWHs since 1999 via a MEPS which is based on a maximum allowable standing heat loss. While HPWH use electricity (like an ESWH) they are currently excluded from meeting the ESWH MEPS requirements.

Section 5(3)(a) of the *Greenhouse and Energy Minimum Standards (Electric Water Heaters) Determination 2012* excludes HPWH, provided that less than 50% of the energy supplied in a typical year is provided using an electric resistance element, when evaluated in accordance with AS/NZS 4234:2008 in Zone 3 with a medium load size. All residential HPWH sold appear to meet this requirement. The data available indicates that all HPWH sold would be excluded from the Electric Water Heater Determination under this Clause.

There are also State-based regulations that limit the type of water heater that can be installed in new homes. Since January 2024 Victoria has required that an electric powered water heater, which includes HPWH, be installed in any new dwellings requiring a planning permit (i.e. to be built). These regulations will take time to affect new buildings as there is a significant time between planning permit approval and the building completion.

Victoria consulted on regulatory policy options that require existing homeowners with natural gas using products (including water heaters) to be replaced by electric products. The Victorian government published a Regulatory Impact Statement in December 2024 that investigates options to progressively electrify all new residential and many new commercial buildings, along with the requirement for existing gas appliances in homes and relevant commercial buildings be replaced with efficient electric appliances at end-of-life (Department of Transport and Planning, 2024). A final decision on these policy options was announced in June 2025 (Victorian Government, 2025). The decision impacts hot water installations as follows:

- From January 2027, all new residential (class 1) buildings will have to be all electric.
- From March 2027, all water heating in rental properties will need to be replaced by a HPWH with a specified minimum efficiency at end-of-life (some exemptions apply).
- From March 2027, all gas instantaneous water heaters in private dwellings will need to be replaced with an electric water heater at end-of-life (some exemptions apply).

In the ACT, new gas network connections are prevented in most areas (from December 2023) and all new buildings captured under the regulation should be designed and built all-electric. In combination with the NCC requirements, this will encourage the uptake of HPWH. Other states and territories will be influenced by the NCC energy performance requirements.

New Zealand incentive programs and regulations

New Zealand has regulated ESWHs since 2002 with a MEPS for ESWHs which is based on a maximum allowable standing heat loss. The New Zealand MEPS has more stringent requirements than Australia. The MEPS for ESWHs has been effective in removing poor performing products from the market.

New Zealand does not have mandatory MEPS or energy efficiency labelling for HPWH as, while HPWH use electricity (like an ESWH), they are currently excluded from meeting the ESWH MEPS requirements, similar as above for Australia.

In August 2020 the New Zealand Building Code was amended, which included the ability for water heaters to be relocated (including from inside to outside) without the need for a building consent. The relocation and new system must still meet the requirements of the building code (MBIE (NZ), 2020). The purpose of this amendment was to reduce cost and time but also enables easier installation of all-in-one HPWH, which often require relocation in New Zealand because they need to be installed outside.

EECA recently published a report on the heat pump water heater market (EECA, 2025b) to provide market understanding. EECA is also working with industry to create a good practice installation guide, similar to EECA's good practice guide for space heating heat pumps (EECA, 2025c).

The New Zealand Government briefly offered a scheme to promote the uptake of HPWH through rebates, which was administered by EECA. The scheme ran as a pilot offering a $1,000 grant in 2009, and from February 2011 to June 2012 offered $575 towards qualifying installations that met certain minimum criteria including testing to the relevant AS/NZS standards.

1.5 Consumer Barriers and Resistance to HPWH Uptake

It is worth considering the factors that may may be creating barriers or resistance to their uptake. Assessing influences on consumer behaviour including preferences, available options and the process that consumers follow when selecting a product may help to explain this.

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 leading considerations in choosing a water heater (Oxford Economics, 2024), for Australian consumers are in descending order of importance are:

- Energy efficiency/cost of running
- Durability/lifespan
- Delivery/installation

For the around 20% of consumers who chose to replace their water heaters with a water heater with a different energy source, the key reasons (Oxford Economics, 2024) given for the change are a desire to:

- Reduce energy bills (39%),
- Seek a more efficient system (34%)
- Cheaper running costs (31%)
- Environmentally friendly (24%).

These market insights suggest that consumers are seeking water heaters that are energy efficient, have lower running costs and are environmentally friendly, all drivers which should encourage the purchase of HPWH and solar water heaters. Despite these being common motivations, the majority of consumers do not install HPWH or other solar water heaters. Further examination of the market research (Oxford Economics, 2024) on the reasons Australian consumers changed their water heater type, and the price they paid suggests that barriers to HPWH take-up include:

- Installed Cost: The majority of consumers reported paying $1000-$2000 for electric or gas waters heaters, while HPWH were generally $2,000 to $4,000 or more. Most consumers do not regard HPWH as cheap, as shown by the 30% of consumers who reported that the reason they converted to GSWHs was they were cheaper, as did 19% of ESWH purchasers, but only 10% of HPWH mentioned them being cheaper. These perceptions and the higher price of HPWH suggest this is a barrier to their take-up.
- Inadequate and limited information on HPWH: The research on the reasons why consumers changed water heaters showed consumers were not well informed about the relative efficiency or environmental impacts of water heaters. A similar proportion of consumers who installed gas

instantaneous water heaters gave the reasons that they were more efficient and had cheaper running costs as did those who installed HPWH, despite HPWH being much more efficient. Likewise, a similar proportion of consumers installed ESWHs due to their 'environmentally friendly' characteristics as did those installing HPWH, again despite the HPWH using a fraction of the electricity. The current lack of publicly available and verified information on the relative energy efficiency, cost efficiency and greenhouse impacts of different types of water heaters may be one of the reasons why more consumers are not choosing HPWH.

- Another significant impact on the purchasing of water heaters comes from the dynamics of the water heater purchasing process, discussed below.

EECA recently surveyed importers/manufacturers as part of its research into the New Zealand HPWH market and asked what they thought the barriers were to greater installation of HPWH (EECA, 2025b). Barriers identified included:

- capital costs,
- consumer awareness,
- installer awareness and training.

Consumer choice process

The process and influences that drive consumer behaviour, referred to in this document as the 'consumer choice process', are key to understanding the current market and measures that may positively alter consumer behaviour.

Water heaters are purchased in ways that are different to many household appliances as they are not regularly sold through retail stores but rather acquired through agents such as plumbers and builders. This complicates consumer behaviour and creates a unique consumer choice process that needs to be considered.

The key source of pre-purchase research for consumers is speaking with a plumber/supplier (27%), well ahead of online product reviews (14%) and online company/brand sites (11%) (Oxford Economics, 2024).

Plumbers and hot water specialists account for 62% of new installations, which is a peak level from Oxford Economics' surveys. Plumbers have the strongest impact on choice of hot water system installed and hot water specialists dominate across all segments of the market.

There is a split incentive issue that arises due to the plumbers and hot water specialists' involvement in the water heater purchase, as they are not directly motivated to reduce the water heater running costs, which are borne by the occupier of the residence where the water heater is installed. Yet these parties have a strong influence on most water heater purchases and in many cases will be motivated to favour a particular brand or type of water heater, rather than the most energy and cost-efficient heater. Their priority may be for ease of installation, maintenance, durability and few customer complaints and call backs rather than energy efficiency.

There is also a second issue for HPWH, in that these stakeholders can have biases against HPWH. For example, a survey of 86 plumbers carried out by Oxford Economics in 2024 reveals lukewarm support for the concept of electrification, with a high 41% in the 'absolutely not' category and just 7% 'most definitely' favouring electrification. Despite this, 26% of plumbers indicated a 'strong observation' of customers moving away from gas towards heat pumps, solar and electric instantaneous forms of water heating, which suggests many plumbers' water heater options are not consistent with the desires of consumers.

In the late 2000s there were concerns about the poor reputation of HPWH, and about high rates of failure or recall. These problems appear to rarely affect current HPWH, but previous poor experiences with HPWH may be causing plumbers and water heater specialists to not recommend them to consumers. While there is no formal report on these issues, anecdotal comments include:

- Some early models were designed to follow the load profile and performed poorly in actual applications
- Some manufacturers were new to HPWH and suffered early failures, poor cold weather performance and reliability issues. There were then ongoing issues as it took time to fix the volume of failures they had, while also trying to improve their products
- Some products were not fit for purpose in commercial applications such as the dairy industry.

Current status of regulations and test methods

Currently there are no regulatory requirements for HPWH to meet MEPS requirements or to carry any energy efficiency labelling.

Australia has regulated ESWHs since 1999 via a MEPS which is based on a maximum allowable standing heat loss (New Zealand implemented similar but more stringent MEPS in 2002). While HPWH use electricity (like an ESWH) they are currently excluded from the ESWH regulation. HPWH can be expected to have an increasingly important role in household energy use because they use less energy than other water heating technologies and water heating is a large part of residential energy consumption. Consequently, reviewing the regulatory tools used for HPWH is considered to be both timely and worthwhile.

For the purposes of allocating STCs or energy efficiency incentives under the relevant State schemes, it has been necessary for suppliers to determine the energy efficiency of HPWH models. This has been done using AS/NZS 5125.1 and AS/NZS 4234, but the limitation of this approach is that these standards rely on numerical simulation of the unit's annual efficiency, based on lengthy component performance tests. There has been strong industry support to move away from simulation of a unit's energy efficiency and use a laboratory based testing method instead. Concerns have been raised by industry about the lack of transparency of these simulation methods, and the potential for products to be designed to gain the most incentives rather than for the consumers' benefit.

In Europe and the USA "24hr tapping cycle" tests, which draw-off hot water in typical usage pattern over 24 hours and measure the electricity consumed, are used to determine the efficiency of HPWH. These types of tests are also used in other markets and are in general a good way to determine the typical efficiency of HPWH. The US method uses an ambient air temperature of 20 °C and hot water outlet temperature of 52 °C, which makes it unsuitable for the climatic conditions experienced in Australia and New Zealand, which are much lower.

The Department of Climate Change, Energy, the Environment and Water (DCCEEW) and EECA have been working with industry representatives to develop an efficient and repeatable testing standard for HPWH that is appropriate for Australian and New Zealand conditions.

The information that can be produced by the new AS/NZS test method ('Appendix H of AS/NZS 5125.1: 2014 Amd 1, Performance Test Method for Heat Pump Water Heaters') includes:

- maximum hot water delivery volume;
- reheat times;
- measurement of energy consumption/efficiency; and
- the operational settings used to achieve the reported HPWH performance values.

Work is underway to compare the energy efficiency of HPWH on the market using the existing simulation and the different tapping cycle test methods including EU test method and Appendix H of AS/NZS 5125.1.

For most products it is expected that the daily cycle COP when tested at 9 °C is likely to be lower than the annual COP values currently obtained via simulation to AS/NZS 4234 (the annual average air temperature is higher than 9 °C). For HPWH with an annual energy saving of 60% in Zone 3 when compared to a reference ESWH with an efficiency of 82% (as defined in AS/NZS 4234), and corresponding annual COP of 2.05, the measured daily cycle COP is expected to be less than2. This is supported by preliminary test results undertaken by the Department.

There is further discussion on test methods later in the document, and several options presented, which consider accuracy of testing, repeatability, and burden on industry.

If the HPWH industry was required to test their products using one of the options presented this would result in more HPWH being correctly sized and specified to meet consumers' needs. More products would also be installed with operational settings which result in their claimed energy efficiency. If HPWH suppliers were required to publicly report the outcomes of this testing, such as via the GEMS registry, the impacts of implemented these testing requirements would be greatly enhanced.

1.6 HPWH and Demand Response and Demand Flexibility

Australia's and New Zealand's electricity systems are changing and becoming more dynamic. The changes include:

- More renewable generation being built (i.e. wind and solar),
- Increasing electrification of homes and businesses, including water heating,
- Uptake of distributed energy resources such as rooftop PV systems and, more recently, battery storage. The large increase in rooftop PV systems in Australia means there are sometimes very low levels of other energy generation required during the middle of the day. The electricity supply system is having to adapt to the potential stability issues caused by this change in energy use.

With these changes, demand-flexible end-use products are useful for maintaining energy security and reducing energy costs (EECA, 2025a).

HPWH are much more energy efficient than ESWH and typically use only 20% to 40% of the power draw of equivalent ESWHs (excluding the impact of a booster element), so generally their introduction will help reduce electricity peak demand and electrical energy use. HPWH tend to be run in the daytime to maximise their efficiency (when the air is warmer) and when they will have less noise impacts. This also means they can be heated from the excess energy from rooftop PV systems. This can have network benefits if an area has little energy network demand at certain times of the day because the HPWH can be heated when electricity is cheaper and would not otherwise be used. However, in some situations HPWH could contribute to peak load because they can have a longer reheat time than ESWH and this could be using electricity at times when there is high energy system demand. It will be useful for managing the energy system if HPWH are able to be demand flexible. This means they can contribute to a flexible electricity system and deliver benefits to consumers and the wider electricity system.

Electricity demand from water heating has been managed since the 1950s in both Australia and New Zealand using ripple control systems to turn off ESWH during times of peak demand for the benefit of the electricity system and by using 'off-peak' metering, timers and tariffs systems so ESWH only heat overnight when demand is lower. Ripple control is an example of demand response, which is a one-way communication from an external party to an end-use product, changing the end-use products response.

Ripple control or other methods of remotely controlling HPWH power supply may not be appropriate demand management methods for HPWH as some HPWH will not automatically restart after having their power interrupted and in some cases, it may damage the HPWH. The use of night heating and of over-night, off-peak tariffs is inefficient and ineffective for HPWH which operate more efficiently and effectively when the ambient temperature is higher, i.e. typically during the day.

An alternative approach to managing energy system demand is to use demand flexibility which involves two-way communication between an external party and end-use product with exchange of information and decision making. A demand flexibility approach for HPWH will deliver additional benefit for consumers and the electricity system over a demand response approach, and overcome the limitations explained above. A demand flexible approach can also enable optimisation of renewable energy.

Households which have solar PV systems can time their HPWH to operate during the day, when their solar power generation occurs using timer controls. Households on flexible electricity tariffs can also take advantage of lower electricity tariffs, but ambient air temperature and the time of the lower electricity tariffs must be considered.

While E3 encourages the development and uptake of demand flexibility (which future proofs and enables benefits for both the electricity system and consumer), due to the developing nature of demand flexibility and demand flexible hot water systems, mandatory requirements for demand flexibility for HPWH are not being considered as options in this CRIS. E3 will consider the demand flexibility of hot water systems through another process.

2. The problem

A range of market failures exist, including information asymmetry, i.e. a lack of information or poor-quality information available to consumers, plumbers and installers. Split incentives have been identified as affecting the water heater market and specifically the HPWH market in Australia and New Zealand. These market failures are representative of the type of issues which have previously been addressed by MEPS and energy labelling regulations in both the Australian and New Zealand appliance markets.

Market failures can result in sub-optimal purchasing decisions for the individual, which in the case of water heaters may reduce consumer satisfaction and increase consumer costs. Market failures also impact on the consumer market as a whole by reducing consumer utility and economic welfare. In these circumstances, government intervention in the market has the potential to improve the overall welfare of the community if the intervention is aimed at correcting or reducing the impact of market failure.

As the HPWH market appears to be subject to market failures that seem to influence consumer behaviour in a material way, as detailed below, there is a case to consider market intervention.

2.1 Market Failures

Information asymmetries

In an ideal market the consumer would have equal access to accurate information on HPWH and alternative water heaters as suppliers, including information such as energy efficiency, energy costs, capital costs, expected service life, the projected running costs and full life-cycle costs of models. The consumer would ideally be able to research and find this information on water heaters quickly and efficiently, and they would be able to compare water heaters based on this information. In reality, this information is either difficult for the consumer to obtain, is not available, or is in a form which makes comparisons between water heaters beyond the ability of many consumers. This lack of information on HPWH properties is also an issue for installers and plumbers.

For example, the only independent source of information on the energy consumption of different models of water heaters of any type is the Energy Rating Product Database[6], where people can find information on the annual energy consumption of models of gas water heaters. The Energy Rating Product Database though does not have information on the annual energy consumption of electric water heaters, including HPWH. Estimates of the electricity consumption for an 'average' ESWH and HPWH can be obtained online but not for specific water heater models.

It is possible to compare HPWH models based on the STC allocations, but this approach would only provide approximate information on annual energy consumption, and many consumers will not be in the position to use this information effectively. In addition, even this limited information is expected to no longer be available post 2028, due to the phase out of STCs by 2030. For NSW and Victorian consumers, they can

[6] Energy Rating - Search the Registration Database

access product registers of HPWH that have been registered for their ESS and VEU incentive programs. These product registries provide detailed information on the energy savings for each product, but the information would be difficult to interpret for most consumers. Some plumbers may have become familiar with the state schemes approved solar product lists, so some of the energy efficiency information could be available to consumers via these plumbers.

Given there are no incentive schemes in New Zealand, the data that is available to consumers is based on products offered in both Australia and New Zealand, and are registered under the STC, NSW, or VEU schemes. This data can be difficult to interpret and may have limited value to New Zealand consumers due to climate differences. Consumers also may not have access to any independent performance data on New Zealand only HPWH models.

This means annual energy consumption of HPWH models cannot be accurately compared, or compared to other types of water heaters, and so projected running costs or life cycle cost information are not available for consumers to make model comparisons.

The result is the only available information on HPWH performance is that provided by some suppliers, usually as part of their marketing materials and even this limited information cannot be verified by the consumer. The supplier's claimed efficiency of a HPWH can be based on testing/simulations using higher ambient temperatures than are relevant to many Australian and New Zealand climates, producing claimed efficiencies that exceed what most consumers will obtain. The major influencers of a water heater purchase are plumbers or specialist water heater suppliers, but as these stakeholders also do not have access to accurate performance information, even they cannot provide informed advice to consumers.

This lack of consumers' access to information, or inaccurate information on energy performance, and hence projected operating costs, creates a significant information asymmetry in the HPWH and broader water heater market, constituting a significant market failure. The current lack of accessible, comparative information is impeding consumers' ability to make well-informed decisions in their water heater purchases.

Split Incentives

In regard to the HPWH market, the split incentive issue concerns the fact that the home occupier is the end-user of their water heater, and in almost all cases pays for the energy the water heater uses, but in many cases other parties are influencing or making the decision over what water heating system will be installed. Such partes include plumbers, builders, water heating system suppliers, property developers, landlords, and property managers of rented properties.

The home occupier is financially motivated to have an efficient water heater with low running costs, but the other parties are more likely to be motivated to install the unit with the lowest upfront cost, the unit that requires the least time and effort on their part, or the unit which provides them the greatest financial gain.

The extent that such split incentives may influence the purchase of water heaters can be estimated by examining the breakdown of water heater sales and the housing market.

- Industry estimates are that approximately 20%-25% of Australian residential water heaters annual sales are installed in new buildings or in renovations (Rheem Australia Pty Ltd, 2023). In almost all the new builds and most renovations, it can be assumed that the builder or property developer will be deciding what water heater is installed. For example, 80% of detached homes built in Australia in 2020/21 were built by the top 100 largest builders (HIA, 2021) (i.e. project home builders) who generally offer limited options to home buyers regarding water heater choice. This suggests a split incentive between builders and home occupiers may influence around 20% of annual water heater installations.

- Nearly a third of Australian (31%) and New Zealand (33%) households rent their homes, which means these households will have almost no influence on their water heater selection, which may adversely affect the type and the efficiency of water heaters installed in rental properties. There is some evidence that this does occur as the proportion of all the more efficient water heaters in Australia (e.g. solar WHs and HPWH versus EWHS or gas water heaters) is higher in owner-occupied homes versus rented homes (Oxford Economics, 2024).
- Of the over 75% of water heater installations that are replacements, market research (Oxford Economics, 2024) suggests a quarter of these are emergency replacements and an additional half are replacing water heaters that have ceased to function correctly. In this situation, consumers will have little time to research water heater alternatives and plumbers, tradies and water heater suppliers will be in a prime position to influence the purchase. The market research supports this, as 23% (in 2024) of all purchasers did not do any research, while a further 37% spoke to plumbers, tradies, retailers or other suppliers. This suggests that most of the replacement installations may be influenced by the plumber/supplier and potentially affected by split incentive issues.

The market data suggests the vast majority of water heater purchases are influenced by one or more types of split incentives. As HPWH do not have the lowest capital cost compared to other types of water heaters, these split incentive issues will discourage the uptake of HPWH versus most other water heater types. Also, even when a purchaser has decided to select a HPWH, the split incentive issues do not encourage the purchase of the most efficient system with the lowest operating costs and total life-cost. These split incentives form barriers that apply in both the Australian and New Zealand markets.

The potential for split incentives to influence consumer behaviour is exacerbated by the information barriers surrounding a lack of reliable information on ongoing energy costs that consumers can easily access.

2.2 Other Consumer Satisfaction and Information Issues

There is a range of other information issues concerning HPWH which affect consumer satisfaction and HPWH take-up. These issues include:

- Consumer confidence in the energy performance claims for HPWH
- Consumer confidence in claimed HPWH performance with regards to:
  - water delivery volume
  - recovery rates
  - Operational settings effects
  - Noise.

These issues are discussed in more detail in the following sections.

The longevity and product quality of HPWH are also issues that significantly affect consumer satisfaction with a HPWH, but at present measures of these have not been developed and they are not currently addressed in this CRIS. It is expected that generally domestic HPWH should have an operating life similar to other water heaters, but this can depend on how well they are installed, water quality, operating environment, and how well and regularly they are serviced.

Other information issues affecting government agencies include:

- State energy efficiency schemes and their reliance on testing and simulations undertaken for STC registration
- Australia's NCC presently uses the STCs for HPWH models as part of the Whole of Home energy performance requirements

Lack of specific HPWH energy performance information

Lack of reliable and accurate information on the energy performance, hence energy costs, of specific models of HPWH not only undermines consumers' ability to choose between HPWH but also undermines their confidence in HPWH as a product category. Without publicly available and verified information on specific HPWH products, the consumer must rely on general information or opinions on the energy performance of HPWH, compared to other water heating options, to determine if they will install a HPWH. Such general information is less persuasive than detailed information on specific products. The lack of specific information means consumers cannot accurately determine the cost savings of HPWH versus other options and are more likely to be dissuaded from buying HPWH due to their higher upfront costs. This both reduces the take-up of HPWH and increases product life cycle costs to consumers.

In Australia, the impact of this lack of information on HPWH uptake is likely to increase if the phase-out of the STC scheme means cheaper, less efficient HPWH start to enter the market in the next few years.

Providing reliable and accurate HPWH water delivery information will increase consumers' ability to compare HPWH and their confidence in HPWH as a water heater type.

Lack of information on HPWH performance

Consumers need to be confident in the hot water delivery volume of any water heater they purchase, and this will be especially true for HPWH sales as many consumers will not have previously had experience of using HPWH. HPWH hot water delivery volume varies with set point temperature, so consumers need to know the 'typical' water delivery volume of the HPWH they are considering installing at a specific set point temperature, and air temperature.

Another aspect of HPWH performance that affects consumer satisfaction and confidence is hot water recovery rates. Too slow recovery rates may mean a HPWH cannot satisfy the varying water demands of the consumer, reducing consumer satisfaction with the HPWH. HPWH have been introduced to the market to address this issue, by having a 'boost' mode where water is heated by both an electric element and heat pump, but this approach reduces the overall efficiency of the HPWH. As HPWH recovery rates will vary with climate, ideally consumers and installers need to know what the recovery rates will be in specific climates. This will help ensure correct sizing, and consumer satisfaction.

Consumers and installers also need to know what operational settings were used when measuring the HPWH's performance characteristics (COP, water delivery and re-heat times, etc) as there are often multiple settings and possibly settings that might be favourable for some elements of performance (such as COP) but not favourable for others (such as hot water delivery).

For consumers to confidently determine the water delivery of a specific HPWH, they need access to publicly available and verified information on the HPWH performance. This means the HPWH performance data needs to be collected, verified and published by a third party independent of the HPWH suppliers or installers, such as a government agency like the GEMS Regulator or EECA.

HPWH performance is significantly affected by ambient temperatures, hence by the climate in which the HPWH is installed. Performance declines in colder climates and in the colder seasons, which affects the energy performance of HPWH and their overall effectiveness at heating water. Information on HPWH effectiveness and energy performance in colder temperatures will therefore be demanded by consumers in colder climates, such as southern New Zealand, Tasmania and colder areas in mainland Australia.

Operational Settings Effects

To further complicate the research task for consumers, many HPWH vary in the efficiency of the operation on the settings or mode in which they are operated. Operating setting changes can include:

- Booster controls: Some units have an 'eco mode' (the names will vary with products) which means the electric resistance booster element of the HPWH is not automatically used. Installers however may not set up the unit to use the non-booster mode or disable this mode to reduce the risk of the HPWH not supplying sufficient hot water, for example if a potentially too small HPWH is being installed or when ambient temperatures are low. Regular use of boosters can dramatically reduce the energy efficiency of a HPWH and increase its operating costs. (Note: By testing HPWH and providing consumers with information on the first hour delivery, re-heat rates, efficiency and operating modes of units the potentially over-reliance on booster element usage might be reduced.)
- Output water temperatures: Water temperature often can be varied in HPWH, and installers may increase the set point temperature to increase the amount of (delivered) hot water, again to reduce the risk of the HPWH not supplying sufficient hot water. Increasing set point temperature will reduce the energy efficiency of the HPWH, increase the tank heat loss and therefore increase its operating costs.
- Timer settings: If activated, timer setting could influence the energy efficiency, hot water delivery and operating costs of the unit by determining when the unit heats.

All of these changes in settings could significantly affect the energy performance of the HPWH and make their actual performance deviate from both the suppliers' claimed performance as well as deviating from the performance measures used to calculate STCs (the current default measure of energy performance in Australia). The result is the consumer may encounter greater uncertainly in attempting to estimate the likely energy performance of any HPWH they plan to install, or this may increase consumer dissatisfaction with HPWH installed as they do not save the amount of energy anticipated.

Greater clarification and consistency in the measurement of HPWH, making such measurement results available and providing information on the effects of common operational changes, will all help to reduce the potentially negative impact of operational setting changes on consumer satisfaction with HPWH. In Australia, the recent Heat Pump Hot Water System: Roadmap (Energy Efficiency Council, 2024) made recommendations that support the provision of standardised consumer information for all products.

Noise

HPWH noise is not an issue directly linked to product energy performance, but it is a significant issue that can affect consumers' choice of water heater. It is also an issue that can affect the occupants of housing, and their neighbours, hence it can be both a building and planning issue in residential housing. Noise levels for HPWH are available from some, but not all, suppliers, and are not provided in a consistent manner (nor measured on a consistent basis).

With smaller property sizes and increased density of housing, noise information of heat pump technology is becoming more important. For space heating air-to-air heat pumps the Zoned Energy Rating Label must display noise information in Australia (optional in New Zealand), and it may be useful to have a similar approach for heat pump water heaters.

Government Program and Scheme Information Requirements

State energy efficiency schemes have become significant market stakeholders in the Australian HPWH market due to the incentives the schemes provide for HPWH installations where they replace inefficient water heaters. For example, the combination of the Solar Homes program and Victorian Energy Upgrade scheme provided assistance for approximately 32,000 heat pump installations in 2024, in NSW, the ESS provided assistance for 37,000 installations in 2023.

Despite the large number of incentives the State schemes direct towards HPWH, the schemes do not themselves measure or model the energy performance of HPWH. The State schemes largely rely on HPWH suppliers remodelling the information on product efficiency derived from the testing/simulation that they undertake for the Clean Energy Regulator to determine the STC allocation of their HPWH products. State schemes also require HPWH to be registered with their schemes, using similar testing/simulation to the CER, adding to the costs of participating in the schemes.

If the number of HPWH registered to receive STCs declines from 2028 the State schemes may require suppliers to undertake measurement and simulation solely to produce the energy performance information they need to allocate their incentives (i.e. their energy efficiency certificates). This may mean a larger proportion of the suppliers' measurement costs will be allocated to their participation in the State schemes and become part of the regulatory burden of these State schemes. From the suppliers' perspective this potentially may reduce the attractiveness and effectiveness of the State incentives for HPWH.

The National Construction Code (NCC) is another government initiative which could be influenced by the phase out of STCs for HPWH, as presently its calculation of whole-of-home energy performance using NatHERS has used STCs to measure the performance of HPWH. Ideally the NCC would model home energy efficiency using energy performance data on the specific HPWH being installed, once STCs are phased out, but this is not possible unless a centralised registry of validated HPWH performance data is developed, e.g. a GEMS registry of HPWH.

3. Objectives and options

3.1 Objectives

This CRIS outlines the barriers that are contributing to slow up-take of HPWH in Australia (outside of the incentive schemes) and New Zealand. It then presents regulatory policy options to address these barriers under the GEMS Act and EEC Act and cost-benefit analyses of these options.

The CRIS addresses whether energy efficiency requirements should be introduced for HPWH in order to better meet the policy objectives of the Australian GEMS and New Zealand EEC Acts. In Australia, the GEMS Act (Australian Government, 2012) objectives include promoting the development and adoption of products that use less energy or produce fewer greenhouse gases. In New Zealand, the purpose of the *Energy Efficiency and Conservation (EEC) Act 2000* (New Zealand Government, 2000) includes the promotion of energy efficiency and energy conservation.

The CRIS explores whether any potential energy efficiency requirements should include mandatory energy efficiency performance requirements and/or information provision requirements.

3.2 Options Considered

The options considered in this CRIS include:

1. Business as Usual (BAU), i.e. no regulatory interventions
2. Develop a MEPS and voluntary information provision in 2026
3. Develop a MEPS and voluntary information provision in 2026 and mandatory information provision in 2028.

Option 1: Business as Usual

This business as usual (BAU) option involves no change to the current situation i.e. no specification of minimum performance levels or the implementation of any requirement for voluntary or mandatory provision of information on the operation and performance of HPWH.

The BAU scenario assumes sales of HPWH would be left to the market to determine and that sales will continue to be influenced by government incentives (if relevant to the region). This assumption recognises that the market will change over time, but that currently there are market forces that could either increase or decrease sales numbers.

In Australia, the declining number of STCs allocated per HPWH installation will decrease those incentives for HPWH, but the State energy efficiency schemes and renewable programs (e.g. Solar Victoria rebates) could partially replace the STCs’ contribution to sale numbers in Victoria and NSW, at least for replacement installations. State regulations that discourage the installation of gas water heaters or ESWHs in new homes are also expected to promote HPWH sale numbers as will the NCC.

It is also possible that the reduced impact of the STC incentives may lead to an increased number of cheaper HPWH models entering the market, which would support sales numbers but probably will lead to more less-efficient HPWH models in the market. If this happened, the impact of less-efficient models entering the market would be to decrease the average efficiency of HPWH over time, and possibly increased customer dissatisfaction with HPWH and then lower sales. However, a conservative assumption has been made that the average efficiency of HPWH will not change over time, as there is insufficient data available to determine if less-efficient HPWH will be sold in the future or to accurately estimate the likely decrease in average energy efficiency which could result from such a market change.

In New Zealand, the conservative assumption for the BAU option has also been used that current (i.e., 2025), sales trends will continue.

This BAU option will be used as the counter-factual scenario when determining the energy and financial impact of the other policy options.

Option 2: Develop a MEPS and voluntary information provision

This option involves establishing a MEPS set at the equivalent of the current minimum requirements for STCs in Australia (equivalent to 60% energy savings in Zone 3).

Some stakeholders have expressed a preference to set the MEPS at a more stringent level than the current market to remove the worst performing products. However, HPWH offer a significant improvement in energy efficiency over ESWH and GWH and it is important that any government intervention does not unnecessarily slow the uptake of HPWH. The level of the MEPS will be reviewed after 3 years when further data on products is available following regulation.

The MEPS policy may not directly remove less efficient HPWH, but it will still have an effect on the average energy efficiency of HPWH. The MEPS will create the need to test HPWH to a regulated test method(s), and to report to the Regulator the test results and conditions under which performance measures were obtained (i.e. to report operating conditions and hot water output). This information (or a subset of it) can be made public on a database such as the Energy Rating Product Database. This will mean much more accurate HPWH performance information is publicly available so product performance can be effectively examined and compared by consumers, plumbers, installers and other stakeholders. This in turn should result in the selection of products that better match consumer requirements and are more energy efficient. Overall, this will result in improvements in average energy efficiency and in consumer satisfaction compared to the BAU scenario, without reducing consumer choice.

More specifically the impact of the MEPS will lead to:

- Suppliers being required to measure the energy performance of their HPWH products and the resulting performance information being published and publicly available, via the Energy Rating Product Database, leading to more appropriate selection of HPWH
- HPWH delivery capacity, recharge/recovery rates and conditions for testing may also be required to be published, improving selection of appropriate HPWH
- The energy performance and other performance claims of HPWH being subject to compliance testing
- Operating settings for new installations being defined for HPWH installations where efficiency requirements must be met. This will enable other regulations and schemes to reference and

mandate the use of these operating settings. Potential users could be the NCC, State regulations or incentive scheme requirements which require installation of efficient HPWH systems and cover the majority of Australian installations. This should reduce excessive use of hot water booster elements, improving affected HPWH performance.

- Supporting State energy efficiency and incentive schemes that promote HPWH, through provision of the information that is needed to operate these schemes, and the provision of information which the schemes could leverage to further drive the adoption of more efficient HPWH.

It is assumed that collectively these impacts will lead to small but significant improvements in the average energy efficiency of HPWH, compared to the BAU scenario. This result has been incorporated in the modelling of the impact of the MEPS scenario.

The other part of this option, the 'voluntary information provision', involves offering HPWH suppliers the opportunity to voluntarily provide additional information on the performance of their products, which could then be made available to the public via the Energy Rating Product Database.

Suppliers with favourable product performance characteristics would have an incentive to voluntarily provide information on their products to such a database, as such a voluntary information in the registry can be an effective marketing channel for them. This could include additional performance information sought by consumers and stakeholders e.g. on noise data. New Zealand and Australia have examples of non-mandatory information provisions, which if used in the supply of a regulated product must meet the requirements outlined in the legislation and are subject to compliance. Examples are the commercial climate performance data for air conditioners[7]. Consumers and stakeholders can be informed that the database contains such additional information on HPWH, and could then use it to research HPWH, further encouraging suppliers to provide information on their HPWH. As consumer awareness grows that HPWH performance must meet minimum standards and that verifiable information is available to assess HPWH performance it is expected that this will increase consumer confidence in HPWH, which in turn will increase HPWH take-up and installation rates.

Though not as comprehensive as a mandatory information and/or label for HPWH, at least such a database would provide publicly accessible and verifiable information on HPWH. Information would be verifiable as, once suppliers choose to list voluntary information, they will be held accountable for the accuracy of that information and the information could be check tested.

The impact of this option is expected to include the gains that a MEPS alone would provide plus the gains from the provision of verifiable HPWH performance information to the public. In combination this option will increase consumers' confidence in the performance of HPWH, enhance the operation of incentive/building code schemes and also encourage suppliers to provide more suitable HPWH models. This is projected to result in a small increase in the uptake of HPWH compared to low-efficiency electric and gas water heaters.

[7] Energy Efficiency (Energy Using Products) Regulations 2002 (SR 2002/9) (as at 12 April 2022) – New Zealand Legislation and Greenhouse and Energy Minimum Standards (Air Conditioners up to 65kW) Determination 2019 - Federal Register of Legislation

Option 3: MEPS and mandatory information provision

This option involves establishing a MEPS set at the equivalent of the current minimum requirements for STCs in Australia (equivalent to 60% energy savings in Zone 3) (as per option two) and requiring HPWH suppliers to provide information on the performance of their products. How the product performance information would be required to be conveyed to consumers has not been decided but it potentially could be via energy labels and/or it might involve the use of mandatory requirements to include performance information in all marketing and product information provided by the suppliers. For example, it might require suppliers to quote tested energy efficiency measurements in advertising, online product promotion, online product specifications etc.

In a similar way to the MEPS only policy option, the inclusion of additional HPWH product information into the Energy Rating Product Database will enhance the public's ability to compare the performance of HPWH. This will increase their confidence in buying a HPWH versus other water heater types. This should result in a small but significant improvement in the overall HPWH uptake, as compared to the uptake of HPWH under the MEPS only policy option.

The provision of mandatory disclosure of relevant information is also supported by the recommendations from the Australian Government's *Independent review of the Greenhouse and Energy Minimum Standards Act 2012* (Recommendation 29) (Australian Government, 2019).

Table 5: Policy Options Modelled

Options	Description
1. BAU	HPWH sales continue at current (2025) trends and no efficiency improvement
2. MEPS and Voluntary Information Provision	Leads to some efficiency improvement and small increase in sales of HPWH
3. MEPS and Mandatory Information Provision	Leads to some efficiency improvement and moderate increase in sales of HPWH

Framework for Measuring and Communicating Performance

The implementation of any MEPS and mandatory information provision options would need to consider what testing method would be used to determine HPWH efficiency and the information that could be required to be conveyed to consumers.

Test Methods

The Department and EECA have been working with industry representatives to review international testing approaches and develop an efficient and repeatable testing standard. This standard determines representative values of key thermal performance parameters without undue testing burden, and in a manner that can be replicated for compliance purposes.

There are several different test methods in use globally (EU and US regulation) and locally in Australia and New Zealand, which include:

- The mostly widely used in Australia and New Zealand: AS/NZS 5125.1, with the results used with the simulation standard AS/NZS 4234. This also uses standing loss test results from AS/NZS 4692.1
- Appendix G of AS/NZS 5125.1, which is a tapping cycle test
- ISO 19967-1:2019 and EN 16147: 2017 + A1: 2022. These are two different standards which use a similar approach and a tapping cycle test
- US Uniform Test Method for Water Heaters, Appendix E to Subpart B of 10 CFR 430. This is also a tapping cycle test
- The new AS/NZS test method, Appendix H of AS/NZS 5125.1: 2014 Amd 1, which is currently being finalised by the technical committee.

A detailed overview of testing methods and on the new test being developed is provided in Test methods, page 56.

The review of the frameworks and test methods used internationally for minimum energy performance and labelling of HPWH observed the following key principles:

- The minimum energy performance is defined by the efficiency measured using a 24 hour tapping cycle test at a single air temperature (USA = 20 °C, EU = 7 °C).
- The 24 hour tapping cycle test has a defined load profile (variation of flow rate and duration or volume of flow, with time), and a defined load size which is limited for the EU based on a minimum mixed water delivery volume (L) for each load size and declared by the manufacturer in the USA.
- EU measures the mixed hot water delivery volume (L) based on a minimum hot water temperature of 40 °C.
- EU testing is completed in the mode the water heater is purchased and control settings.
- USA testing is completed at a defined temperature setpoint of 52°C, or the maximum which can be achieved, and using the default mode as defined by the manufacturer in the I&O manual for giving selection guidance to the consumer.

The ambient air temperature for the US test method is 20 °C, which would not result in accurate estimates of HPWH performance in many Australian and New Zealand climates, and so has been ruled out for consideration. ISO 19967-1:2019 is not widely used as it is not a mandated test method locally or internationally.

The selection of the test method(s) which could be used to underpin any MEPS/labelling regulation needs to consider:

- The repeatability of the test,
- The cost to complete the test,
- The results from the test and how they can be applied for a MEPS and/or labelling.

Selection of the test method(s) also needs to consider trade implications. Australia and New Zealand have commitments under the World Trade Organisation to not unnecessarily introduce trade barriers, which is a consideration when determining which test method to use. Another consideration is to not add unnecessary burden, and to use existing test information where appropriate.

As there are many different combinations of test standards that could be used, three options have been proposed. These options provide balance between certainty of meeting MEPS, not introducing trade barriers, and reducing industry burden on complying with proposed requirements. Options A and C allow importers/manufacturers to select from two or more test methods in order to allow existing test reports (e.g. EN 16147) to be utilised. Option C also allows simulation (based on existing test reports) to be used as an interim measure during a 2-yr transition period to enable faster implementation and reduce pressure on the test facilities.

Test Option	Description	Pros	Cons
A	Importers/manufacturers can test to • Appendix G of AS/NZS 5125.1, • EN 16147: 2017 + A1: 2022, or • Appendix H of AS/NZS 5125.1.	The test methods are comparable. Allows multiple compliance pathways (including international test methods). Can use existing test results (EN).	Large burden on industry as retesting of products is required (unless tested to EN). Likely reduction of products on the market. -> Could be overcome with a long transition period. Compliance challenges for regulator as multiple methods -> can be overcome.
B	Importers/manufacturers can test to • Appendix H of AS/NZS 5125.1.	Simple, only one test method	Largest burden on manufacturers and importers, as all products would have to be retested. Likely reduction of products on the market. -> Could be overcome with a long transition period. Introduces trade barriers as citing local standard only. Net effect: Likely reduced products in the market Will impact the development of New Zealand HPWH market as large burden placed on small suppliers.
C	Importers/manufacturers can test to • Appendix G of AS/NZS 5125.1, • EN 16147: 2017 + A1: 2022, • Appendix H of AS/NZS 5125.1, or • Use existing AS/NZS 5125.1 test results + AS/NZS 4234 simulation for products offered for supply during a 2-year transition period. -> the product could continue to be supplied after the 2-year period.	Allows multiple compliance pathways (including international test methods). Least burden on industry as uses existing results (EN, and AS/NZS 5125.1 + AS/NZS 4234	More complex for two-year period on the regulator Compliance challenges for regulator as multiple methods -> can be overcome.

To implement test option A or C would require EECA and the GEMS regulator to select a MEPS method (e.g. Appendix H of AS/NZS 5125.1), and define how the results of an alternative method (e.g. EN 16147) compare to the MEPS method e.g.

- If the alternative test method is easier and the COP result for that product is less than MEPS, then the product does not meet MEPS.
- If the alternative test method is easier and the COP for that that product is more than MEPS, the COP could be multiplied by an adjustment factor to create a COP equivalent to the MEPS COP and determine whether the product meets MEPS.
- If the alternative test method is more difficult and the COP result for that product is less than MEPS, the COP could be multiplied by an adjustment factor to create a COP equivalent to the MEPS COP and determine whether the product meets MEPS.
- If the method is more difficult and the COP result for that product is higher than MEPS, the product meets MEPS.
- The adjustment factors could be conservative to account for a margin of error.

Another way of implementing test option A or C would be to set MEPS levels for each test standard, so different MEPS levels would be applicable depending on which testing standard was used to assess the HPWH performance. The MEPS levels would be determined so the efficiency performance requirements for the HPWH were consistent regardless of which test standard is used.

Methodologies would also need to be developed to convert the results of the different test methods so these results could be used to implement the information provision/labelling component of the policy.

Information provision

Both Policy Options 2 and 3 include information provision, with the information being mandatory in Option 3. The content and format of future mandatory information provision/labelling options has not been decided and would be subject to a separate consultation process.

There are a number of performance metrics that could be voluntarily requested/required to be included in the Energy Rating Product Database and in other HPWH product marketing or communications (e.g. product advertising, promotional materials, virtual or physical Energy Rating Labels etc.). Such metrics could include:

- Reheat rate,
- Hot water delivery,
- COP,
- Noise,
- Heating capacity.

Most of these factors are influenced by ambient air temperatures so information on HPWH performance in different climates (e.g. zones) will need to be provided so that this could be accessed by consumers, e.g. via tools like New Zealand's Efficient Appliance Calculator[8].

Australian and New Zealand air conditioner labelling and international HPWH labelling provide some examples of potential product labelling which address some of the potential HPWH performance metrics which may need to be provided, as follows:

- Air-to-air space heating heat pumps have the Zoned Energy Rating Label and show the products COP (star rating) performance using test results at different temperatures, and climate zones.
- EU labelling includes additional performance tests at colder (2 °C) and warmer (14 °C) conditions for annual electricity consumption. The label also includes the load size at which testing was completed, and an assigned energy efficiency class (A+ to F) based on the value of efficiency obtained at 7 °C.
- EU labelling includes measurement of indoor and outdoor sound levels.
- US labelling includes tank storage volume, first hour rating (volume of hot water delivered in one hour) and yearly energy use (kWh) and energy cost ($).

However, as previously mentioned, choice of the performance metrics and how this information would be conveyed to consumers will be subject to further research and consultation following this CRIS.

[8] Efficient appliance calculator — compare products | Gen Less

4. Projected costs, benefits and impacts

4.1 Rationale for government action

Government action may be needed when the market fails to provide the most efficient and effective solution to a problem. A range of market failures exists for HPWH in Australia and New Zealand. These were described in the Market Failures section.

In Australia, the GEMS Act objectives include promoting the development and adoption of products that use less energy and produce less GHG. In New Zealand, the purpose of the EEC Act 2000 includes the promotion of energy efficiency and energy conservation. Improved energy efficiency reduces energy consumption, energy costs and GHG emissions for consumers and businesses.

Without government action, the market failures identified earlier will persist and may worsen over time and remain barriers to the adoption of HPWH, hence of more energy efficient and lower GHG emission water heating.

4.2 Options considered

The policy options to address these market failures are categorised into two stages. First, to develop a MEPS set at the equivalent of the current minimum requirements for STCs in Australia (equivalent to 60% energy savings in Zone 3), and voluntary information provision via the Energy Rating Product Database. Second, to provide mandatory information of the HPWH products.

The options considered for the evaluation of the costs, benefits and impacts are:

1. Business as Usual (BAU), i.e. no regulatory interventions
2. Develop a MEPS, and voluntary information provision in 2026
3. Develop a MEPS and voluntary information provision in 2026 and mandatory information provision in 2028.

A cost benefit analysis has been completed for policy Option 2 and Option 3. The cost benefit analysis compares the options with the BAU (Option 1), and includes the following costs and benefits:

Benefits

- Energy saving for consumers/the economy due to improved efficiency of HPWH.
- Energy saving for consumers/the economy due to consumers using information to select and install HPWH instead of less efficient gas and electric water heaters.
- Value of reduced emissions occurring as a result of energy savings from the policy.
- In Australia, regulatory benefits to industry and government including any saved administrative resources, test costs and registration costs resulting from changed regulatory settings.

Costs

- Incremental capital cost of more energy efficient HPWH.
- Incremental capital costs for consumers/the economy due to consumers using information to select and install HPWH instead of less efficient gas and electric water heaters.

- Regulatory costs to industry and government including any additional administrative resources resulting from the new regulatory settings.

The modelling approach and assumptions are detailed in Appendix B – Cost benefit analysis modelling. The BAU option is not illustrated, but used as a comparison of the cost, benefits and impacts.

4.3 Projected benefits and costs

Option 2: MEPS and voluntary information

The costs and benefits associated with the policy option are shown in Table 6. The costs and benefits are modelled to 2060 (installed stock to 2040). All financial impacts are evaluated with a discount rate of 7% for Australia (in AUD) and 2% for New Zealand (in NZD) unless otherwise stated.

Table 6: Summary of costs, benefits and impacts - Option 2

Country	**Australia (AUD)**	**New Zealand (NZD)**
Period	**2025 - 2040**	**2025 - 2040**
Costs ($M)	$216	$36.5
Benefits ($M)	$611	$86.9
NPV ($M)	$395	$49.4
BCR	2.8	2.4

Country	**Australia**	**Australia**	**New Zealand**	**New Zealand**
Electricity Energy Savings (GWh)				
Year	2030	2040	2030	2040
Annual	43	208	11	46
Cumulative	94	1,402	24	317
Gas Energy Savings (PJ)				
Annual	0.2	0.7	0.01	0.02
Cumulative	1	6	0.02	0.2
GHG Emission Reduction (kt CO^2-e)				
Annual	24	55	1	4
Cumulative	65	509	3	29

Under this option, the benefits are significant for Australia, with a net benefit of $395M and annual electricity savings of 208 GWh pa and annual gas savings of 700 TJ in 2040. In New Zealand the net benefit is $49M, and annual electricity savings of 46 GWh pa and annual gas savings of 20 TJ in 2040.

The detailed breakdown of the costs and benefits is shown in Table 7. The table shows that the most significant costs are the upfront costs to the consumer when choosing to install a HPWH instead of a less energy efficient gas or ESWH. Similarly, the consumer receives running cost benefits from this choice but also obtains savings from the more efficient HPWH due to the MEPS. The table also show that supplier businesses in Australia offset their increased costs with savings from reduced administration and compliance costs associated with the multiple incentive schemes.

Table 7: Detailed breakdown of costs and benefits - Option 2

Country	**Australia (AUD)**	**New Zealand (NZD)**
Cost Details ($M)		
MEPS costs to consumer/supplier	$10.2	$0.4
Costs of consumer choice	$198	$33
Business compliance costs	$13	$3
Business cost savings	-$6	$0
Government net costs	-$0.2	$0.5
Total Costs	$216	$36
Benefit Details ($M)		
MEPS benefits to consumer	$314	$4.8
Benefits of consumer choice	$224	$68
Sub Total consumer benefits	$538	$73
Society carbon benefit	$73	$13
Total Benefits	$611	$86

A summary of the categories of the costs and benefits are as follows (further details are provided in the section Modelling assumptions):

- MEPS costs to consumer/supplier – additional costs of product modifications to meet the MEPS requirements.
- Costs of consumer choice – additional incremental cost to consumers from selecting a HPWH compared to a ESWH or gas water heater.
- Business compliance costs – additional costs to suppliers to register products with the regulator.
- Business cost savings –reduced registration and performance testing/modelling costs to participate in Australian State schemes.
- Government net costs – net costs to governments to administer the regulatory scheme and publicise HPWH information after collecting registration fees (only in Australia).
- MEPS benefits to consumer – reduced energy costs from more efficient installed HPWH due to the MEPS.
- Benefits of consumer choice –reduced energy costs from selecting a HPWH compared to a ESWH or gas water heater.
- Society carbon benefit – value of benefits to society from the GHG emission savings from increased use of efficient water heaters.

Option 3: MEPS and mandatory information

The costs and benefits associated with the policy option are shown in Table 8.

Table 8: Summary of costs, benefits and impacts - Option 3

Country	**Australia (AUD)**	**New Zealand (NZD)**
Period	**2025 - 2040**	**2025 - 2040**
Costs ($M)	$805	$159
Benefits ($M)	$1,494	$361
NPV ($M)	$689	$202
BCR	1.9	2.3

Country	**Australia**	**Australia**	**New Zealand**	**New Zealand**
Electricity Energy Savings (GWh)				
Year	2030	2040	2030	2040
Annual	54	402	18	192
Cumulative	112	2,391	36	1,051
Gas Energy Savings (PJ)				
Annual	0.4	3	0.0	0.1
Cumulative	0.9	20	0.0	0.7
GHG Emission Reduction (kt CO^2-e)				
Annual	38	239	2	16
Cumulative	89	1,503	4	96

Under this option, the projected benefits are high for both Australia and New Zealand, with a net benefit of $688M for Australia and $202M for New Zealand. The energy savings and emission reductions are also significant with cumulative GHG emission reductions of 1.5 Mt CO^2-e for Australia and 96 kt CO^2-e for New Zealand by 2040.

The detailed breakdown of the costs and benefits is shown in Table 9. Like Option 2, the table shows that the most significant costs are to the consumer when choosing to install a HPWH instead of a less efficient gas and electric water heater, but the consumer also obtains benefits from this choice.

Table 9: Detailed breakdown of costs and benefits - Option 3

Country	Australia (AUD)	New Zealand (NZD)
Cost Details ($M)		
MEPS costs to consumer/supplier	$10.2	$0.5
Costs of consumer choice	$785	$154
Business compliance costs	$15	$3
Business cost savings	-$6	$0
Government net costs	$0.7	$0.8
Total Costs	$805	$159
Benefit Details ($M)		
MEPS benefits to consumer	$314	$4.8
Benefits of consumer choice	$896	$301
Sub Total consumer benefits	$1,210	$306
Society carbon benefit	$284	$55
Total Benefits	$1,494	$361

Details of the composition of the various costs and benefits are provided underneath Table 7.

4.4 Energy saving impacts

The impact of the options in terms of energy savings per annum are shown in Figure 4 and Figure 5 for Australia and Figure 6 and Figure 7 for New Zealand.

Australia

Figure 4: Annual projected energy savings for Option 2 and 3 – Australia (electricity)

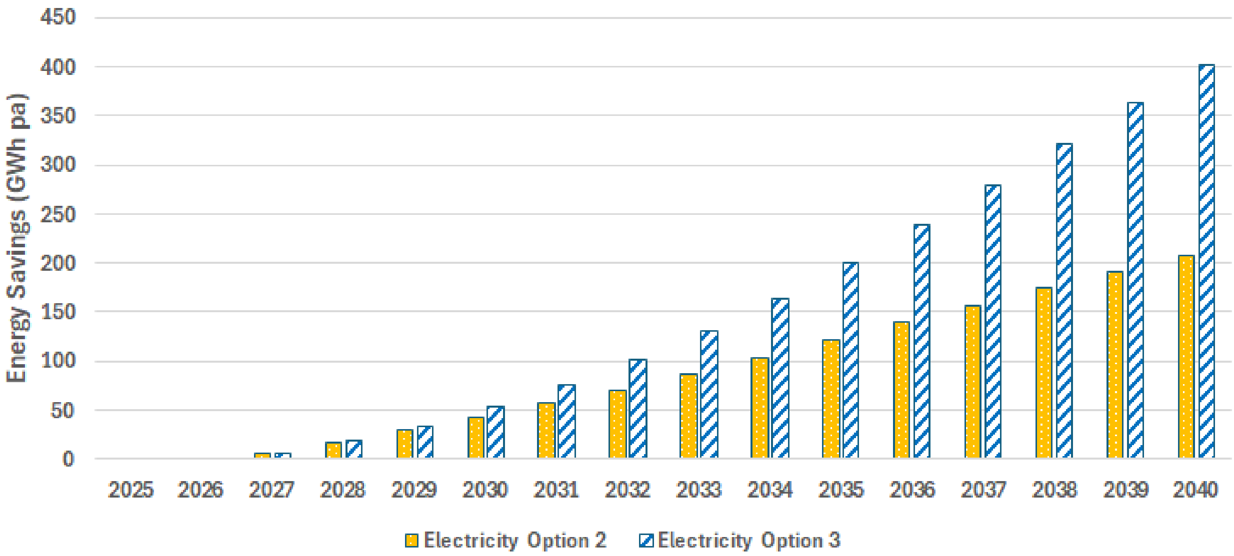
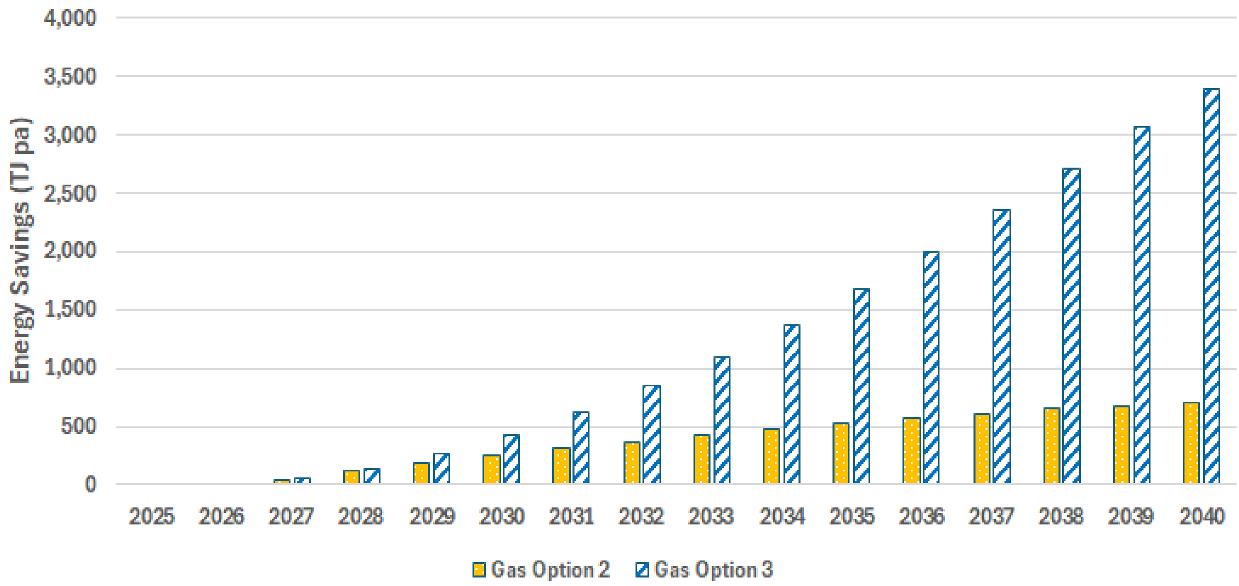


Figure 5: Annual projected energy savings for Option 2 and 3 – Australia (gas)



New Zealand

Figure 6: Annual projected energy savings for Option 2 and 3 – New Zealand (electricity)

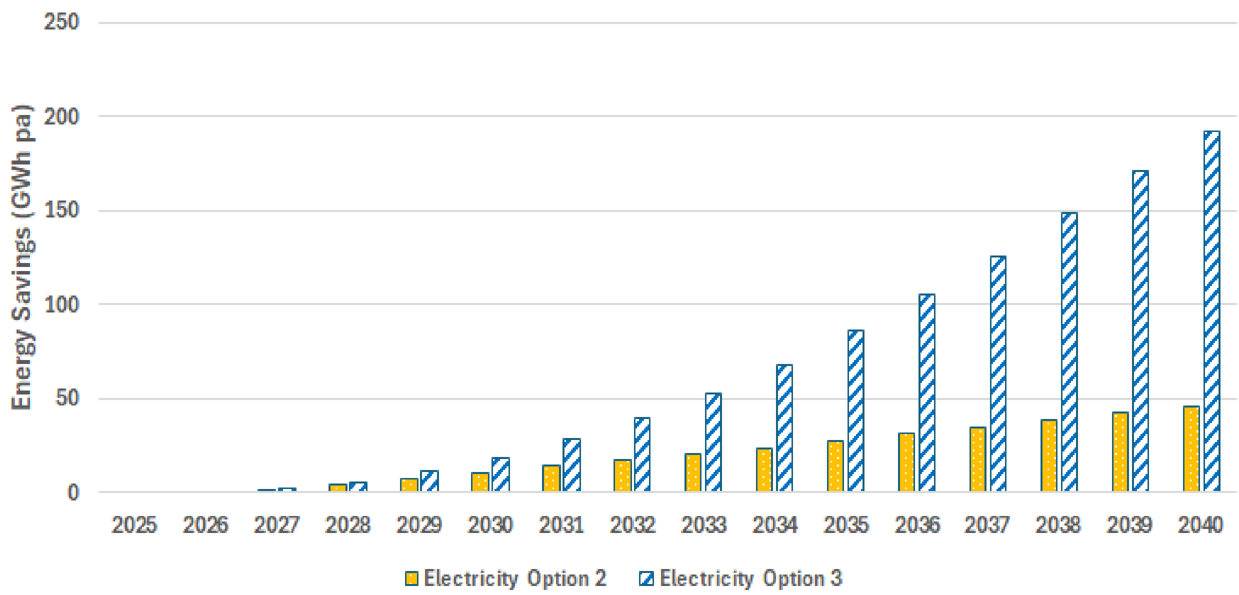
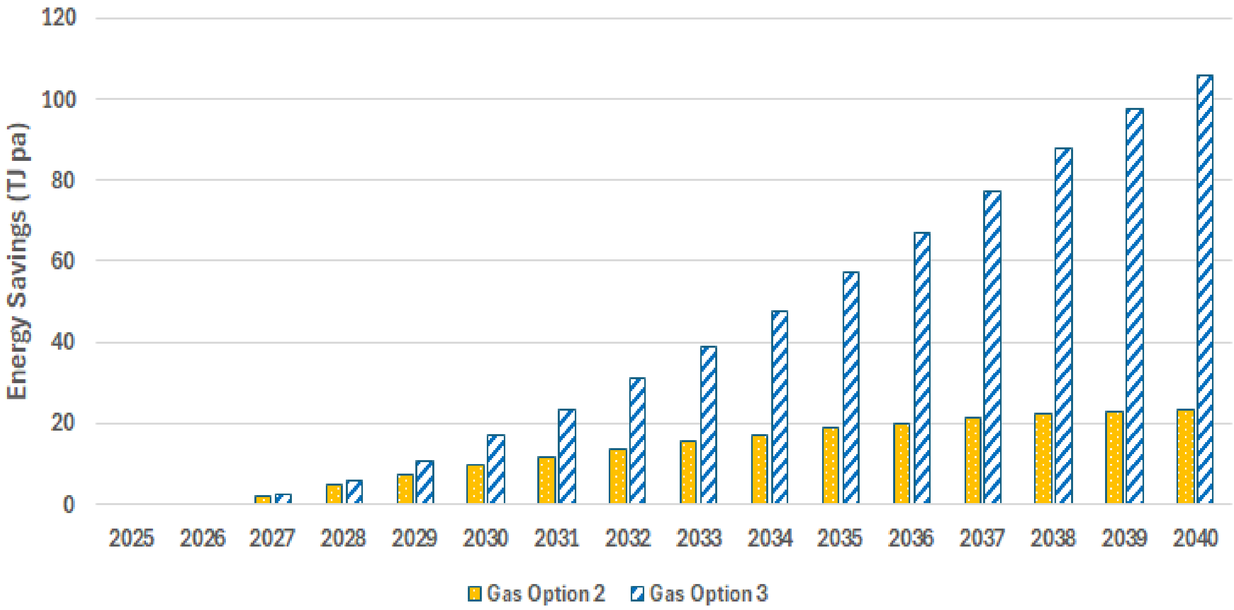


Figure 7: Annual projected energy savings for Option 2 and 3 – New Zealand (gas)



4.5 Modelling assumptions

The key modelling assumptions are provided in the following section, with further details shown in Appendix B – Cost benefit analysis modelling.

Implementation dates[9]

- Option 2: MEPS and voluntary information provision (2026)
- Option 3: MEPS and voluntary information provision (2026) and then mandatory information (2028)

Policy options energy impacts

The modelling of the policy options assumes the following impacts of the proposed policy on efficiency and uptake/installation of water heater products (compared to the BAU or Option 1):

Option 2: MEPS and voluntary information

- average efficiency increase of 2% above BAU efficiency from 2027
- HPWH replace 2% of low-efficiency electric and gas water heaters from 2027

Option 3: MEPS and mandatory information

- The increase in HPWH average efficiency from Option 2

[9] Note that the proposed implementation timeline applies to Australia only, as regulatory updates in New Zealand follow a separate domestic process and the timeline might be beyond 2027.

- HPWH replace 15% of low-efficiency electric and gas water heaters. This replacement rate is modelled to occur slowly, from 2% in 2028 to 15% in 2038. For Victoria, the maximum replacement rate is reduced to 5% in 2038 due to their new regulations due to commence in 2027.

The average increase in efficiency for Option 2 assumes the regulations will enable installations to be correctly sized and control settings more appropriately suited to consumer situations, increasing the efficiency of HPWH installed. It will also enable governments to leverage the MEPS/labelling to pull the market to a higher level of efficiency that it would otherwise be.

The increase in replacements of low-efficiency electric and gas water heaters with HPWH from Option 3 is the result of a proportion of consumers and intermediaries utilising the mandatory information to make informed choices. Some of this benefit is also shown under Option 2, as the MEPS is assumed to give consumer confidence to move to a HPWH, and installers the confidence to recommend them.

In 2022, the NSW Office of Energy and Climate Change (OECC) undertook consumer preference and needs research for hot water systems (Callosum Consulting, 2022). The report found that the willingness for consumers to pay for Hot Water System energy savings is high if they are adequately presented with information about energy use, energy efficiency and operating costs. In addition, government programs and regulations can confidently promote the performance of HPWH in comparison with low-efficiency water heaters.

Financial parameters

The financial parameters used for the CBA include:

- 2025 present value dollars (Australian values in AUD, New Zealand values in NZD)
- Australia discount rate of 7% (sensitivity at 0, 3 and 10%), New Zealand discount rate of 2% (sensitivity at 0, 1 and 8%)
- Impacts have been modelled to 2060 (installed stock to 2040).
- Government and business costs are shared to each state/region based on the number of households.

Projected benefits and costs

The benefits include:

- Energy savings to consumers valued at the consumer energy price for Australia (by state) and at the long run marginal energy price for New Zealand
- Carbon price valued at the central or base case in Australia and New Zealand using the projected emissions factors for each fuel/energy source (sensitivity at zero, low and high carbon price)

The costs include:

- Increased purchase price of HPWH due to the MEPS/testing requirements. This is a conservative value as most of the products will not require any modifications, however an allowance for this cost is included in the modelling.
- Incremental cost difference to consumers due to their choice to install HPWH compared to cheaper low-efficiency electric and gas water heaters.

- Net changes in product testing costs (including changes in costs due to the new AS/NZS test method ('Appendix H of AS/NZS 5125.1: 2014 Amd 1, Performance Test Method for Heat Pump Water Heaters') compared to the existing test/simulation method). This is a conservative approach as options have been presented that can use existing test information.
- Net changes in business costs due to the registration costs and reduced State scheme costs. It is assumed that after 2028 the State incentive schemes will utilise the registration data as the main mechanism of calculating certificates.
- Net changes in government costs (including increased Australian and New Zealand government administration and compliance costs, while reducing the State scheme administration costs).

The impacts of changes to electricity demand have not been evaluated in this CBA due to the uncertainty with evolving technology and system options, as discussed in HPWH and Demand Response and Demand Flexibility, page 15.

4.6 Cost Benefit Analysis

Australia and New Zealand

A Summary of the costs and benefits is shown in Table 10.

Table 10: Summary of costs and benefits

Option 2	**Australia (AUD)**	**New Zealand (NZD)**
Total Benefits (NPV, $M)	$611	$86.9
Total Costs (NPV, $M)	$216	$36.5
Net Benefits (NPV, $M)	$395	$49.4
Benefit Cost Ratio	2.8	2.4
Cumulative Electricity Energy Savings (GWh)	1,402	317
Cumulative Gas Energy Savings (PJ)	5.9	0.2
Cumulative GHG reduction (kt CO2-e)	509	29
Option 3	**Australia (AUD)**	**New Zealand (NZD)**
Total Benefits (NPV, $M)	$1,494	$361
Total Costs (NPV, $M)	$805	$159
Net Benefits (NPV, $M)	$689	$202
Benefit Cost Ratio	1.9	2.3
Cumulative Electricity Energy Savings (GWh)	2,391	1,051
Cumulative Gas Energy Savings (PJ)	20.0	0.7
Cumulative GHG reduction (kt CO2-e)	1,503	96

Note: Financial impacts are evaluated with a discount rate of 7% for Australia and 2% for New Zealand, and modelled to 2060 (installed stock and cumulative savings to 2040)

4.7 Uncertainty and Sensitivity

Discount rates

The sensitivity of the CBA for different discount rates is shown in Table 11 for Australia and Table 12 for New Zealand.

Table 11: Discount rate sensitivity analysis – Australia Discount rate (real)

	Nil (0%)	Low (3%)	Med (7%)	High (10%)
Option 2				
Total Benefits (NPV, $M)	$1,760	$1,085	$611	$416
Total Costs (NPV, $M)	$363	$286	$216	$178
Net Benefits (NPV, $M)	$1,398	$798	$395	$238
Benefit Cost Ratio	4.9	3.8	2.8	2.3
Option 3				
Total Benefits (NPV, $M)	$4,760	$2,806	$1,494	$979
Total Costs (NPV, $M)	$1,565	$1,162	$805	$625
Net Benefits (NPV, $M)	$3,195	$1,644	$689	$354
Benefit Cost Ratio	3.0	2.4	1.9	1.6

Table 12: Discount rate sensitivity analysis – New Zealand Discount rate (real)

	Nil (0%)	Low (1%)	Med (2%)	High (8%)
Option 2				
Total Benefits (NPV, $M)	$124	$103	$86	$33
Total Costs (NPV, $M)	$43	$40	$36	$24
Net Benefits (NPV, $M)	$81	$63	$49	$10
Benefit Cost Ratio	2.9	2.6	2.4	1.4
Option 3				
Total Benefits (NPV, $M)	$540	$440	$361	$126
Total Costs (NPV, $M)	$195	$176	$159	$91
Net Benefits (NPV, $M)	$345	$265	$202	$36
Benefit Cost Ratio	2.8	2.5	2.3	1.4

Carbon Price

The sensitivity of the CBA for different values of carbon is shown in Table 13 for Australia and Table 14 for New Zealand. The central value was used in the main analysis presented in this Consultation RIS.

Table 13: Carbon price sensitivity analysis – Australia (AUD, Discount rate 7% real)

Option 2	None	Low	Central	High
Total Benefits (NPV, $M)	$538	$574	$611	$647
Total Costs (NPV, $M)	$216	$216	$216	$216
Net Benefits (NPV, $M)	$322	$358	$395	$431
Benefit Cost Ratio	2.5	2.7	2.8	3.0
Option 3				
Total Benefits (NPV, $M)	$1,210	$1,352	$1,494	$1,636
Total Costs (NPV, $M)	$805	$805	$805	$805
Net Benefits (NPV, $M)	$405	$547	$689	$831
Benefit Cost Ratio	1.5	1.7	1.9	2.0

Table 14: Carbon price sensitivity analysis – New Zealand (NZD, Discount rate 2% real)

Option 2	None	Low	Central	High
Total Benefits (NPV, $M)	$73	$81	$86	$90
Total Costs (NPV, $M)	$36	$36	$36	$36
Net Benefits (NPV, $M)	$37	$45	$49	$54
Benefit Cost Ratio	2.0	2.2	2.4	2.5
Option 3				
Total Benefits (NPV, $M)	$306	$342	$361	$381
Total Costs (NPV, $M)	$159	$159	$159	$159
Net Benefits (NPV, $M)	$147	$183	$202	$223
Benefit Cost Ratio	1.9	2.2	2.3	2.4

4.8 Stakeholder Impacts

Suppliers

Businesses that supply water heaters will be required to test their HPWH models to register the products in Australia with the GEMS regulator and in New Zealand with EECA. These costs will be substantial at the start of the regulation for Option 2 if existing test data is not used. Following the start of the regulation, all new models will also need to be tested and registered before supply.

For option 3, additional effort and costs will be incurred to provide the information on a label, online and/or in product literature. The details of these requirements will be determined in further consultation following this RIS.

Purchasers, Consumers and Installers

Purchasers, consumers and installers will obtain greater information to evaluate the benefits of HPWH. They will also have more confidence in the performance of HPWH products, and select products suitable for their situations, given that the performance is measured and reported consistently.

Regulators and Administrators

The GEMS regulator and EECA will have a role in ensuring compliance with the requirements of the regulations is enforced. This will increase the administration burdens on the Australian and New Zealand Government. However, the benefits of the Energy Rating Product Database, consistent and check tested performance will also reduce the administrative burden on State schemes, building codes, and national incentive programs. The public database will also be particularly important for the administration of the Australian NCC, with the coming phase out of STCs for HPWH.

Testing facilities and simulations supporting calculations

If the new AS/NZS test method ('Appendix H of AS/NZS 5125.1: 2014 Amd 1, Performance Test Method for Heat Pump Water Heaters') is the only method used, test facilities will be required to utilise a new method. However, the testing time and burden of Appendix H of AS/NZS 5125.1 is similar to the current testing requirements for AS/NZS 5125.1, as are the climate conditions, tolerances and measurements. From a testing facility's perspective, the most significant change is the requirement to hold low temperature conditions for longer, and without the HPWH heating, which may require upgrades to the test facility cooling systems. Work has been carried out with multiple independent Australian testing facilities, as well as with manufacturers, to ensure that testing facilities are available. The use of AS/NZS 4234 for simulating the performance of HPWH will be reduced, which will reduce the need for additional consultants or trained in-house staff to conduct several simulations for each model.

Impacts on Competition and Innovation

The MEPS level is not expected to reduce product availability and therefore there will be minimal impact on competition. Depending on the testing approach taken there may be reduced consumer choice in the short term, but this can be overcome via implementation. Alternate methods for complying with the proposed policy options are considered in the Test Methods section. Appendix H of AS/NZS 5125.1 is also not expected to reduce innovation, as it will enable products to be measured under more realistic (and closer to real world) conditions.

5. Conclusions and recommendations

5.1 Conclusions

HPWH are a more efficient and lower emissions alternative to traditional electrical and gas water heating options, being generally 60% more energy efficient than ESWHs. Yet HPWH form a minority of water heater sales and installations, in part due to problems in the HPWH market.

The problems in the HPWH market include market failures as a result of split incentive issues and customer awareness and satisfaction issues, stemming from inadequate access to quality information on HPWH performance characteristics. Introducing a MEPS for HPWH, combined with improved information provision to consumers, could help address many of these issues.

The cost benefit analysis that has been undertaken clearly shows that either policy option, of introducing a MEPS together with voluntary information provision or of introducing a MEPS together with mandatory information provision, would lead to positive net benefit results. These policy options were found to create the following net benefits:

- MEPS with voluntary information provision:
  - Australia AUD$395M
  - New Zealand NZD$49M
- MEPS with mandatory information provision/labelling:
  - Australia AUD$689M
  - New Zealand NZD$202M.

The breakdown of the costs of the policy options also shows that over 90% of the cost of implementing the options is due to consumers selecting HPWH instead of less efficient water heater technologies. So a large majority of the costs of implementing these policy options is being paid by the consumers who freely choose to pay more upfront in order to reduce long term costs.

The benefit cost ratio of the MEPS with voluntary information provision is higher than that of the third option of MEPS with mandatory information provision, due to the higher take up of HPWH in Option 3. However, the mandatory information option still has a strong benefit cost ratio (1.9 for Australia and 2.3 for New Zealand) and creates almost double the net benefits in Australia and four times the net benefits in New Zealand compared to the voluntary information provision option. Sensitivity testing with varying discount rates also showed that the MEPS with mandatory information provision policy option would still produce positive net benefits even if high discount rates were used in the cost benefit analysis.

Given the much greater net benefits of the MEPS with mandatory information provision policy option, compared to the MEPS with voluntary information provision option, and the strong positive benefit cost ratios of the mandatory option, it is apparent the MEPS with mandatory information provision policy option will produce the most societal and consumer net benefits.

5.2 Recommendation

This CRIS recommends that Option 3, MEPS with mandatory information provision/labelling policy option, be implemented. This option will deliver the largest net economic benefits of the options examined, the largest energy and GHG savings, and will result in benefit cost ratios of 1.9 for Australia and 2.3 for New Zealand.

It is recommended that the policy option should be implemented as follows:

- Develop a MEPS to be set at the equivalent of the current minimum requirements for STCs in Australia (equivalent to 60% energy savings in Zone 3), and voluntary information provision, to be implemented in 2026
- Add mandatory information provision in 2028.

E3 welcomes stakeholder feedback before any recommendations are put forward to Energy Ministers for their consideration.

6. Implementation and timing

Next Steps

The publication of this CRIS marks the beginning of a process which will proceed in the following stages:

1. The CRIS will be circulated to stakeholders as widely as possible, and submissions invited for a period of 4 weeks from its initial publication.
2. E3 will hold an information session/s during that period to give an opportunity for stakeholders to ask questions and seek clarification on the RIS. This would most likely be in the form of video conferences.
3. E3 will review written submissions received up to the closing date. These will be made public unless the submitter indicates that a submission is confidential. Stakeholders may make both a public and a confidential submission if they wish.
4. E3 will review the RIS in the light of submissions received, and if necessary, review the analysis and recommendations accordingly.
5. E3 will prepare a Regulation Impact Statement for Decision (DRIS) for submission to Commonwealth, State, Territory and New Zealand Energy and Climate Change Ministers.
6. If Ministers (and the New Zealand Government) decide on a course of action that involves regulatory change, the Commonwealth Minister will oversee preparation of the appropriate Determination and the New Zealand Government will approve any amendments to the Energy *Efficiency (Energy Using Products) Regulations 2002*.
7. Consultation will be undertaken during the preparation of the Determinations and Regulations for the implementation of the recommended options

If Commonwealth, State, and Territory Energy Ministers, and the New Zealand Government agree to changing the requirements for HPWH then the decision is expected to be implemented as below.

- The regulations the HPWH must comply before being supplied are dependent on the date of importation or manufacture in New Zealand or Australia.
- If the HPWH is imported or manufactured in New Zealand or Australia before the enforcement date of the amended regulations it must comply with the regulations in force prior to the amendment (i.e. no energy efficiency requirements).
- If the HPWH is imported or manufactured in New Zealand or Australia from the enforcement date of the amended regulations it must comply with the amended regulations (i.e. meet MEPS, be registered etc.)

It should be noted that the Trans-Tasman Mutual Recognition Agreement (TTMRA) applies to products supplied in Australia or New Zealand: Trans-Tasman Mutual Recognition Agreement and Free Trade Agreements | EECA. The TTMRA is a cooperation and trading agreement between Australia and New Zealand, which recognises the relationship of the two countries.

7. Questions for stakeholders

Purchasing

1. What do you think are the major factors that are considered by consumers when buying a heat pump water heater? (compared to ESWH, and GWH, and to other HPWH).
2. What do you think are the major factors that are considered by other parties (e.g. plumbers, builders, property developers, retailers) when recommending a heat pump water heater for a consumer? (compared to ESWH, and GWH, and to other HPWH).
3. When purchasing a heat pump water heater, is there sufficient information available to compare the energy efficiency, hot water delivery and reheat time in cold climates, running costs and noise? If no, what additional information is needed?

Split Incentives

4. To what degree are landlords, builders or plumbers choosing traditional ESWH and GWH (over heat pump water heaters) because of split incentives?
5. To what degree are landlords, builders or plumbers choosing less energy efficient heat pump water heaters because of split incentives?

Minimum Energy Performance Standards

6. Is there a case for introducing minimum energy performance standards (MEPS) for HPWH?
7. Would introducing MEPS as described in Option 2 have a positive impact on the HPWH market in terms of energy efficiency? Please provide reasons.

Information Provision and Labelling

8. Do you think that there is a case for mandatory display of information in advertising material (e.g. catalogue, brochure and online material)?
9. Do you think that there is a case for a mandatory physical and digital Energy Rating Labels for HPWH? Provide reasons.
10. What would be useful information to include in the mandatory display of information e.g. energy efficiency, noise, hot water delivery and reheat time?
11. Should a similar approach to the Zoned Energy Rating Label for space heating heat pumps, be taken for HPWH?
12. What would be useful information to include in a physical/digital label for HPWH e.g. energy efficiency, noise, hot water delivery and reheat time?

Noise

13. Should noise testing and declaration of noise levels for HPWH be mandatory (Australia only)[10]?
14. If mandatory noise testing was to be introduced, it is suggested a few standards could be used such as AS 1217.2, ISO 3743-1, ISO 3744 and ISO 3741. Do you have any concerns with using these standards? If yes, please provide detail including solutions to address these concerns.
15. If noise testing was voluntary, do you have any concerns? If yes, please outline these.

Technical considerations for policy options

16. Three options were presented for testing to show compliance, which option do you prefer and why?
    a. Test method option A (Appendix G of AS/NZS 5125.1+ EN 16147 + Appendix H of AS/NZS 5125.1)
    b. Test method option B (Appendix H of AS/NZS 5125.1)
    c. Test method option C (Existing AS/NZS 5125.1 + AS/NZS 4234 data can be used + EN 16147 + Appendix H of AS/NZS 5125.1 + Appendix G of AS/NZS 5125.1) with a 2-year transition time for use of simulation-based test (AS/NZS 4234) to show compliance.
17. Do you think that the proposed commencement dates (of 2026 for MEPS and 2028 for labelling) provide sufficient lead time for implementation in the following scenarios? Please provide reasons.
    a. Test method option A (Appendix G of AS/NZS 5125.1 + EN 16147 + Appendix H of AS/NZS 5125.1)
    b. Test method option B (Appendix H of AS/NZS 5125.1)
    c. Test method option C (Existing AS/NZS 5125.1 + AS/NZS 4234 data can be used + EN 16147 + Appendix H of AS/NZS 5125.1 + Appendix G of AS/NZS 5125.1) with a 2-year transition time for use of simulation-based test (AS/NZS 4234) to show compliance.

Implementation Impacts on Market

18. Do you think that the proposed commencement dates provide sufficient lead time for implementation? Please provide reasons.
19. What impact do you think implementing these measures (MEPS and labelling) would have on competition, product costs and consumer choice? Please provide justification.
20. Are there any issues to consider if product testing and registration was introduced and based on Appendix H of AS/NZS 5125.1 including a new maximum hot water delivery test and tapping cycle test? Please provide detail.
21. Do you consider that there are any major technical or functional issues related to the proposals? If so, how should these be addressed?

[10] Note that any proposed requirements relating to noise in this CRIS are optional under New Zealand energy efficiency regulatory regime.

Sales Data

22. Can you provide improvements to the market data presented for Australia and New Zealand, and in particular, the estimates of current and projected sales of heat pump water heaters? Please provide data (this can be marked confidential).

Anything Else

23. Is there anything else to consider that would increase the energy efficiency of HPWH?

All submissions may be published to ensure transparency unless requested to be kept private.

Glossary

Glossary of terms

Term	Description
BAU	Business as Usual. The normal operating practice in a business or industry without any new intervention.
CER	The Clean Energy Regulator was established in Australia on 2 April 2012 by the Clean Energy Regulator Act 2011 and is a non-corporate Commonwealth entity and statutory authority. It is responsible for administering legislation that reduces greenhouse gas emissions and increases the use of renewable energy.
COP	Coefficient of performance.- The metric that determines the efficiency of the HPWH. This is the ratio of thermal energy delivered to the electrical energy consumed.
Demand flexibility	Two-way communication between external parties and end-use products that involves decision making. This enables products time of use to be changed to reduce peak demand and optimise energy use.
ESS	The NSW Energy Savings Scheme (ESS) provides rebates for eligible households and businesses to upgrade to energy-efficient heat pump water heaters.
Energy efficiency	A general term which is typically calculated by dividing the energy obtained (useful energy or energy output) by the initial energy (energy input).
ESWH	Electric Storage Water Heaters heat and store water in an insulated tank using electricity
GEMS	Greenhouse and Energy Minimum Standards *Act* 2012 (GEMS Act), Australia's national framework for appliance and equipment energy efficiency. It came into effect on 1 October 2012.
HPWH	Heat Pump Water Heaters are energy-efficient systems that use a refrigeration cycle to extract heat from the surrounding air and transfer it to water for heating.
MEPS	Minimum Energy Performance Standards that specify the minimum level of energy performance that appliances and equipment must meet or exceed before they can be supplied or used for commercial purposes
NatHERS	The Nationwide House Energy Rating Scheme (NatHERS) provides energy ratings for new homes and is being expanded to include energy ratings for existing homes.
NCC	National Construction Code (Australia)

Term	Description
NEPS	National Energy Performance Strategy provides a long-term framework to manage energy demand, so our community can enjoy the economic, climate and health benefits of improved energy performance.
NZ Building Code	A set of regulations that define the minimum performance standards buildings in New Zealand must meet.
NZEECS	New Zealand's Energy Efficiency and Conservation Strategy is a framework developed by the government to promote energy efficiency, conservation, and the use of renewable energy
Rated	A rated value or amount is one that is claimed by the manufacturer and that is based on a tested value or amount.
STCs	Small-scale technology certificates. STCs are created under the SRES administered by the Clean Energy Regulatory as a way to meet renewable energy targets and reduce carbon emissions in Australia.
SRES	Small-scale Renewable Energy Scheme is an Australian Government initiative that encourages investment in small-scale renewable energy.
Thermal performance	A general term referring to thermal performance metrics such as how much hot water is provided (capacity), how efficiently it is delivered, and how much energy is consumed (power input).
VEECs	Victorian energy efficiency certificates are electronic certificates created under the Victorian Energy Upgrades (VEU) program when certain energy efficiency activities are undertaken in residential or non-residential premises. Each certificate represents one tonne of greenhouse gas emissions reduction (CO_2-e).
VEU	The Victorian Energy Upgrades (VEU) program offers rebates for installing energy-efficient water heaters, including heat pump and solar hot water systems.

Glossary of standards and test methods

Name	Description
AS 1217.2:1985 Acoustics – Determination of sound power levels of noise sources. Part 2 – Precision methods for broad-band sources in reverberation rooms.	Australian Standard for acoustic testing of sound power
AS/NZS 4234:2021 **Heated water systems - Calculation of energy consumption**	Sets out a method for evaluating the annual energy performance of water heaters using a combination of test results for component performance and mathematical models to determine the standardized annual supplementary energy use.
AS/NZS 4692.1:2005 Energy consumption, performance and general requirements for Electric water heaters	Includes performance test procedures, minimum performance requirements and a range of other requirements for water heaters. It also includes the revised test method for the determination of standing heat loss for electric storage water heaters, and the method for the determination of hot water delivery and mixed hot water delivery.
AS/NZS 5125.1:2014 **Heat pump water heaters - Performance assessment - Part 1: Air source heat pump water heaters**	Performance assessment methods for air-sourced heat pump water heaters. Note, this standard contains multiple methods, explained in Table 16.
EN 12102:2013 Air conditioners, liquid chilling packages, heat pumps and dehumidifiers with electrically driven compressors for space heating and cooling - Measurement of airborne noise - Determination of the sound power level	A European Standard for determining the airborne noise from air conditioners, liquid chilling packages, heat pumps, and dehumidifiers with electrically driven compressors
EN 12102-1:2017 Air conditioners, liquid chilling packages, heat pumps, process chillers and dehumidifiers with electrically driven compressors - Determination of the sound power level - Part 1: Air conditioners, liquid chilling packages, heat pumps for space heating and cooling, dehumidifiers and process chillers	A European Standard for determining the sound power level of air conditioners, liquid chilling packages, heat pumps, process chillers, and dehumidifiers with electrically driven compressors. **Note:** This standard has now been replaced by EN 12102-1:2022, however, the 2017 version is

Name	Description
	still referred to by the GEMS Determination for Air Conditioners.
EN 12102-2:2019 Air conditioners, liquid chilling packages, heat pumps, process chillers and dehumidifiers with electrically driven compressors - Determination of the sound power level - Part 2: Heat pump water heaters	A European Standard that specifies methods for testing the sound power level of air/water, brine/water, water/water and direct exchange/water heat pump water heaters and heat pump combination heaters with electrically driven compressors and connected to or including a domestic hot water storage tank for domestic hot water.
EN 16147:2017 Heat pumps with electrically driven compressors - Testing, performance rating and requirements for marking of domestic hot water unit	This European Standard specifies methods for testing, rating of performance and calculation of water heating energy efficiency.
ISO 3741:2010 Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Precision methods for reverberation test rooms	Specifies methods for determining the sound power level or sound energy level of a noise source from sound pressure levels measured in a reverberation test room.
ISO 3743-1:2010 Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for small movable sources in reverberant fields — Part 1: Comparison method for a hard-walled test room	Specifies methods for determining the sound power level or sound energy level of a noise source by comparing measured sound pressure levels emitted by this source (machinery or equipment) mounted in a hard-walled test room, the characteristics of which are specified, with those from a calibrated reference sound source.
ISO 3744: 2010 Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane.	Specified methods for determining the sound power level or sound energy level of a noise source from sound pressure levels measured on a surface enveloping the noise source (machinery or equipment) in an environment that approximates to an acoustic free field near one or more reflecting planes.
ISO 19967-1:2019 Heat pump water heaters. Testing and rating for performance. Part 1: Heat pump water heater for hot water supply.	Specifies test conditions and test procedures for determining the performance characteristics of air source heat pump water heaters for hot water supply with electrically driven compressors with or without

Name	Description
	supplementary electric heater and connected to or including only on hot water storage tank.

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Appendix A – Test methods

Testing methods

The current incentive schemes (SRES, VEU and ESS) require heat pump water heaters (HPWH) thermal performance testing to AS/NZS 5125.1, which physically tests the capacity, input power and efficiency (or coefficient of performance, COP) of a HPWH through heat-up cycles at four air temperature and humidity conditions (~8°C to 33°C), and a low temperature condition (2°C). The tank heat loss is tested in accordance with AS/NZS 4692.1, and the standby energy consumption of the heat pump at 20°C recorded. The correlated input power and COP (efficiency) equations generated from this physical testing, are then combined with manufacturer supplied control and component information to simulate the annual energy performance of the HPWH, in general accordance with AS/NZS 4234, and obtain an estimate of the annual energy use and corresponding savings, based on defined weather files, hot water load profile and baseline product. The result is a very accurate evaluation of the HPWH's annual energy use and savings for the specific load profile, weather file, and control settings. However, individual households will have load profiles and local climate conditions that vary significantly, and in some cases users or installers can also adjust the control settings which impact energy use. The energy use and savings of individual installations will therefore vary significantly from the registered values.

The test and simulation methodologies for the current incentive schemes were not developed for the purposes of defining a Minimum Energy Performance Standard (MEPS), nor for defining the volume of useful hot water or time it will take the product to re-heat after a large draw-off. For all-in-one HPWH, where the water is heated at the tank and not circulated, these values could be estimated directly from the existing AS/NZS 5125.1 thermal performance test data, however for stand-alone HPWH, where the water is circulated to the heat pump and then back to the tank, the required data is not available due to the fact that the water in the tank is mixed during testing. In both cases, simulation could be used to provide an estimate, and sample testing could be used to evaluate the accuracy of these estimates.

Other markets around the world have water heater labelling and minimum energy performance requirements as summarised in Table 15, and there are multiple test methods available for evaluating the thermal performance of HPWH as summarised in Table 16. The review of the frameworks and test methods used internationally for minimum energy performance and labelling of HPWH observed the following key principles:

- The minimum energy performance is defined by the efficiency measured using a 24hr tapping cycle test at a single air temperature (USA = 20°C, EU = 7°C).
- The 24hr tapping cycle test has a defined load profile (variation of flow rate and duration or volume of flow, with time), and a defined load size which is limited for the EU based on a minimum mixed water delivery volume (L) for each load size and declared by the manufacturer in the USA.
- EU measures the mixed hot water delivery volume (L) based on a minimum hot water temperature of 40°C.
- EU testing is completed in "out-of-the-box" mode and control settings.

- USA testing is completed at a define temperature setpoint of 52°C, or the maximum which can be achieved, and using the default mode as defined by the manufacturer in the I&O manual for giving selection guidance to the consumer.

Table 15: Summary of North American and European Water Heater Requirements

Market (Operating Mode and Setpoint)	**Energy Performance Requirement(s)**	**Label Requirement(s)**
USA (Default mode, set to 52°C)	Efficiency* (%)	Storage Volume (L) Size: Very small, low, medium or high First Hour Rating (L) Annual energy consumption and operating cost
European Union (Out-of-the-box)	Mixed water delivery volume (L) Efficiency* (%) Sound power level (dB)	Size: 3XS to XXL Efficiency class: A+ to F Annual energy consumption for three zones Sound power level

*Note that efficiency is defined very differently for these two markets, with differences in the test methods and conditions, and a conversion coefficient of 2.5 included in the European efficiency calculation to reflect the primary energy of EU electricity generation (estimated 40% efficiency).

Table 16: Summary of Heat Pump Water Heater Thermal Performance Test Methods

Test Method Brief Description	**Key Outputs**	**Benefits**	**Disadvantages**
ISO 19967-1: 2019 24hr tapping cycle test at 7°C air temperature, including 24hr stabilisation, 48hr standby, 24hr variable flow rate tapping cycle test, and hot water delivery to 40°C.	• **Heating up time** and energy consumption, from cold. • Standby, including tank heat loss. • Daily energy delivered, energy consumption and **efficiency** (COP). • **Volume of mixed water delivered** equivalent to 40°C, based on 10°C inlet, and average thermal power (kW).	• International standard • Sub-set of EN 16147 which has been well established (excluding Table A.2). • Provides metrics for delivered hot water volume, reheat time and efficiency.	• Not currently being used. • Minimum hot water temperature of 40°C. • Does not include, as written, a low temperature test (2°C). • Long test method, particularly if low temperature test is added, with variable flow rates (more complex). • May be challenging for labs to achieve low temperature (2°C) test.
EN 16147: 2017 + A1: 2022 As above, but with additional test conditions at 2°C, and 14°C air temperature.	• As above • **Annual energy consumption** and COP.	• Well established method with hundreds of products tested and registered. • Test conditions include 7°C and 2°C, providing demonstration of both typical efficiency and low temperature performance. • Provides metrics for delivered hot water volume, reheat time, efficiency and calculation of annual energy consumption.	• Minimum hot water temperature of 40°C. • Long test method, particularly for all three conditions (2°C, 7°C and 14°C), with variable flow rates (more complex). • May be challenging for labs to achieve low temperature (2°C) test.
US Uniform Test Method for Water Heaters, Appendix E to Subpart B of 10 CFR 430	• Standby losses • **First hour rating (water delivered)** between 52°C and 46°C with 14°C inlet water. • **Daily efficiency**	• Well established method with hundreds of products tested and registered.	• 20°C test condition does not provide any information of how products will perform at lower air temperatures.

Test Method Brief Description	**Key Outputs**	**Benefits**	**Disadvantages**
24hr tapping cycle test of mixed water at 52°C, at 20°C air temperature, including 12hr soak, first hour delivery test to 46°C, re-heat, and 24hr variable flow rate tapping cycle test.	• Annual Energy Consumption and Cost • Recorded data would enable a **re-heat time** to be calculated.	• Provides metrics for delivered hot water volume and efficiency. • Medium length test method, at easy to achieve condition (20°C).	• Variable flow rates (more complex). • Outlet water is tempered to 52°C for test, which is not typical for Australian or NZ markets, and does not capture water heater outlet temperature.
Appendix G of AS/NZS 5125.1 24hr tapping cycle test at 19°C and 7°C or 1°C air temperatures, including preconditioning with a minimum of three heat-up and draw-off cycles, 24hr tapping cycle test, and hot water delivery to 45°C.	• Daily useful energy output (MJ) • **Daily electrical energy consumption** • **Daily average efficiency** (COP) • Standardised volumetric recharge rate (L/h) • **Recharge time** (h) • **Delivered hot water** volume equivalent at 45°C (L)	• Developed for the purpose of defining a minimum energy performance standard for the Australian market. • Potentially good balance between accuracy, repeatability and length of test. • Provides metrics for delivered hot water volume, reheat time and efficiency.	• Not currently being used, and therefore not well established. • May be challenging for labs to achieve low temperature (1°C) test.
Appendix H of AS/NZS 5125.1 Hot water delivery and 24hr tapping cycle tests at 1°C, 9°C and 19°C air temperature, including: - initial heat-up, preconditioning draw and re-heat, maximum hot water delivery and re-heat; and	• **Delivered hot water** volume equivalent at 50°C (L) • **Reheat time** (min) • **Daily heating cycle efficiency**, COP	• Developed specifically by local manufacturers to meet current market need of communicating key information to consumers and installers to assist in product selection. • Simpler, shorter test method than EN 16147. • Provides metrics for delivered hot water volume, reheat time and efficiency.	• Currently in the process of publishing. • Need to demonstrate repeatability. • May be challenging for labs to achieve low temperature (1°C) test. • Does not currently provide a calculation method for annual energy use.

Test Method Brief Description	**Key Outputs**	**Benefits**	**Disadvantages**
- initial heat-up, preconditioning draw and re-heat, and 24hr tapping cycle test.			
AS/NZS 5125.1 Thermal Performance including AS/NZS 4692.1 Tank Heat Loss Heat-up test at 4 air conditions (~8°C to 33°C) plus optional low temperature (1°C) heat-up test, resulting in correlated equations for input power and COP (efficiency) as functions of air and water temperature. Tank heat loss and standby energy consumption are also evaluated.	• Regression coefficients for **efficiency** (COP) and **input power** equations • Tank heat loss • Standby energy consumption • **Low temperature (1°C) heat-up test results** (optional)	• Existing market participants in Australia already have these test reports. • Well established method for evaluating capacity, efficiency and input power of HPWH over a wide range of operating conditions. • Single point conditions, such as thermal capacity, efficiency and input power can be extracted from report data.	• Does not directly provide a measurement of useful hot water delivery or re-heat time after a large draw-off. • For stand-alone HPWH, the storage tank water is mixed during the heat-up tests (excluding the low temperature test), and therefore does not provide a representative heat-up time or energy consumed.
AS/NZS 5125.1 Thermal Performance (incl. AS/NZS 4692.1 Tank Heat Loss) + AS/NZS 4234 Simulation Annual simulation of energy use for standardised load profile and weather files, based on manufacturer declared control systems and component specifications; and measured heat pump thermal performance,	• Simulated Annual energy consumption based on: - Manufacturer supplied component data, and - Regression coefficients for **efficiency** (COP) and **input power** equations - Tank heat loss - Standby energy consumption - **Low temperature (1°C) heat-up test results** (optional)	• Existing market participants in Australia already have these calculations and test reports. • Well established method for evaluating capacity, efficiency and input power of HPWH over a wide range of operating conditions. • Single point conditions, such as thermal capacity, efficiency and input power can be extracted from report data.	• Does not directly provide a measurement of useful hot water delivery or re-heat time after a large draw-off, but this could be simulated. • Current calculations methods contain many manufacturer supplied values, and further guidance may be required on how to approach user-adjustable control parameters. • Industry has concerns that this method could be misused to

Test Method Brief Description	Key Outputs	Benefits	Disadvantages
standby energy consumption and tank heat loss.			provide advantages results that do not match real world use.

Minimum Energy Performance and labelling requirements for Europe and the USA currently utilise 24hr tapping cycle test methods to evaluate energy consumption and efficiency and include system standby and hot water delivery (capacity) tests as part of the overall product evaluation.

In the European Union (EU) water heaters[11,12] are currently required to be labelled, as shown in Figure 8 , and to meet minimum performance values[13] for efficiency and hot water delivery volume, and maximum sound power levels. The information provided on the label includes:

- declared **load profile** (3XS to XXL);
- **water heating energy efficiency class** (A+ to F), under average climate conditions (7°C) for HPWH;
- **annual electricity or fuel consumption** (kWh or GJ_{GCV}), under average (7°C), colder (2°C) and warmer (14°C) climate conditions for HPWH; and
- **sound power level** (dB) both indoors and outdoors, as applicable.

Additional product information is also required to be provided via a *product fiche*[14] (technical specification).

In the US water heater manufacturers are required to provide EnergyGuide labels[15], as shown in Figure 9, including the required text shown in Figure 10, and to meet minimum efficiency values[16]. The label contents for water heaters include:

- **Water heater type** (instantaneous water heater or water heater; gas, natural gas, propane gas, oil or electric) and **draw pattern** (very small, low, medium, high).
- **Capacity** as defined by either the **maximum flow rate** for instantaneous water heaters, or rated **storage volume** and **first hour rating** (volume of hot water delivered in one hour, allowing re-heating) for storage water heaters, as determined according to appendix E to 10 CFR Part 430, subpart B[17].
- **Annual energy consumption and operating cost**, determined in accordance with subpart B to 10 CFR Part 430[18].

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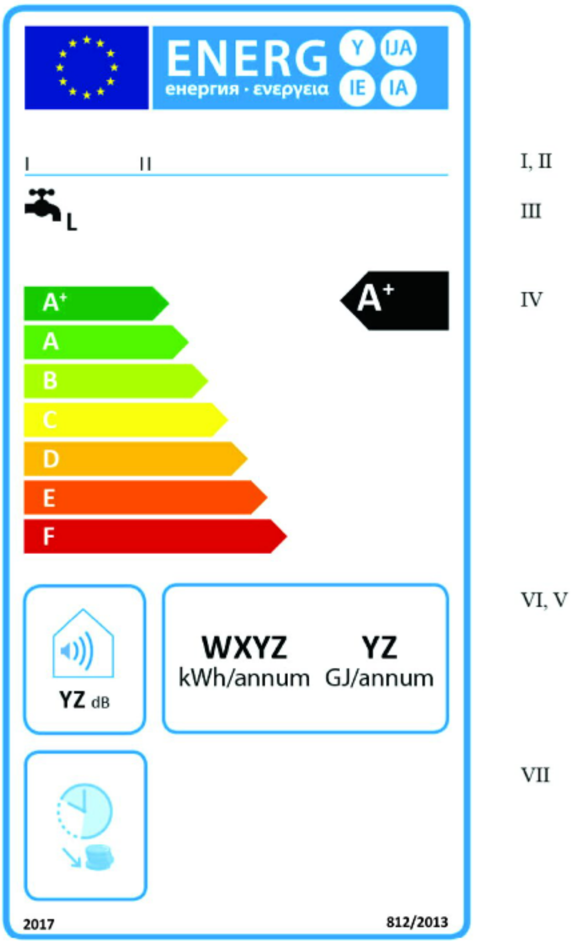
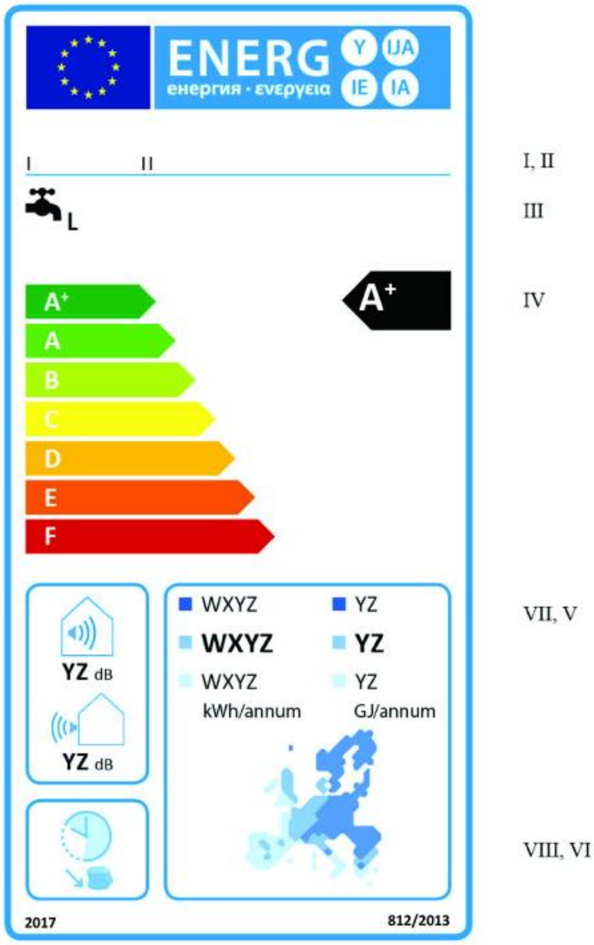
[11] European Commission requirements for water heaters - Water heaters — EU Ecodesign and Energy Labelling
[12] Regulation (EU) 812/2013 Energy labelling of water heaters, hot water storage tanks and solar device - EU Regulation No 812/2013 on energy labelling of water heaters — EUR-Lex
[13] Regulation (EU) 814/2013 Ecodesign requirements for water heaters and hot water storage tanks. - EU Regulation No 814/2013 on ecodesign requirements for water heaters — EUR-Lex
[14] Regulation (EU) 812/2013 Energy labelling of water heaters, hot water storage tanks and solar device - EU Regulation No 812/2013 on energy labelling of water heaters — EUR-Lex
[15] Energy Labelling Rule 16 CFR Part 305 - USA Energy Labeling Rule — eCFR Part 305 (16 CFR)
[16] US DoE Energy Conservation Program for Consumer Program Federal Register Final Rule 10 CFR 430 - USA Energy Conservation Program for Consumer Products — eCFR Part 430 (10 CFR)
[17] Uniform Test Method for Measuring the Energy Consumption of Water Heaters, Appendix E to Subpart B of 10 CFR Part 430 - USA Test Procedures for Water Heaters — Appendix E to Subpart B of Part 430 (10 CFR)
[18] Calculation of annual operating costs, annual energy consumption and uniform energy factor, Subpart B to 10 CFR Part 430 - USA Uniform test methods — 10 CFR §430.23 (e) Water Heaters

Figure 8: EU Water Heater Labels

Conventional Water Heater Label



Heat Pump Water Heater Label



I, II: Supplier's name or trade mark, and Model identifier.

III: Declared load profile (3XS to XXL)

IV: Water heating energy efficiency class (A+ to F), under average climate conditions for HPWH

V: Annual electricity consumption (kWh) and/or fuel consumption (GJ_{GCV}), under average, colder and warmer climate conditions for HPWH

VI, VII: Indoor sound power level (dB), if applicable and outdoor sound power level (dB) for HPWH

VII, VIII: Off-peak, if applicable

Heat pump water heaters VI: European temperature map displaying three indicative temperature zones

Figure 9: Example EnergyGuide labels[19]

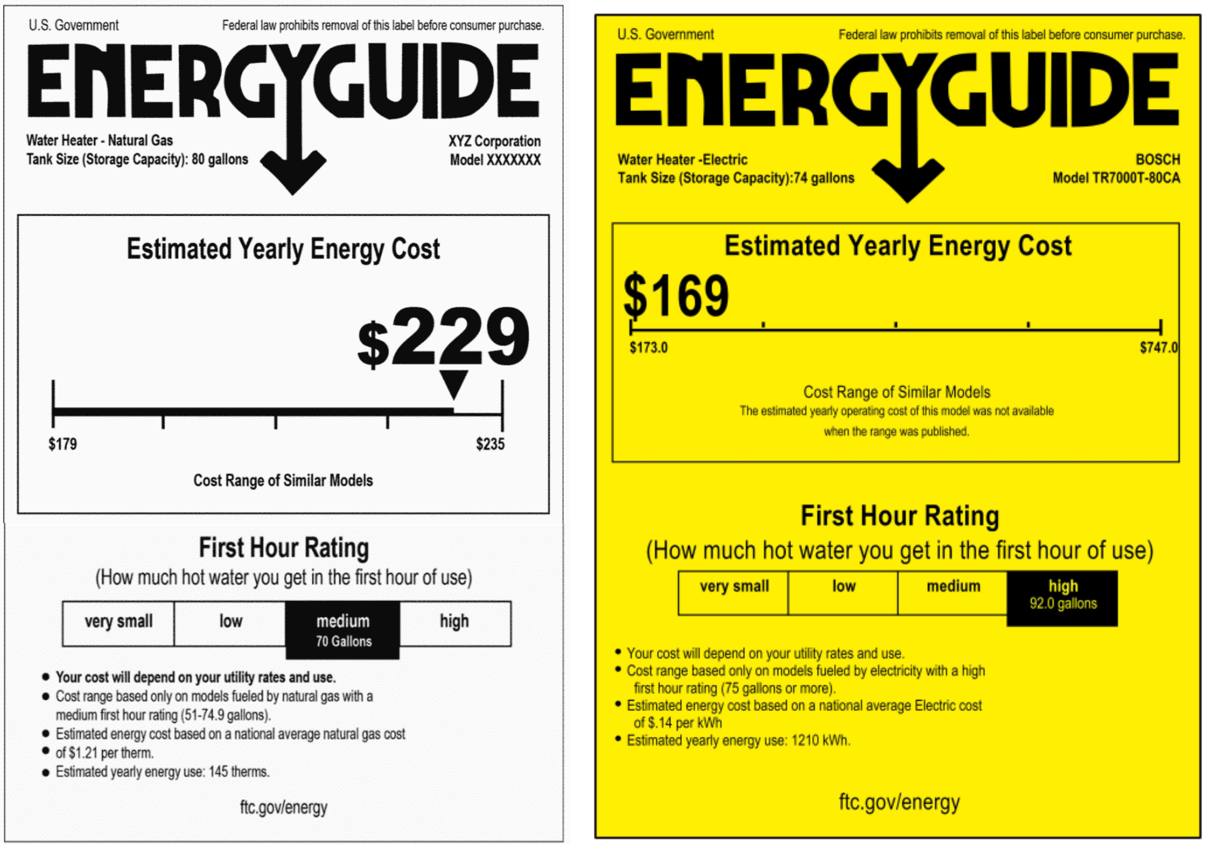


Figure 10: EnergyGuide Label required text for storage water heaters[20].

> Your costs will depend on your utility rates and use.
> Cost range based only on models fueled by [natural gas, oil, propane, or electricity] with a [very small, low, medium, or high] first hour rating [fewer than 18 gallons, 18-50.9 gallons, 51-74.9 gallons, or 75 gallons or more].
> Estimated energy cost is based on a national average [electricity, natural gas, propane, or oil] cost of [___ cents per kWh or $___ per therm or gallon].
> Estimated yearly energy use: ___ [kWh or therms].
> *ftc.gov/energy.*

The US and European water heater requirements have resulted in hundreds of products being tested using their methods, providing consistent data to installers and consumers. Values obtained from the US product database are summarised in Table 17 and Table 18 to demonstrate the range of tank volumes, first hour

[19] Appendix L of the Energy Labelling Rule - [EnergyGuide label format — Appendix L to Part 305 (16 CFR)]
AHRI (Air Conditioning, Heating and Refrigeration Institute) Directory for Residential Water Heaters - [Air-conditioning, Heating, and Refrigeration Institute (AHRI) Directory of Certified Product Performance, USA - Water Heaters]
[20] Part 305.17 of Energy Labelling Rule, Label Content for Water Heaters - [Energy labeling requirements — 16 CFR §305.17]

ratings (useful hot water delivered in one hour, starting with a hot tank) and efficiencies (or COPs) supplied to the US residential market.

Table 17: Summary of US Water Heater Data – Heat Pump Water Heaters[21]

Performance Parameter	Unit	Min	Average	Maximum
- Storage Volume	L	136	220	413
- First Hour Delivery	L	155	272	397
- Recovery efficiency	%	233	396	465
- Uniform Energy Factor (similar to COP)		2.8	3.6	4.07

Table 18: Summary of US Water Heater Data – Electric Resistance Storage Water Heater

Performance Parameter	Unit	Min	Average	Maximum
Electric Resistance Storage Water Heater				
- Recovery efficiency	%	98	98	98
- Uniform Energy Factor (similar to COP)		0.88	0.92	0.95

Each of the existing test methods has both benefits and disadvantages, as listed in more detail in Table 16:

- The US test method is limited to testing at 20°C air temperature and 52°C water outlet temperature and does not provide any information about the lower air temperature performance and higher water temperature performance of the product. In Australia, heating the water to between 55°C and 60°C is typically required for legionella management, and in New Zealand hot water is required to be maintained at 60°C. It is important that the thermal performance at these water temperatures is included in a test method.
- The European test method is time consuming and challenging for test laboratories to achieve, particularly at the 2°C test condition, and with its variable flow rates and long test duration. It also utilises a minimum hot water temperature of 40°C which is not well suited to applications with outdoor tanks and less insulated pipework.
- The ISO test method is essentially a subset of the European test method with a single air test condition of 7°C and is not currently being utilised in any country. In developing the proposed new

[21] AHRI (Air Conditioning, Heating and Refrigeration Institute) Directory for Residential Water Heaters - AHRI Directory of Certified Product Performance — Water Heaters

AS/NZS test method concerns were raised with the potential for defrosting to occur in HPWH at 7°C, and that this may reduce the repeatability of the test method.

- The AS/NZS 5125.1 thermal performance test (including AS/NZS 4692.1 tank heat loss and AS/NZS 4234 simulation) does not currently evaluate the key metrics of useful hot water volume and re-heat time, but calculation methods could be developed based on the existing test data.
- Appendix G of AS/NZS 5125.1 is not currently used.

Preliminary laboratory testing has demonstrated that testing at lower air temperatures, such as 1-2°C, can be very challenging, particularly for extended periods where the heat pump is not operating.

Proposed new test method

The Department and EECA have been working with industry representatives to develop an efficient and repeatable testing standard that determines representative values of key thermal performance parameters without undue testing burden, and in a manner that can be replicated for compliance purposes. The following comments on the new AS/NZS test method ('Appendix H of AS/NZS 5125.1: 2014 Amd 1, Performance Test Method for Heat Pump Water Heaters') are based on the draft test method developed by the Standards Australia working group, there may be changes to this test method before it is finalised. This test method aims to provide the following thermal performance metrics at three climate conditions (cold = 1°C, warm = 9°C and hot = 19°C):

- maximum hot water delivery;
- reheat time;
- daily coefficient of performance (COP), or efficiency; and
- the operation settings used to achieve the reported HPWH performance values.

The test method is made up of two components:

- Maximum hot water delivery test; and
- 24hr tapping cycle test.

For both test components, there are multiple pre-conditioning steps required in order to heat the water and develop tank stratification (vertical temperature distribution) in a repeatable manner. The pre-conditioning steps include:

- Fill the tank with cold water;
- Heat-up;
- Partial draw-off; and
- Reheat.

The maximum hot water delivery test provides useful sizing information including the maximum volume of water that can be delivered at 50°C, and the reheat time, for each air temperature condition. For some products both of these may vary significantly with air temperature, such as when a mid-tank element is used for heating at lower air temperatures, or the heat pump's capacity is significantly reduced at lower air temperatures, resulting in a longer reheat time.

Once pre-conditioning is complete, the maximum hot water delivery test requires water to be drawn-off until the tank outlet water temperatures drops below a minimum useable hot water temperature of 50°C. The draw-off is then immediately stopped and the tank allowed to reheat recording the time taken to recover from this maximum hot water delivery. The key performance parameters of equivalent hot water delivery volume at 50°C and reheat time are reported along with more detailed information including the physical volume delivered, average outlet temperature, energy delivered and electricity consumed.

The 24hr tapping cycle test is intended to represent a typical daily operation of the product (at fixed air temperature conditions), and includes 8 draw-offs spread over 12 hours, followed by 12 hours without any draw-offs. Throughout the test the energy delivered as hot water is recorded along with all electricity consumption including standby, de-frost, tank heat loss, circulating pump and controller electricity consumptions. The tank temperature is monitored at 6 positions in the tank, enabling an energy balance to account for differences in the stored energy at the start and end of the test. The system daily efficiency, or coefficient of performance (COP) is then determined from the ratio of energy delivered to electricity consumed. Additional detailed information and charts are required as part of the report to demonstrate operation of the product and compliance with the test method.

One of the key challenges with the existing AS/NZS 4234 simulations for the incentive schemes has been defining what parameters to use when a product has multiple operating modes and user/installer adjustable control parameters. In the past there have been discussions of using the “worst case” value, however, it is unclear which should be considered “worst case”: a higher set point which achieves lower efficiency but higher hot water delivery, or a lower set point which achieves higher efficiency but lower hot water delivery.

Appendix H of AS/NZS 5125.1 addresses this by requiring the test to be conducted:

- In the operating mode recommended by the manufacturer; and
- At a set point temperature as close as possible to 60°C (as defined by the measured temperature at the third temperature sensor in the tank), if the temperature set point is adjustable.

The operating mode, control settings and measured set point temperature must all be included in the test report. This is considered to be best way to enable consumers to make a fair comparison between products when there are user adjustable settings. The user can then choose to adjust the temperature up to obtain a higher hot water delivery volume, or down to achieve a better efficiency.

Overall Appendix H of AS/NZS 5125.1 is very similar to both the American and European test methods (and the ISO), including both delivery and tapping cycle tests, however it includes the lower air temperatures not covered by the American or ISO methods, higher set point and minimum water temperatures more suited to Australian and New Zealand markets, and has a significantly shorter duration than the European test method. These test methods, and AS/NZS 5125.1 including Appendix G, were all used to help inform the working group in developing Appendix H of AS/NZS 5125.

Noise testing

HPWH noise has been identified as a significant issue that can affect consumers’ choice of water heater. It is also an issue that can affect the occupants of housing, and their neighbours, hence it can be both a building and planning issue in residential housing. Some models are alleged to create excessive noise which may annoy owners or their neighbours. Noise levels for HPWH are available from some, but not all, suppliers and are not provided in a consistent manner, nor measured using a standardised test method.

Noise is generated by the moving parts of the HPWH (electric motors, compressors and fans) during operation. This occurs mainly during heating, but can also occur at other times such as during defrost cycles. Noise levels may therefore vary across the operating range of the product, and, as for all products, the noise level experienced by consumers can be significantly impacted by specific features of the installation. Testing completed by IEA Annex 51 (HPWH Noise and seasonal variations based on interlaboratory results (PDF, Heat Pumping Technologies Annex 51)) has demonstrated variations in heat pump (including both air conditioners and heat pump water heater) sound levels of 58 to 69 dB(A) with outdoor air temperatures varying from 15°C to 2°C. Preliminary results also show a small increase in sound levels as water temperature increases throughout the heat-up cycle.
Defining a standardised test method for the noise level of HPWH, including specification of the HPWH operating condition, installation, surroundings and noise measurement, and collecting this information would enable consumers to compare consistent values when quoted in marketing and sales materials.

The GEMS Determination for air conditioners includes requirements for measuring and reporting noise levels. Noise level (or sound power) tests must be conducted to either EN 12102:2013 or EN 12102-1:2017 (which replaced EN 12102:2013), using the installation and operating conditions of the standard cooling full capacity test (35 °C outdoor / 27 °C indoor), or for heating only products, the standard heating full capacity test (7 °C outdoor / 20 °C indoor). EN 12102-1:2017 specifies the requirements for determining the sound power level emitted into the surrounding air by air conditioners, heat pumps, liquid chilling packages with electrically driven compressors when used for space heating and/or cooling, and/or for process, as described in the EN 14511 series and dehumidifiers as described in EN 810. EN 12102-1 was updated in 2022.

The GEMS Determination for air conditioners requires noise (sound power) to be determined before applying for registration for all products, and noise is published for about 50% of products in the GEMS register. For those products that have a Zoned Energy Rating Label, noise is then included on the label. Of the 5803 products currently on the register 3029 do not have an indoor sound level value, and 2721 do not have an outdoor sound level value. For the 3082 products with sound level data, they range from 50dB(A) to 89 dB(A) outdoors, and from 36.5dB(A) to 75 dB(A) indoors.

For pool pumps the test standard (AS 5102.1: 2019) includes measurement of A-weighted sound power in accordance with either AS 1217.2, ISO 3741, ISO 3743-1 or ISO 3744 at each pump rating point. The GEMS (Swimming Pool Pump-units) Determination 2021 requires the measured sound power to be included in an application for registration.

The Department and EECA are currently working with acoustic consultants to determine a suitable test method, similar to that for air conditioners or pool pumps. There are a number of options available for testing the noise level of heat pump water heaters, including:

1. Test in accordance with EN 12102-2:2019. This standard specifies method for testing the sound power level of air/water, brine/water, water/water and direct exchange/water heat pump water heaters and heat pump combination heaters with electrically driven compressors and connected to or including a domestic hot water storage tank for domestic hot water production.

2. Measurement of A-weighted sound power in accordance with either AS 1217.2, ISO 3741, ISO 3743-1 or ISO 3744 over a heat-up cycle, at a defined air temperature range. It will be necessary for the air temperature range to be relatively large due to the challenges of minimising background noise during acoustic testing, and for the heat-up cycle to be clearly specified, such as the maximum 3-minute average value obtained during a pre-conditioning reheat with an air temperature of less than 10°C.

Appendix B – Cost benefit analysis modelling

A financial analysis model has been built to review the overall costs and benefits related to each policy option. Proposals are compared to business as usual (BAU) where there is no change to the HPWH regulatory environment. The modelling in this CRIS includes the following benefits and costs:

Benefits

- Energy saving for consumers/the economy due to improved efficiency of HPWH.
- Energy saving for consumers/the economy due to consumers using information to select and install HPWH instead of less efficient gas and electric water heaters.
- Value of reduced emissions as a result of energy savings from policy.
- In Australia, regulatory benefits to industry and government including any saved administrative resources, test costs and registration costs resulting from changed regulatory settings.

Costs

- Incremental capital cost of more energy efficient HPWH.
- Incremental capital costs for consumers/the economy due to consumers using information to select and install HPWH instead of less efficient gas and electric water heaters.
- Regulatory costs to industry and government including any additional administrative resources resulting from the new regulatory settings.

The benefits to consumers of incentives (such as the STCs, VEU and ESS incentives) are not included, as are the direct costs of these incentives to governments, as they are considered a financial transfer from government to the consumer. This approach simplifies the CBA. By excluding incentives, the analysis concentrates on the core costs and benefits directly associated with the policy, and aligns with previous E3 RIS.

Parameters and assumptions

Table 19: Primary modelling assumptions and parameters

Assumptions	Parameters
Scenarios	• BAU • Option 2: MEPS to be set at equivalent of 60% savings in Zone 3 for HPWH in 2026 • Option 3: Option 2 MEPS in 2026 and mandatory information provision in 2028
Sales	• Australian historical sales data based on trade data and CER data • New Zealand historical sales data based on EECA data • Forecast sales based on projected trends and government policy impacts

Assumptions	Parameters
Scope	The analysis presented has been based on the sales of all-in-one and stand-alone HPWH to the residential and small business sector.
Stock	Australian and New Zealand water heater stock levels have been estimated by EnergyConsult using the updated RBS water heating module and validated with ownership surveys by region. Water heaters are retired from the stock according to a survival function, with the average (50%) life of the different categories of water heaters ranging from 12 to 20 years.
Projection period	Impacts have been modelled to 2060 (to capture the ongoing energy savings of the installed stock to 2040).
Industry costs	All incremental capital/development costs are assumed to be passed on to consumers
Product prices	Australia: Retail product prices were used New Zealand: Wholesale product prices were used It is assumed that a PE ratio of 0.2 is applied for increased HPWH costs due to the MEPS and testing requirements. For Option 3, the incremental cost difference from installing and purchasing HPWH compared to low-efficiency electric and gas water heaters is used.
Registration administration costs and compliance costs	• Government administration costs are made up of salary, program administration and check testing • Industry administration costs made up of time to complete registration, registration fees (Australia only), testing of products. • Cost savings are included due to reduced State government scheme implementation costs and industry testing costs
Energy consumption and prices	• Historic and future trends in energy efficiency for water heaters is based on the trends found by analysing registration data, CER data and New Zealand EECA data over the last 25 years. • The stock model used contains information on the numbers, categories, efficiency and energy consumption of water heaters. Energy consumption estimates for the BAU baseline are established, and then the energy consumption under different policy options are calculated and compared to the BAU consumption. • Products are retired from the stock according to a survival function which includes some early breakdowns, most water heaters retiring around the average and some water heaters having an extended life. • Energy prices used are: o Australia: based on ACIL Allen modelling for each state/territory for electricity and the Australian Energy Regulator for natural gas (AER, 2024). o New Zealand: based on long-run marginal electricity cost and the wholesale natural gas price as advised by EECA, Feb 2025

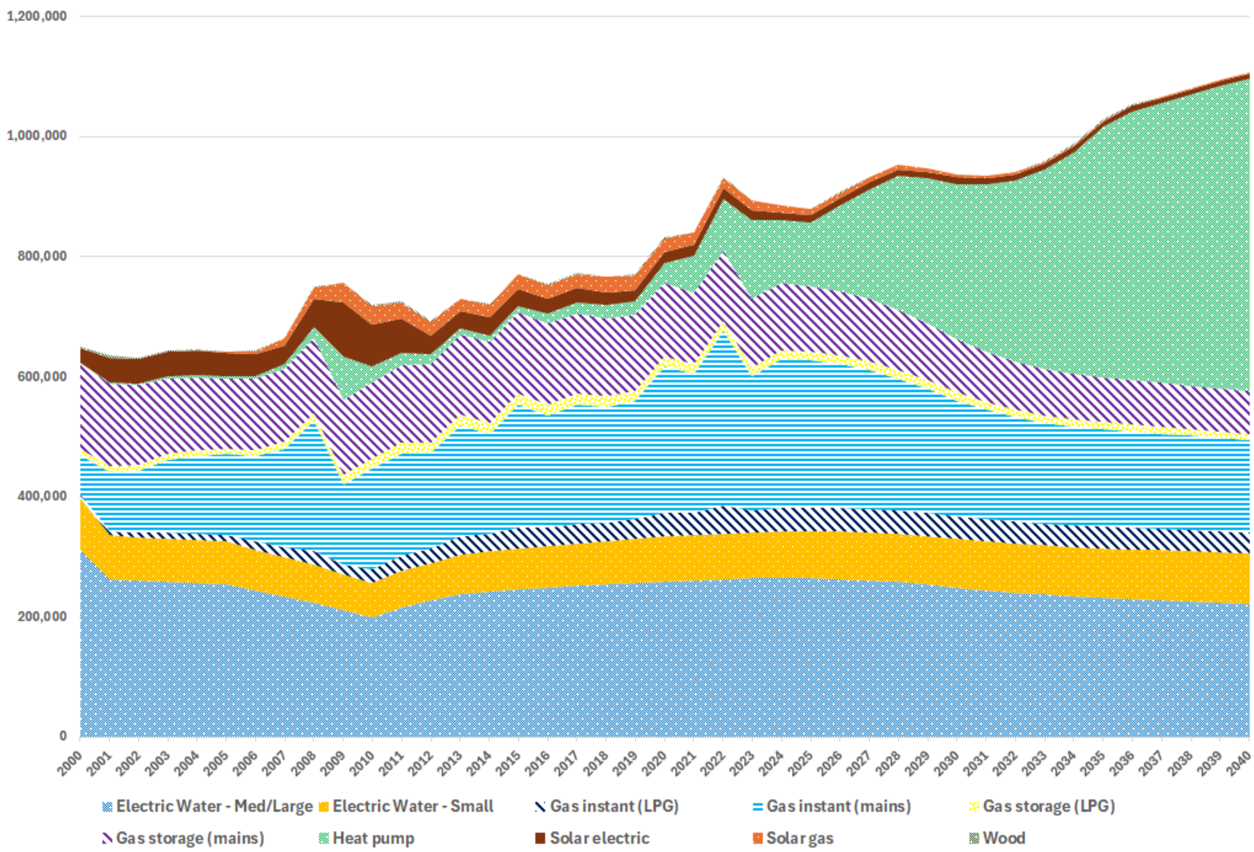
Assumptions	Parameters
GHG emissions	GHG emissions have been accounted for as CO_2 equivalent units (CO_2-e), see Table 25 • **Australia:** Projected factors from 2025 to 2040 - (DCCEEW, 2024) by state and assumed to decline to close to zero from 2040 to 2050. • **New Zealand:** as advised by EECA Feb 2025.
Sensitivity analysis (NPV)	**Australia:** 7% real discount rate, with sensitivity tests at 0%, 3% and 10%. **New Zealand:** 2% real discount rate, with sensitivity tests at 0%, 1% and 8%.
Key assumptions	• Reduction in energy use is due to new policy options described above. • GHG abatements have been estimated and the financial/economic benefits of lower levels of greenhouse gas emissions have been quantified in the analysis, with sensitivity analysis conducted.

Calculation of sales and stock

Australian Sales

Sales are based on a range of sources for water heaters in Australia, and utilise the CER installation data for HPWH and other solar water heaters (CER, 2025a). The residential baseline study (RBS) provides comprehensive data for water heaters (EnergyConsult, 2021) and the hot water module was updated in 2025 for this CRIS to assess the impacts of the potential policy options (RBS2.5, 2025). The BAU sales of water heaters by category for Australia is shown in Figure 11. Historical sales are estimated to 2024 (from a range of sources, including CER, trade data, industry estimates) and forecast from 2025 to 2040, based on a range of factors, including current market trends, current government policy (including the June 2025 Victorian government announcement related to gas hot water heaters (Victorian Government, 2025)) and incentives.

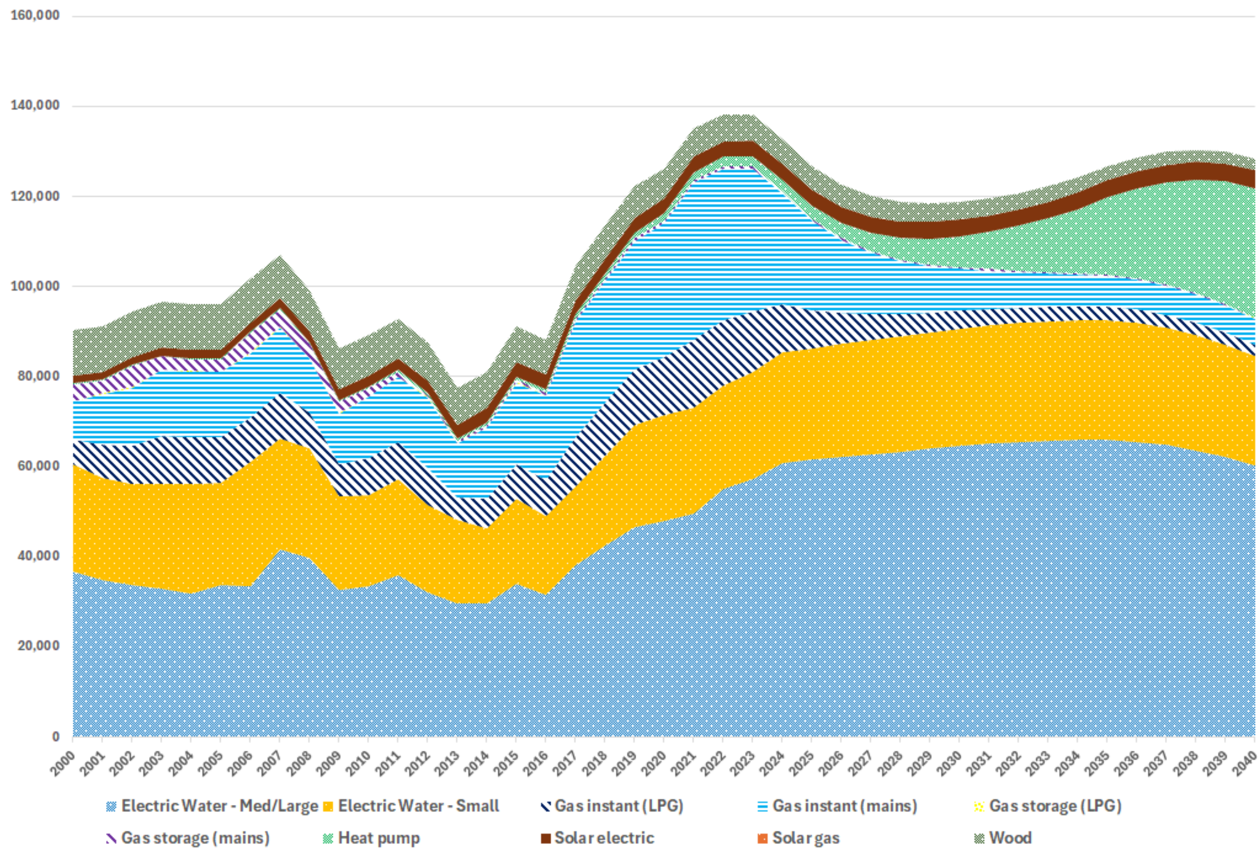
Figure 11: Annual sales of water heaters by category – historical to 2024 and projected to 2040, Australia



New Zealand Sales

Sales of water heaters by category are based on the updated RBS water heater module for New Zealand (RBS2.5, 2025). In New Zealand, sales of electric and gas water heaters are reported to EECA by suppliers as part of the regulations for MEPS. Historical sales are estimated to 2024 and forecast from 2025 to 2040, based on a range of factors, including current market trends and government policy. Figure 12 shows the annual sales for the BAU (Option 1).

Figure 12: Annual sales of water heaters by category – historical to 2024 and projected to 2040, New Zealand



Stock and energy modelling approach

The calculation of stock and energy consumption utilises the RBS water heater module, which is described in the 2015 RBS (EnergyConsult, 2015a), updated to 2025 with current information. The RBS uses standard engineering calculations to provide the energy consumption for each water heater product category (EnergyConsult, 2015b), and is represented by the following simplified formula:

*Total Energy Consumed = Stock Numbers * Unit Energy Consumption (UEC)*.

The next aspect of the energy modelling is determining the Unit Energy Consumption (UEC) value for each end-use product to be used in the residential energy end-use model based on engineering formula. On a simplified level, UEC is determined by:

*UEC = Usage * Unit Efficiency.*

The key assumptions and calculations include:

- Sales and stock modelling for each category based on life of equipment and validated with ownership data from ABS, New Zealand statistics and market research (Oxford Economics, 2024)
- Energy consumption calculations for each product type, based on hot water usage and energy efficiency from MEPS registration data, EECA sales data or CER data to 2024.
- Projected changes in BAU efficiency based on market trends, CER data and MEPS registration data

Calculation of energy consumption for HPWH is based on the average efficiency of products installed and recorded by the CER (CER, 2025a), using savings factors simulated under AS/NZS 4234 for each climate zone. The sales weighted average efficiency for each zone is shown in Figure 13. It shows that average efficiency is increasing to 2021, then remaining relatively flat from 2022 to 2024. The vast majority of installations of HPWH are in zone 3 and 4, as shown in Figure 14.

Figure 13: Average energy savings factor of HPWH by zone - Australia

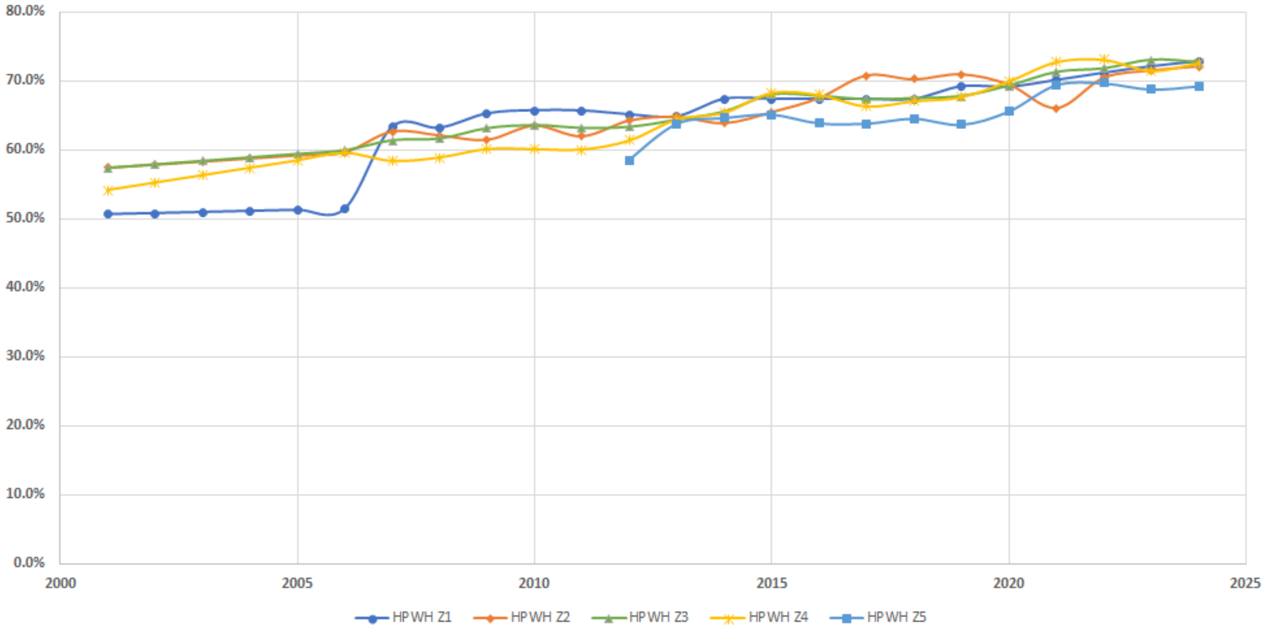
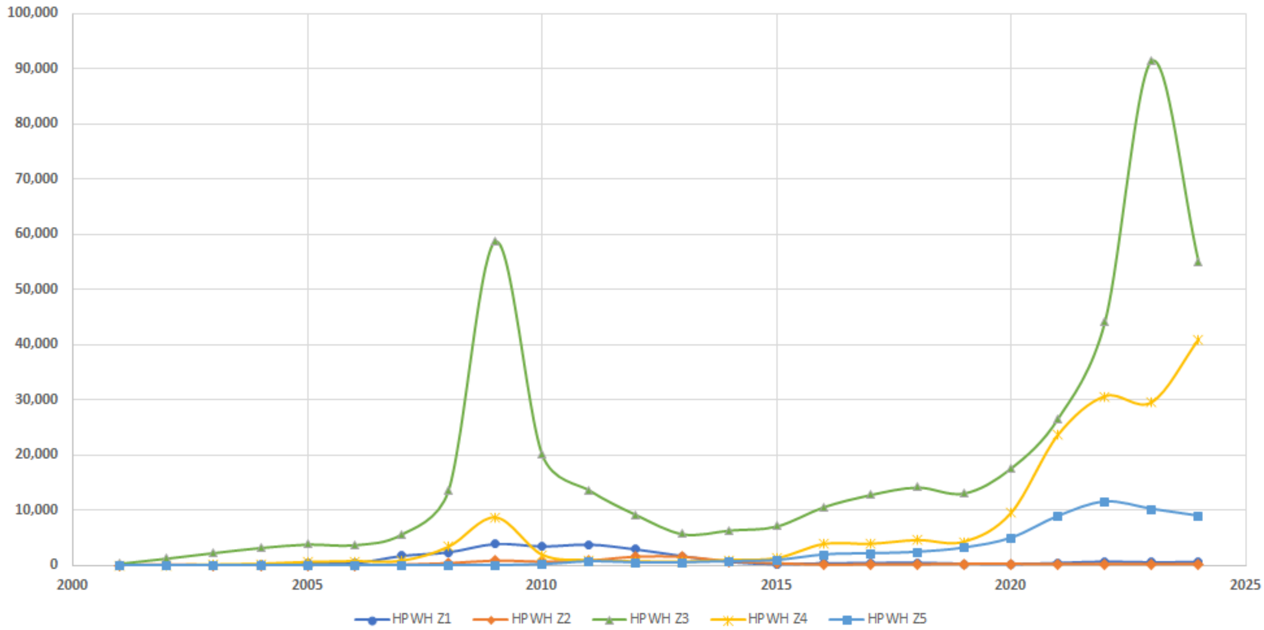


Figure 14: Installations of HPWH by Zone - Australia



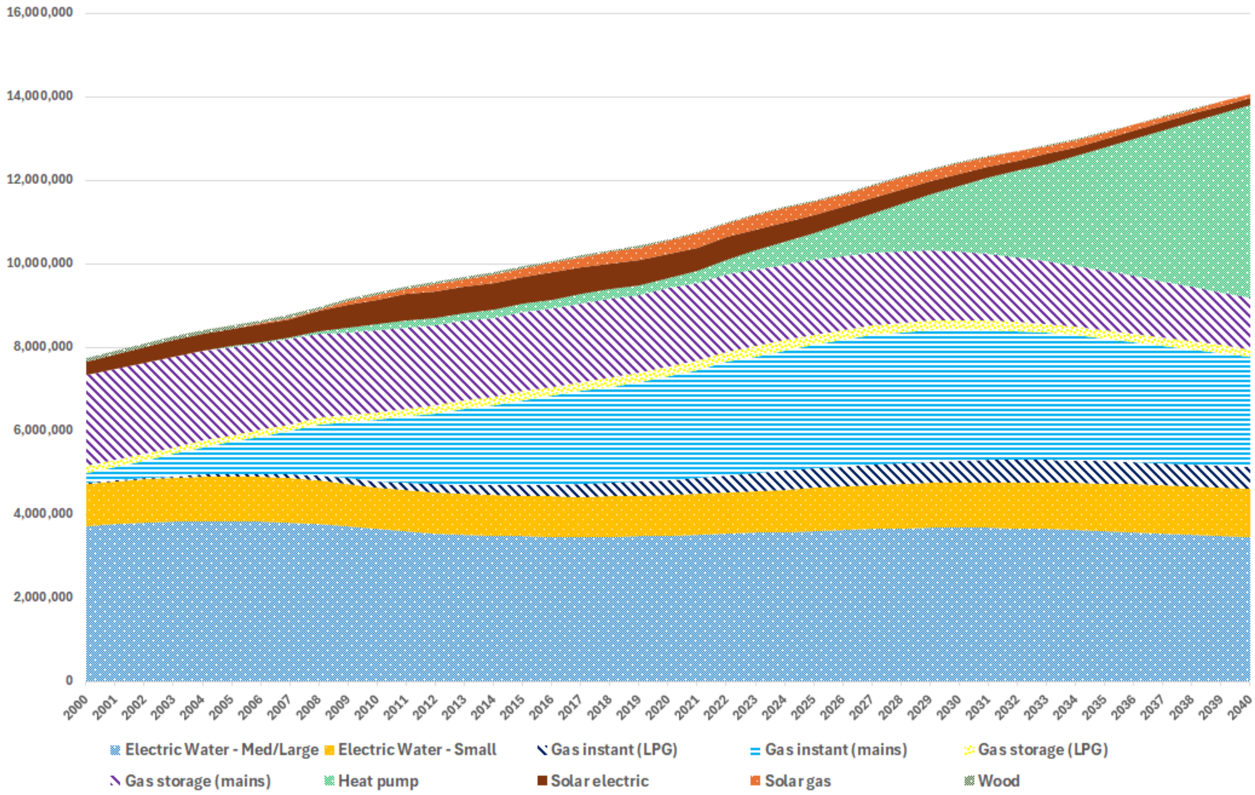
For New Zealand, the majority of the hot water heater product category data was obtained by analysis of the EECA sales data for each product category. The sales of HPWH are estimated and are much lower than Australia.

It should be noted that New Zealand ESWHs are categorised into small, medium and large using different size ranges compared to Australia.

Stock

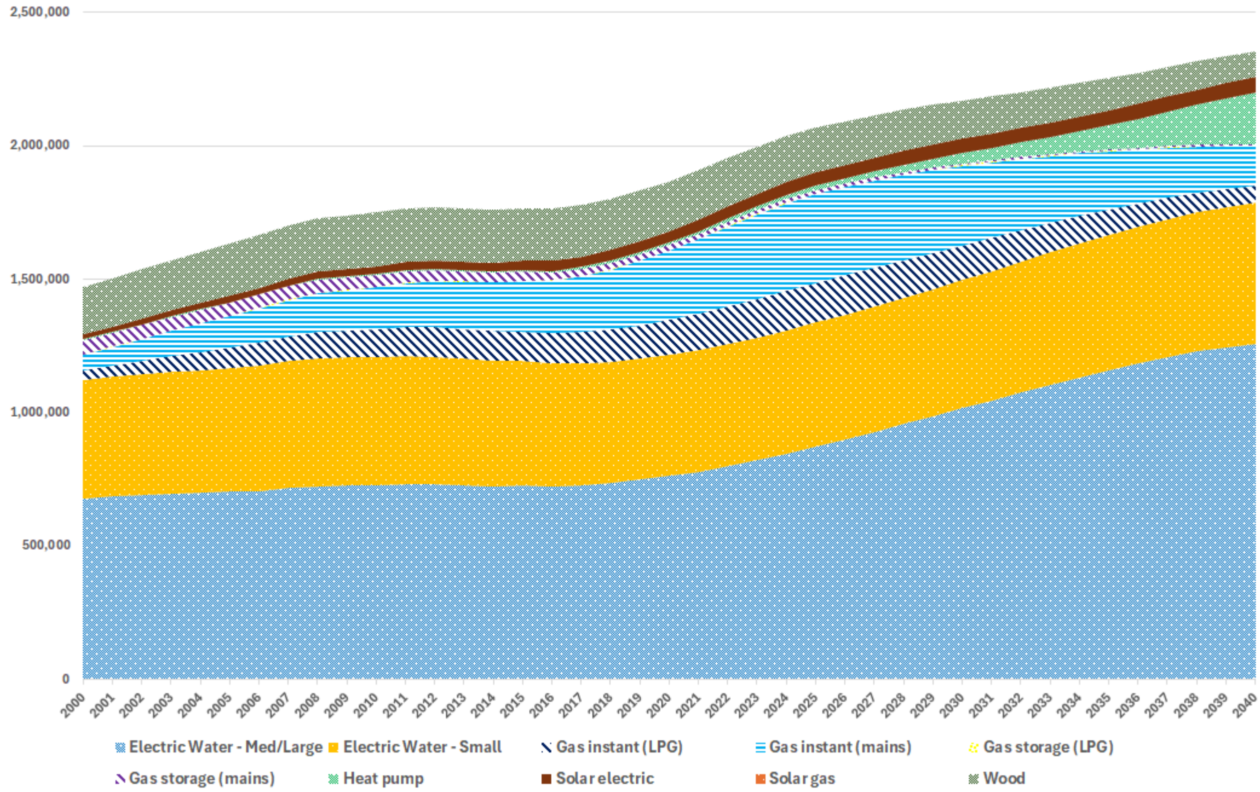
For Australia, the historical estimated and projected BAU stock is shown in Figure 15.

Figure 15: Stock of water heaters by category – historical to 2024 and projected to 2040, Australia



For New Zealand, the historical and projected BAU stock is shown in Figure 16.

Figure 16: Stock of water heaters by category – historical to 2024 and projected to 2040, New Zealand



Energy Consumption

The RBS model provides outputs of energy consumption by product categories for both Australia and New Zealand in the BAU option. Figure 17 shows the total energy consumption (TJ) of water heaters by category – historical to 2024 and projected to 2040, for Australia. Figure 18 shows the total energy consumption (TJ) of water heaters by category – historical to 2024 and projected to 2040, for New Zealand.

Figure 17: Total BAU energy consumption of water heaters by category – historical to 2024 and projected to 2040, Australia

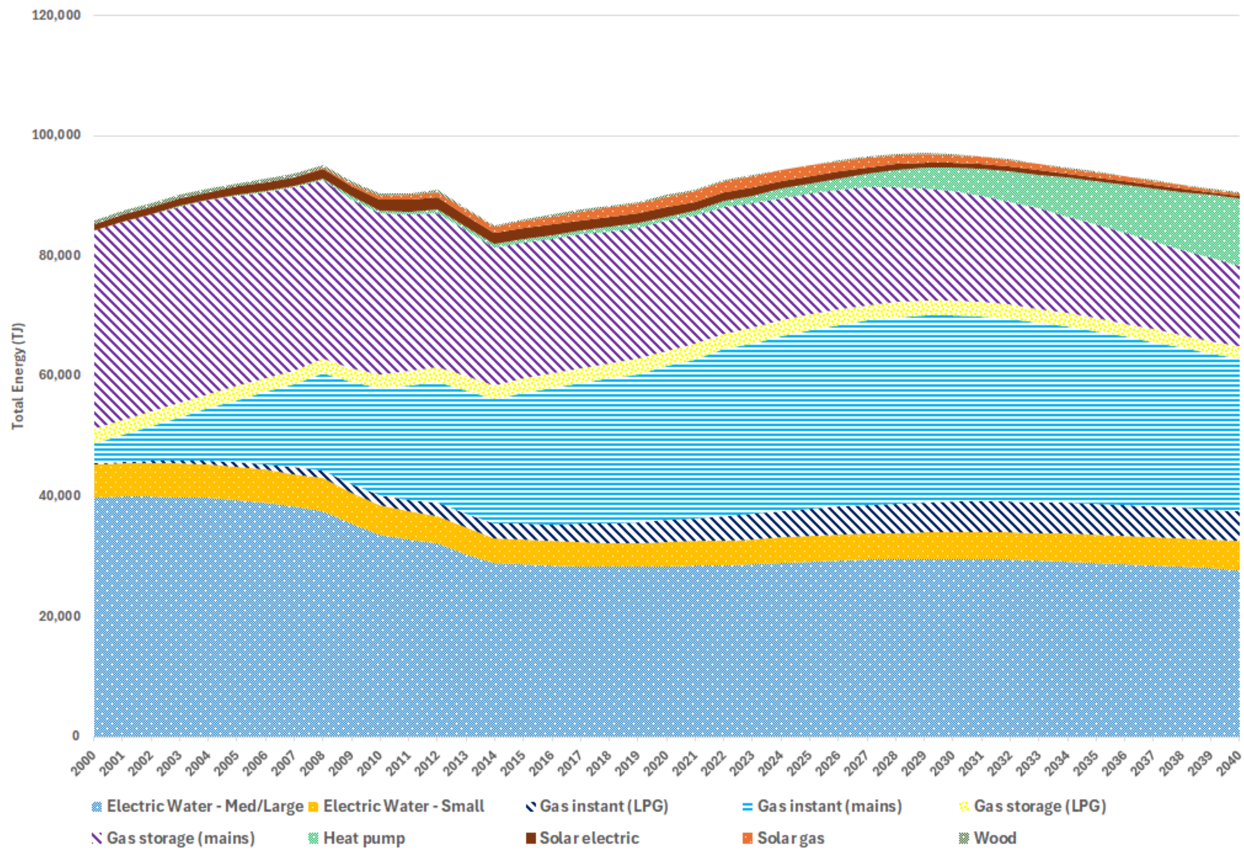
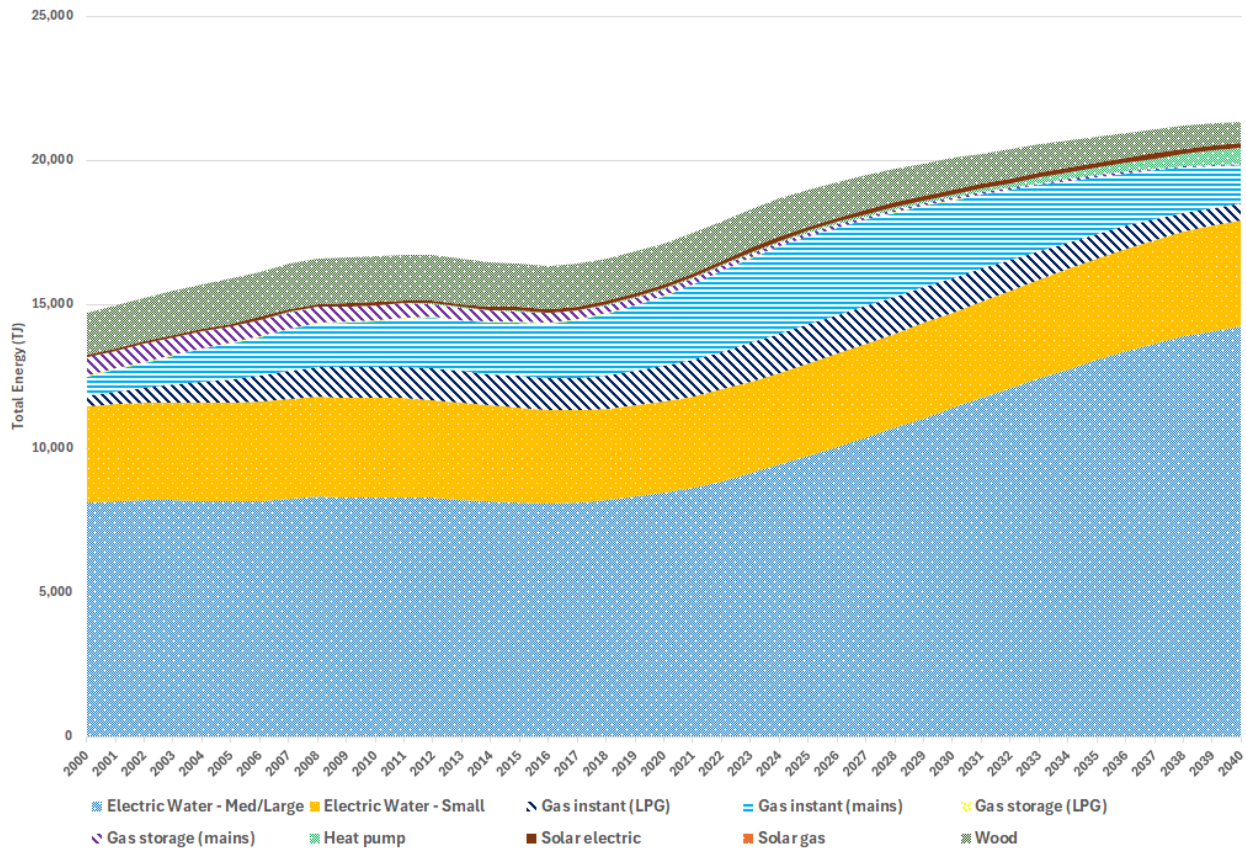


Figure 18: Total BAU energy consumption of water heaters by category – historical to 2024 and projected to 2040, New Zealand



Cost Benefit Analysis parameters

In terms of an approach for the CBA, it is necessary to do this from either a consumer or societal perspective. The consumer or private approach is chosen as the basis for the CBA and aligns with the approach used in recent RISs for assessing the benefits and costs of energy efficiency policy measures, including the commercial building energy efficiency provisions in the 2025 National Construction Code (NCC)[22], the RIS for MEPS and other measures for Commercial Ice Makers[23] and RIS: Televisions, computer monitors and digital signage displays[24].

The New Zealand Government requires that electricity savings are based on long run marginal cost (LRMC), rather than marginal retail energy prices, with financial benefits associated with greenhouse gas abatement and avoided or delayed infrastructure investment also included in the benefits. Resource (or manufacturing) costs should be used for the product costs. As these are not available, the wholesale price

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[22] CIE 2024, *Increasing the stringency of the commercial building energy efficiency provisions in the 2025 National Construction Code, Consultation Regulation Impact Statement,* Prepared for the Australian Building Codes Board April 2024, by the Centre for International Economics.

[23] E3 2023, *Regulation Impact Statement for Consultation: MEPS and other measures for Commercial Ice Makers*, May 2023.

[24] DCCEEW 2023, *Consultation Regulatory Impact Statement: Televisions, computer monitors and digital signage displays*, May 2023

has been used in this CBA. These prices are higher than manufacturing cost, and therefore the CBA presents a conservative assessment of the impact of the policy options.

All Net Present Value (NPV) figures are real 2025 dollars. NPV is a calculation that allows decision makers to compare the costs and benefits of various alternatives on a similar time scale by converting all options to current dollar figures. New Zealand values are shown in New Zealand dollars, calculated with an exchange rate of 1.087 New Zealand dollars to Australian dollars where necessary.

Timeframe and discount rates

It is assumed that Option 2 will be introduced in 2026 and Option 3 in 2028, with the expected date for calculating impacts beginning in 2027 and 2029 respectively. The modelling period is from 2025 to 2040, with the projected benefits of installed stock included till 2060.

All the outputs in the cost-benefit analysis were assessed in Australia at a 7% discount rate, with sensitivity tests at 0%, 3% and 10%. For New Zealand a 2% discount rate is used, with sensitivity tests at 0%, 1% and 8%.

Energy prices

The electricity prices and forecasts used in the modelling are taken from documented research:

- In Australia the 2025 energy prices are sourced from Default offers or published tariffs in jurisdictions that regulate the prices. The variable component only is used. They are then projected to 2050 by applying an index from variable component of residential prices (using 2025 as the base) prepared by ACIL Allen for the *Regulation Impact Statement for Consultation: Improved energy efficiency of Portable Air Conditioners*.
- In New Zealand electricity prices are the long-range marginal cost provided by the Energy Efficiency and Conservation Authority.

The gas prices and forecasts used in the modelling are calculated as follows:

- In Australia natural gas prices are based on the variable component of residential gas median market price from the Australian Energy Regulator (AER, 2024), and forecast to 2057 using the price index from the AEMO 2025 Gas Statement of Opportunities (ACIL Allen, 2024). LPG prices are based on current bottle gas price of $180 per 45kg.
- In New Zealand natural gas prices are valued at the wholesale price (industrial price of 4.15 c/MJ) and the current LPG price of $175 per 45kg bottle.

The energy prices used for the CBA are shown in Appendix D – Energy Prices and GHG Emission Factors.

Greenhouse gas emission factors

The GHG emission factors and forecasts used in the modelling are taken from *Australia's emissions projections 2024* (DCCEEW, 2024), with the Australian factors assumed to decline to close to zero over the period from 2040 to 2050. The New Zealand factors are sourced from EECA in 2025 and based on the scenarios produced by the *Climate Change Commission's 2021 Final Advice* (New Zealand Climate Change Commission, 2021).

The greenhouse gas emission factors used for the CBA are shown in Appendix D – Energy Prices and GHG Emission Factors.

Value of greenhouse gas emissions avoided

The benefits include a value for the reduction of Greenhouse Gas Emissions in accordance with CBA methodologies. The emissions reduction value is calculated by multiplying the carbon reduction by the carbon price in each year. For Australia, the carbon price ranges from $70/tonne in 2024 to $420/tonne in 2050 (AUD real), (AEMC, 2024), and in New Zealand, the carbon price ranges from $120/tonne in 2025 to $321/tonne in 2050 (New Zealand Treasury, 2025) (NZD real, central scenario).

Sensitivity tests are undertaken as follows:

Australia: Zero, and 50% lower and 50% higher than the central carbon price.
New Zealand: Zero, low and high recommended emission values.

Policy Parameters and Inputs

Policy impact inputs

The modelling of the policy options assumes the following impacts of the proposed policy on efficiency and uptake/installation of water heater products (compared to the BAU or Option 1):

Option 2: MEPS

- average efficiency increase of 2% above BAU efficiency from 2027
- HPWH replace 2% of low-efficiency electric and gas water heaters from 2027

The average increase in efficiency for Option 2 assumes the regulations will enable installations to be correctly sized and control settings more appropriately suited to consumer situations, increasing the efficiency of HPWH installed. The increase in replacements of low-efficiency electric and gas water heaters with HPWH is the result of increased consumer confidence to move to a HPWH, and for installers to recommend them.

Option 3: MEPS and mandatory information

- includes the increase in HPWH average efficiency from Option 2
- HPWH replace 15% of low-efficiency electric and gas water heaters sales. This replacement rate is modelled to occur slowly, from 2% in 2028 to 15% in 2038 compared to the BAU. This represents a shift in the sales from low-efficiency electric and gas water heaters to HPWH.

The increase in replacements of low-efficiency electric and gas water heaters with HPWH from Option 3 is the result of a proportion of consumers and intermediaries utilising the mandatory information to make informed choices. The value of 15% in 2038 is supported by a research project the NSW Office of Energy and Climate Change (OECC) undertook in 2022 called the Hot Water Discrete Choice Experiment. The project researched consumer preference and needs for hot water systems (Callosum Consulting, 2022). The report found that the willingness for consumers to pay for Hot Water System energy savings is high if they are adequately presented with information about energy use, energy efficiency and operating costs. It found that on average, when presented with supporting information, between 30% and 50% of consumers chose a HPWH to replace their gas instantaneous/storage water heater or ESWH. In New Zealand, the research found that, between 50% and 75% of consumers chose a HPWH to replace their gas instantaneous/storage water heater or ESWH. The 15% replacement rate used for the modelling is under half the rate found in the NSW research for Australia, and a third for New Zealand.

In addition, government programs and regulations can confidently promote the performance of HPWH in comparison with low-efficiency water heaters. The program administrators of the VEU and ESS have noted that providing greater mandatory information will assist with reducing consumer complaints and reduce the risks of poor performance or inadequate how water delivery.

Cost inputs

The evaluation of the costs and benefits of the policy options includes the following values.

Incremental equipment costs

A key input for the modelling of the costs of the proposed policy options is the impact of the options on the price of the product to the buyer. The assumption used in the modelling is that more efficient equipment is more expensive than a similar performing product with lower efficiency. This approach has been used for past RISs to determine the relative costs of the efficiency improvements due to the policy options modelled.

Option 2: MEPS:

The modelling uses the price efficiency (PE) ratio to assess the cost impacts of the policy option, such as every 1% increase in the average efficiency of the products being sold/installed the average price increases by 1.0% (a PE ratio of 1.0). For the evaluation of the cost increase due to the MEPS and Appendix H of AS/NZS 5125.1, it is assumed that suppliers will incur minor additional product costs such as modifying control strategies, system tank sizes and thermal performance modelling. An assumed PE ratio of 0.2 is used to represent these additional costs.

Option 3: MEPS and mandatory information:

For Option 3, the costs are calculated as the incremental increase in capital and installation costs of the HPWH compared to the low efficiency gas and electric water heaters. The costs used in the CBA are shown in Table 20.

Table 20: Purchase and installation costs for the main categories of water heaters

Category	Purchase and installation costs – Australia (AUD)	Purchase and installation costs – New Zealand (NZD)
ESWH Med	1800	3000
ESWH Large	2300	3400
GIWH – NG and LPG	1800	2935
GSWH - NG and LPG	2200	3590
HPWH	4200	6850

Government costs

The costs to government are shown in Table 21. For both policy options there is an assumed establishment cost to government, which includes research, consultation, analysis and revisions to the Australian and New Zealand legislation/implementation procedures. Ongoing annual costs are estimated to total $250,000 per year for Option 2 and $400,000 for Option 3.

Table 21: Government costs for policy options

Item	Option 2	Option 3
Establishment (Once Off)	$300,000	Included in Option 2
Administration of Program/Yr	$100,000	Included in Option 2
Random Check/Testing/Yr	$100,000	Included in Option 2
Consumer Information/Education/Yr	$50,000	$150,000

Cost savings for the NSW and Victorian State governments are expected to occur after 2028, when it is assumed that the ESS and VEU will utilise the Energy Rating Product Database for determining eligible products and calculating estimated savings per product. These cost savings are made up of reduced program administration, auditing/compliance and policy research. These savings are estimated to be $250,000 per year and are net of the fees charged by the VEU to register products.

Business costs

The costs to business are shown in Table 22. These costs apply to both policy options, and assume the staff costs are valued at $85 per hour. It is assumed that in the first year there will be 300 models registered, and 50 models registered every subsequent year.

Table 22: Estimated business compliance costs for policy options

Item	Inputs (hours)	Total $/Year/business	$/model registered
Education- Train staff, keep up-to-date with regulations	80	$6,814	$1,136
Record Keeping -Maintain documents for 5yrs	8	$818	$681
Permission -Test product in laboratory (Appendix H of AS/NZS 5125.1)			$20,000
Permission - Complete MEPS registration	2		$170
	Inputs (other)		
Share of registrations in NZ	20%		
Permission - Registration Fee (Band 3) AU only	$670		$670

For Option 3, it is estimated that businesses will incur an additional $5,000 per model to make the mandatory information available on product specifications and brochures.

Businesses are expected to also reduce costs associated with the VEU and ESS. These savings are assumed to occur from 2028, and include:

- Testing to the existing AS/NZS 5125.1 = $15,000 per model
- Registration fee for VEU = $500 per model
- Administration for VEU applications = $340 per model (4 hours staff time)

Appendix C – Summary of Government Incentive Schemes and Regulations related to HPWHs

Australia

State/Territory governments and the Federal Government are influencing the market for HPWH in Australia by offering incentives for installation of HPWH, both direct via rebates/loans and indirect by energy efficiency/GHG certificates. There are also regulations related to the installation of water heaters in new homes that encourage HPWH to be installed, and planning laws that prohibit the use of gas in new building developments. In addition, State/Federal governments are upgrading social housing (i.e., public houses that are owned by the State government) with HPWH as part of energy efficiency upgrades.

Direct Rebates

Victoria – Solar Homes Program

The Solar Homes hot water rebate provides rebates via authorised hot water retailer and eligible products of a 50% rebate on the purchase price of the system, up to the value of $1,000 (or up to $1,400 for locally made products), for the replacement of existing hot water systems (hot water system to be replaced is at least 3 years old from the date of purchase). All HPWH on the eligible products list:

- are registered as being tested for energy consumption performance in accordance with AS/NZS 4234:2021 under the Victorian Energy Upgrades program;
- contain only low Global Warming Potential (GWP) refrigerants, i.e. below 700; and
- have an end-user configurable integrated timer located on the outside of the unit, or one that can be connected to a solar PV system to run the hot water during periods of solar generation.

The Solar Homes rebate can be combined with the other financial incentives available, including STCs, and VEECs (from the Victorian Energy Upgrades program) where either an electric storage water heater or a gas water heater is replaced. This can result in a significant financial incentive for households to switch from electric storage or gas to a heat pump water heater.

See [Hot water rebate information — Solar Victoria]

ACT - Home Energy Support Program

The ACT Government's Home Energy Support Program offers rebates of up to $5,000 for eligible homeowners to install energy-efficient products, including heat pump hot water systems. The rebate covers 50% of the total cost for the supply and installation of HPWH, up to $2,500.

This initiative is part of the ACT's commitment to achieving net zero emissions by 2045 and transitioning away from fossil fuel gas. The program helps households reduce energy bills and switch to more sustainable options.

Eligible homeowners can also combine the rebate with a zero-interest loan of up to $10,000 through the ACT Government's Sustainable Household Scheme to cover remaining costs.

Also offers rebates to concession card holders of 50% of the total installation price of HPWH, up to a maximum rebate of $2,500.

See [Home energy support rebates for homeowners — ACT Government]

Indirect Scheme Incentives

Victoria – Victorian Energy Upgrades

The Victorian Energy Upgrades (VEU) program utilises Victorian Energy Efficiency Certificates (VEECs), which are issued by accredited providers for energy efficiency upgrades. These certificates provide a discount to consumers who install equipment or complete a VEU activity. The accredited providers sell the VEECs to energy retailers, who use them to meet the annual emissions reduction targets set by the Victorian Government.

The categories of incentives available for water heating upgrades are:

- Replace inefficient electric hot water system with HPWH
- Replace inefficient gas hot water heater with HPWH

Homeowners and businesses may receive discounts of $560 – $630, depending on the price of VEECs and the characteristics of the eligible HPWH. As noted above, this can be combined with incentives from rebates and STCs.

See [Hot water system discounts — Victorian Energy Upgrades]

NSW – Energy Saving Scheme

The Energy Saving Scheme (ESS) is a certificate scheme to encourage end user energy efficiency upgrades. Under the Energy Savings Scheme Rule, the Government sets targets for energy retailers and large energy users. These targets are met by creating or buying Energy Savings Certificates (ESC). Energy Savings Certificates are created for eligible activities that reduce energy usage, such as installing energy-efficient appliances.

Unlike a rebate, the discount on the installation costs of the HPWH system is provided as an incentive. The incentive is paid directly by an accredited supplier, known as an Accredited Certificate Provider (ACP), who will pass on the discount to the consumer purchasing the HPWH.

In NSW, an incentive of between $190 and $670 is available when replacing an electric or gas water heater with a HPWH. Once accredited supplier and the relevant HPWH have been chosen, the accredited supplier will provide a nomination form to complete before any work begins. The form must be signed and completed in order to receive the rebate.

See [Upgrade your hot water — NSW Government, NSW Climate and Energy Action]

ACT – Energy Efficiency Improvement Scheme

The Energy Efficiency Improvement Scheme (EEIS) requires electricity retailers in the ACT to help households and small-to-medium businesses achieve energy savings. The Scheme was established under the Energy Efficiency (Cost of Living) Improvement Act 2012 (the Act) and came into effect on 1 January 2013.

The average incentive to ActewAGL customers reported by the Scheme was around $850 for a heat pump hot water system.

South Australia – Retailer Energy Productivity Scheme (REPS)

REPS is a South Australian government initiative that supports households and businesses to reduce their energy costs while also maximising the benefits to South Australia's power system to deliver a smarter, more affordable, reliable and sustainable energy future for all South Australians.

The objective of the REPS is to 'improve energy productivity for households, businesses and the broader energy system, with a focus on low-income households. This will reduce energy costs and greenhouse gas emissions.'

Energy retailers have REPS productivity targets (expressed in normalised gigajoules of energy) to meet under REPS, which can be achieved by delivering eligible energy productivity activities to homes and businesses. The Minister determines the form of these activities, and the retailers decide what activities and incentives they will offer to customers. This may include a discount on services, free products or products up to a certain value, a cash rebate, vouchers etc.

One of the eligible activities is the WH1 activity – Replace or Replace or Upgrade Water Heater: Residential and Small Energy Consuming Customers Only. Heat pump hot water heaters can be installed under this activity. The specification for this activity incentivises retailers to offer this installation to REPS customers, by awarding a proportionally higher number of REPS gigajoules than 5 or 6 star rated gas water heaters.

See Water Heater Upgrade or Replacement Specification (WH1, PDF) — South Australia Department for Energy and Mining

Social Housing upgrades

State and Territory governments have been undertaking energy efficiency upgrades to social housing for several years. Some of these programs have included the replacement of low-efficiency water heaters with HPWH.

The Federal government has expanded many of these programs with the **Social Housing Energy Performance Initiative.**

The Social Housing Energy Performance Initiative (SHEPI), with a $300 million investment, aims to upgrade up to 100,000 social housing homes to improve energy efficiency, reduce energy bills, and enhance comfort for residents. The initiative focuses on a range of upgrades, including thermal shell improvements, installation of energy-efficient appliances such as heat pump water heaters (HPWH), ovens, and cooktops, and solar systems.

This initiative is co-funded with state and territory governments, ensuring upgrades are tailored to local climates.

Key upgrade types include:

- **Thermal shell** improvements (shading and insulation)
- **Energy-efficient appliances** (HPWH, ovens, cooktops)
- **Solar systems** (panels and batteries)

The initiative is rolling out over four years and is part of the $1.7 billion Energy Savings Package from the 2023-24 Budget. Agreements have been made with most states and territories, each with different funding and plans:

- **Queensland**: $116 million ($58 million from the Australian Government) to upgrade around 32,000 homes (including thermal shell, appliances, and solar systems). Details of the Funding Agreement are at: QLD SHEPI Funding Agreement.
- **New South Wales**: $175 million ($87.5 million from the Australian Government) to upgrade approximately 24,000 homes by June 2027 (including solar systems, reverse-cycle air conditioners, heat pump water heaters, LED lighting, ceiling fans, window shading, insulation, and draught-proofing). Details of the Funding Agreement are at: NSW SHEPI Funding Agreement.
- **Australian Capital Territory**: $14.4 million ($7.2 million from the Australian Government) to upgrade around 5,000 homes (including thermal shell and appliances). Details of the Funding Agreement are at: ACT SHEPI Funding Agreement.
- **Victoria**: $92 million ($46 million from the Australian Government) to upgrade around 5,000 homes (including thermal shell, appliances, and solar systems). Details of the Funding Agreement are at: VIC SHEPI Funding Agreement.
- **South Australia**: 35.8 million ($17.9 million from the Australian Government) to upgrade around 3,500 homes (including thermal shell and appliances). Details of the Funding Agreement are at: SA SHEPI Funding Agreement.
- **Tasmania**: 16.6 million ($8.3 million from the Australian Government) to upgrade around 1,600 homes (including thermal shell and appliances). Details of the Funding Agreement are at: TAS SHEPI Funding Agreement.
- **Northern Territory**: $10 million ($5 million from the Australian Government) to upgrade around 625 homes (including heating and cooling. Details of the Funding Agreement are at: NT SHEPI Funding Agreement.

Regulations, building codes and planning laws

National Construction Code (NCC)

The National Construction Code (NCC) 2022 requirements for new homes and major renovations to be energy efficient and meet '7 star' requirements except in Northern Territory, encourages the installation of high efficiency water heaters. As HPWH are high efficiency water heaters, the NCC is increasing pressure on the market to adopt HPWH. Under the NCC whole of home (WoH) energy requirements, new homes are required to be assessed for the energy efficiency of fixed appliances and systems within the dwelling. This includes heating and cooling equipment, hot water systems, lighting, and pool and spa pumps. Effectively, this requirement means that a solar or heat pump heated water system are likely to be required if rooftop solar PV is not used (ABCB, 2024).

The NCC has two ways of assessing whether new homes will meet WoH energy performance requirements:

Deemed method

- Uses a calculator or set of tables with default HPWH performance characteristics

Calculation method

- Uses NatHERS to rate homes and the WoH energy performance by entering the number of STCs that a HPWH would receive under the SRES.

Victoria

Starting January 1, 2024, new gas connections for new dwellings, apartment buildings, and residential subdivisions requiring planning permits are being phased out. This policy has been implemented through amendment VC250 to the Victoria Planning Provisions and all planning schemes in Victoria.

See Victoria's Gas Substitution Roadmap — Planning Victoria

The Victorian Government has also developed a Regulatory Impact Statement (RIS) exploring options to progressively electrify all new residential and many new commercial buildings, and options requiring gas appliances in existing residential and certain commercial buildings be replaced with electric appliances when the current appliance reaches end-of-life.

See Building electrification engagement — Victoria Department of Energy, Environment and Climate Action

The decision was made in June 2025, and from 1 March 2027, if a gas hot water appliance breaks and cannot be repaired, it must be replaced with an electric alternative.

See Electric and efficiency standards for buildings — Energy Victoria

NSW

NSW residents need a qualified Accredited Service Provider to install or alter their electricity connection. Some local councils have introduced rules around connections.

ACT

The ACT Government has commenced a regulation to prevent new fossil fuel gas network connections in most areas. The regulation stops new sources of emissions from fossil fuel gas use. It is part of a broader plan to phase out fossil fuel energy and electrify Canberra by 2045 : Regulation to prevent new gas connections starts in December - Chief Minister, Treasury and Economic Development Directorate

New Zealand

No incentives are provided for HPWH currently in the NZ market.

Regulations, building codes and planning laws

New Zealand Building Code (NZBC)

NZBC addresses hot water energy efficiency in clause H1: Energy efficiency provisions, as follows:

Systems for the heating, storage, or distribution of hot water to and from *sanitary fixtures* or *sanitary appliances* must, having regard to the energy source used:

(a) limit the energy lost in the heating process; and

(b) be constructed to limit heat losses from storage vessels and from distribution systems; and

(c) be constructed to facilitate the efficient use of hot water.

In August 2020 the New Zealand Building Code was amended, which included the ability for water heaters to be relocated (including from inside to outside) without the need for a building consent. The relocation and new system must still meet the requirements of the building code (MBIE (NZ), 2020). The purpose of this amendment was to reduce cost and time but also enables easier installation of all-in-one HPWH, which often require relocation in New Zealand.

Water heaters (gas and electric storage) need to be compliant with MEPS.

Appendix D – Energy Prices and GHG Emission Factors

Electricity and natural gas prices

Table 23: Residential electricity price projections by region (cents/kWh)

Region /Year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
NSW	34.5	32.6	36.7	39.2	36.6	34.9	33.0	34.5	32.2	34.9	34.8	36.6	38.5	40.3	42.1	43.9
ACT	35.9	33.7	38.5	41.5	38.4	36.4	34.1	35.9	33.1	36.4	36.2	38.4	40.6	42.7	44.9	47.1
NT	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1
QLD	29.2	26.2	23.2	26.7	28.0	27.9	24.4	25.6	25.5	25.1	22.8	27.7	32.7	37.6	42.6	47.5
SA	38.9	33.9	39.4	43.7	41.2	39.4	36.6	38.5	36.5	39.3	42.3	46.7	51.1	55.6	60.0	64.4
TAS	29.1	23.7	23.8	30.9	30.3	27.2	27.6	29.0	27.8	29.5	33.4	35.2	37.0	38.8	40.6	42.4
VIC	30.2	26.5	31.4	37.5	35.8	33.0	30.6	31.7	30.1	32.1	36.3	37.8	39.3	40.8	42.3	43.8
WA	32.4	30.1	29.6	29.8	29.4	30.3	30.6	30.4	31.1	31.0	31.0	30.7	30.7	31.2	31.3	31.4
NZ	9.6	9.2	9.2	9.2	9.2	9.2	9.0	9.0	9.0	9.1	9.1	9.2	9.3	9.4	9.4	9.4

Note: New Zealand electricity price is the long-range marginal cost provided by the Energy Efficiency and Conservation Authority, in NZD
Sources: Australian Energy Regulator, Victorian Essential Services Commission (AER, 2025; ESC, 2025) and State/Territory regulated tariffs, indexed by ACIL-Allen price projections.

Table 24: Residential natural gas price projections by region (cents/MJ)

Region /Year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
NSW	5.0	5.3	4.3	4.4	4.3	4.0	4.0	4.0	3.9	4.2	4.1	4.2	4.2	4.2	4.2	4.4
ACT	4.8	5.0	4.1	4.2	4.1	3.8	3.8	3.8	3.7	4.0	3.9	4.0	4.0	4.0	4.0	4.2
NT	9.4	9.4	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	9.2	9.2	8.9	9.7	9.9
QLD	9.0	9.1	7.9	8.1	8.5	8.1	7.8	7.7	7.7	7.7	7.4	7.5	7.5	6.9	7.4	7.5
SA	8.0	7.8	6.7	7.0	6.8	6.4	6.2	6.2	6.1	6.7	6.4	6.5	6.6	6.6	6.6	6.9
TAS	5.3	5.6	4.8	5.0	4.9	4.6	4.5	4.7	4.7	5.0	4.9	4.9	4.9	4.9	4.9	5.1
VIC	3.9	4.2	3.5	3.7	3.6	3.3	3.3	3.4	3.4	3.7	3.6	3.6	3.6	3.6	3.6	3.8
WA	3.6	3.6	3.7	3.8	3.7	4.1	4.3	4.5	4.9	4.9	4.9	4.9	4.9	5.1	5.2	5.2
NZ	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2

Note: New Zealand natural gas price is the wholesale price (industrial price) provided by the Energy Efficiency and Conservation Authority, in NZD
Sources: Australian Energy Regulator (AER, 2024), and forecast using the price index from the AEMO 2025 Gas Statement of Opportunities (ACIL Allen, 2024)

GHG Emission Factors

Table 25: Electricity greenhouse gas emission factor projections by region (kg CO_2-e/kWh)

Region /Year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
NSW	0.55	0.50	0.43	0.36	0.23	0.16	0.16	0.14	0.09	0.09	0.08	0.07	0.06	0.06	0.06	0.03
ACT	0.55	0.50	0.43	0.36	0.23	0.16	0.16	0.14	0.09	0.09	0.08	0.07	0.06	0.06	0.06	0.03
NT	0.61	0.56	0.47	0.44	0.44	0.43	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.37	0.37	0.37
QLD	0.74	0.67	0.62	0.55	0.37	0.19	0.20	0.15	0.16	0.17	0.14	0.13	0.12	0.11	0.12	0.11
SA	0.24	0.25	0.23	0.23	0.17	0.11	0.09	0.06	0.07	0.07	0.07	0.07	0.06	0.05	0.06	0.06
TAS	0.22	0.21	0.21	0.04	0.04	0.02	0.04	0.04	0.05	0.06	0.01	0.01	0.01	0.01	0.01	0.01
VIC	0.84	0.77	0.75	0.56	0.38	0.27	0.24	0.20	0.20	0.19	0.02	0.02	0.01	0.01	0.01	0.01
WA	0.56	0.53	0.48	0.34	0.26	0.14	0.13	0.14	0.14	0.13	0.13	0.12	0.12	0.12	0.11	0.14
NZ	0.04	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05

Sources *Australia's emissions projections 2024* (DCCEEW, 2024), Table 47 Indirect scope 2 and 3 combined emissions factors in the baseline scenario and for New Zealand provided by the Energy Efficiency and Conservation Authority.

Appendix E – Detailed Information on HPWH Technology

Thermal Performance of HPWH

Air-source heat pump water heaters (HPWH) extract energy from the air surrounding the heat pump and transfer it to the water via a refrigerant cycle, producing hot water. These systems are typically composed of:

- a heat pump (similar to an air conditioner) which uses a refrigerant cycle to transfer energy from the air to the water, including an internal controller for the refrigerant cycle;
- a water storage tank;
- air and water temperature sensors or thermostats;
- optionally an electric resistance element which is typically used to provide heating when the heat pump becomes ineffective (inefficient or unable to operate, such as for low or high air temperatures);
- optionally a water circulation pump; and
- optionally an overall system controller, which may control one or more of the pump, element, and heat pump, depending on inputs from the air and water temperature sensors and a time-clock or timer.

The efficiency (coefficient of performance, COP), capacity and electricity consumption (input power) of HPWH depend strongly on both air (energy source) and water (energy sink) temperatures, as shown in Figure 19 and Figure 20. The range of COPs (or efficiencies) for this example HPWH is 1.9-5.2 (190-520%), while the range of capacities is 1.7-4.3kW. Different refrigerants and product designs will result in different performance curves, but the general trends are similar in most cases. This wide range of variation makes it challenging to compare the performance of products not tested under the same conditions, such as when tested to a different test method, and it is often not possible to extrapolate test results to another condition, particularly if the product may be switching between element and heat pump.

Figure 19: Example HPWH thermal performance curves - capacity

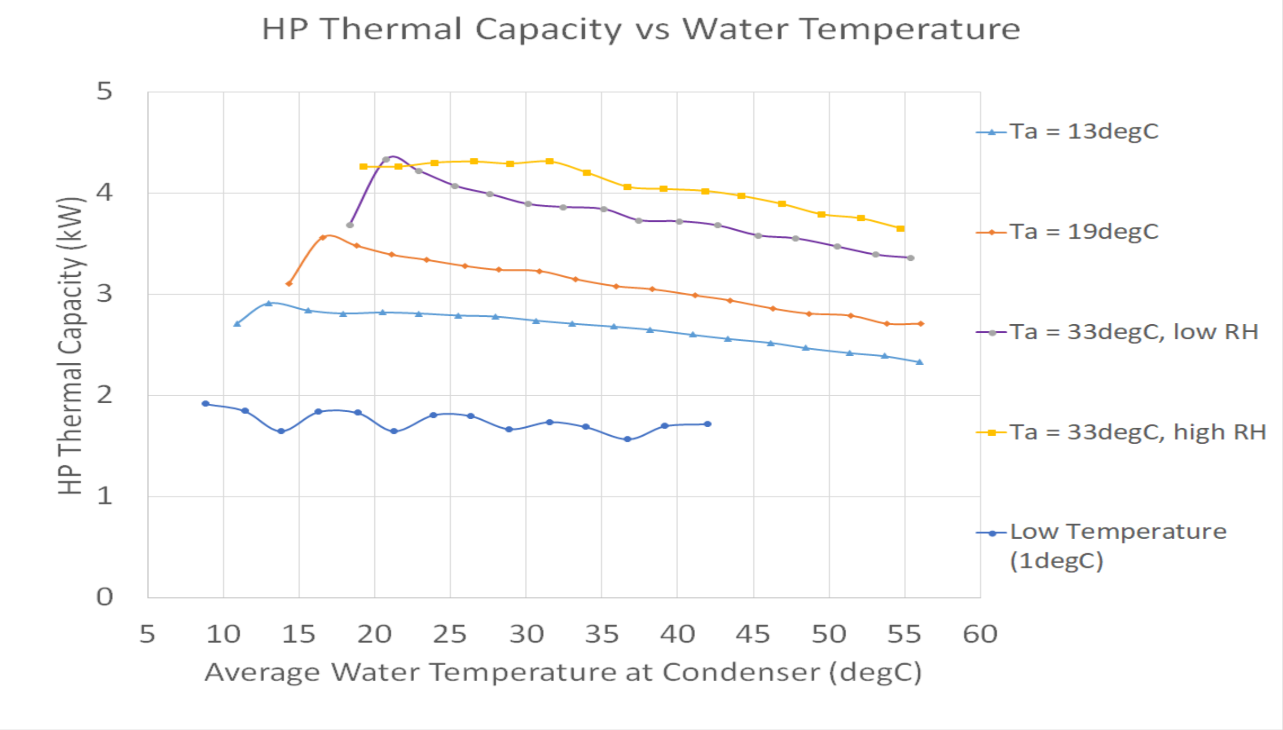
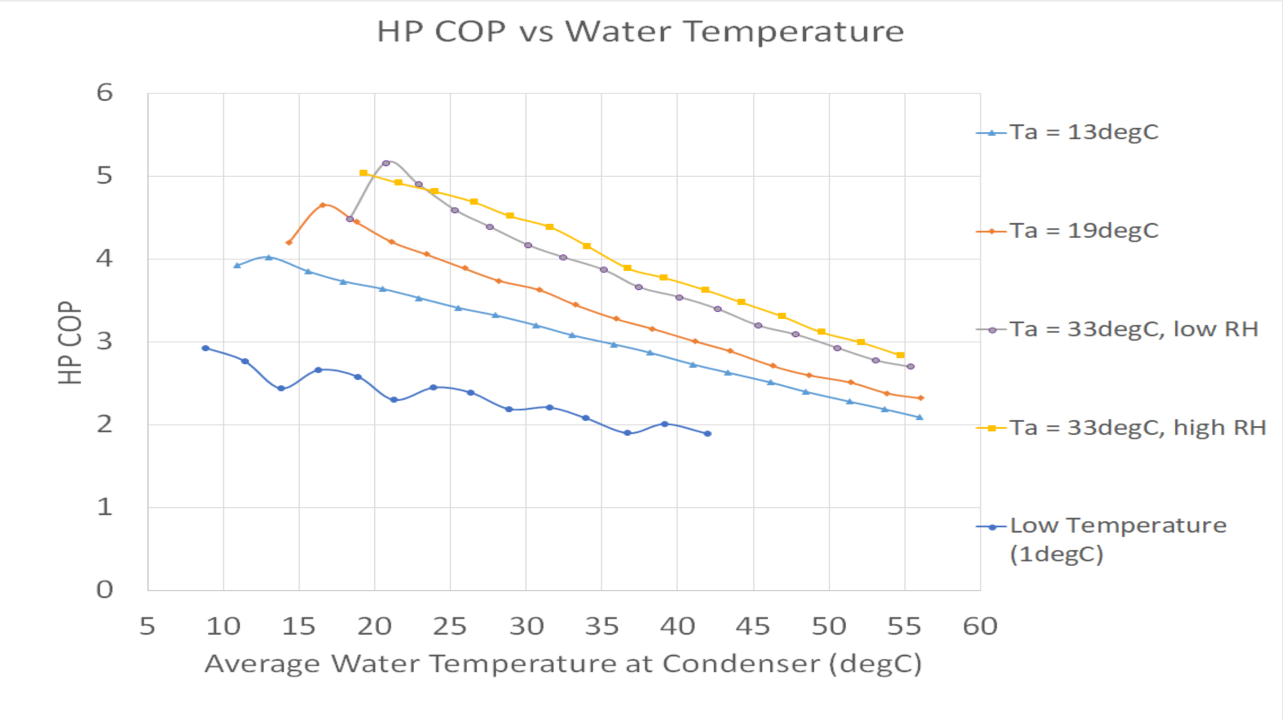


Figure 20: Example HPWH thermal performance curves - COP



Note: Ta = air temperature, which is unusually high for the 13 °C test point (normally <10 °C) due to frosting on the evaporator of this model. This unit is an Integral, Wrap-Around Coil HPWH with a resistive electric element for use at low air temperatures, which was not used during this testing.

The thermal performance of other refrigeration cycle products, such as air conditioners, is also sensitive to operating conditions, however the range of operating temperatures for HPWH is much wider on the water side, requiring different refrigerants and product designs. The colder the air temperature, the harder it is to extract energy from the air, and the more likely that frosting occurs (around zero), reducing capacity and efficiency. Similarly, the hotter the water temperature the harder it is to push energy into the water. Measurement of HPWH thermal performance over a wide-range of conditions, with a focus on colder air temperatures to ensure performance at these higher risk points, is therefore required.

HPWH can deliver hot water very efficiently, however:

- They may not heat the water to as high a temperature as a gas or electric water heater, and therefore do not store as much energy as the same size electric or gas storage water heaters.
- They may not heat the whole tank, particularly when switched to element mode.
- At low ambient temperatures, their capacity can be much lower, taking significantly longer to reheat.
- Their efficiency decreases with low ambient temperatures, and if they switch to element mode.

This may result in less hot water than expected, cooler water than expected and less energy savings than expected (or higher running costs). These challenges can be addressed by ensuring consistent communication of the volume of useful hot water that can be delivered by the product, the time it will take the product to reheat, and how efficiently the product will operate, particularly at lower air temperatures (or what its annual energy use will be, based on a standard load size).

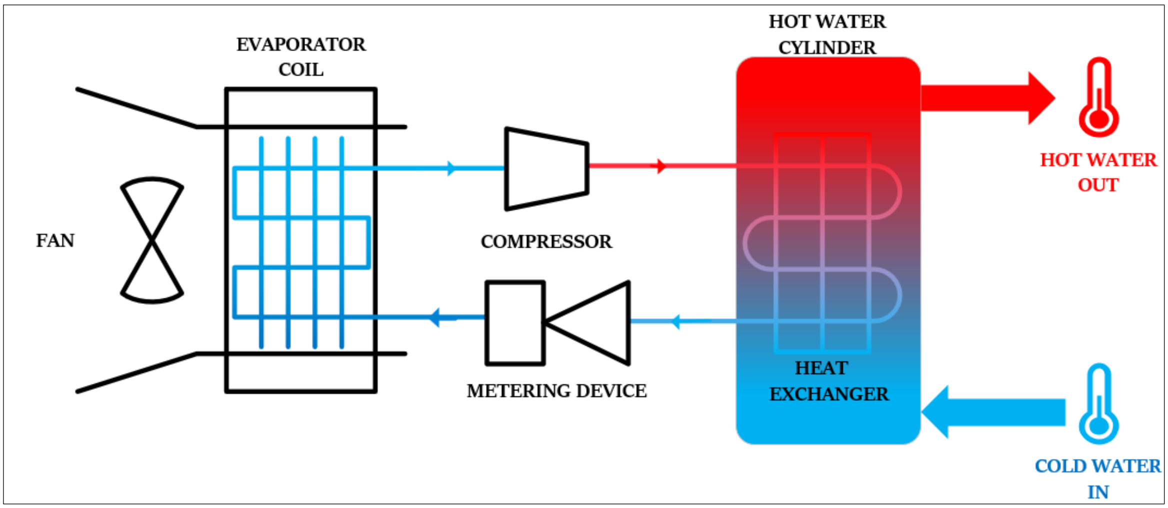
HPWH System Components and Configurations

The heat pump uses a refrigerant (fluid), such as CO_2 (R744), Propane (R290), R134a, R410a or R32, which is circulated around the cycle from the:

1) evaporator, where a fan is used to draw air across the heat exchanger (HX), transferring heat energy to the cold, low-pressure liquid refrigerant, enabling it to boil from a liquid to a gas, absorbing heat from the surroundings; to the
2) compressor, where the gas is compressed to raise the pressure and (as a side effect) raise the temperature; to the
3) condenser, where heat is transferred from the hot gas to the water via a heat exchanger (and optionally using a pump to circulate the water), and the refrigerant gas condenses to a liquid; to the
4) expansion valve, which controls the amount of refrigerant released into the evaporator and reduces its pressure.

A simplified illustration of the process can be seen in Figure 21.

Figure 21: Schematic diagram of an air-to-water heat pump



There are considerable variations in the design and configurations of HPWH. From a technical point of view these are divided into two categories: Integral and Stand-alone; while from an installation point of view it is often more convenient to define configurations based on whether there is more than one external housing or package, and the connections between them: All-in-one, Split-Refrigerant loop, and Split-Water loop.

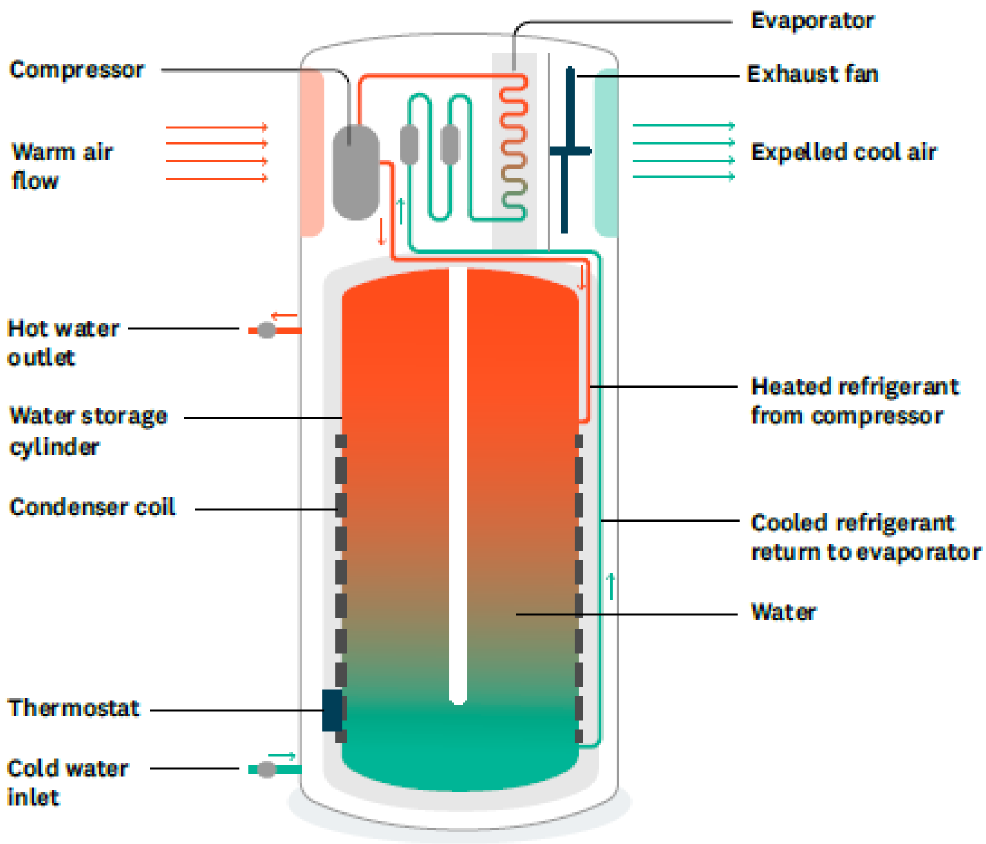
AS/NZS 5125.1[25] defines HPWH to be "**Integral**" if the condenser is connected as an integral part of the tank or mounted inside the tank, and heat is delivered to the water in the tank by free convection over the tank wall or condenser tubing inside the tank; and "**Stand-alone**" if the water flows through the condenser.

There are multiple ways in which a condenser can be integral with the storage tank, including:

- wrap-around coil or microchannel (Figure 22); or
- coil-in-tank heat exchangers (Figure 21).

[25] AS/NZS 5125.1: 2014 Heat pump water heaters – Performance assessment Air source heat pump water heaters - AS/NZS 5125.1:2014 — Heat pump water heaters: Performance assessment (SAI Global)

Figure 22: Key components of a heat pump water heater



While many stand-alone HPWH consist of a rectangular heat pump unit separate to the storage tank (Split – Water loop), it is also possible to have them tank mounted, where the heat pump unit including the condenser is mounted on top of the tank and water is pumped from the tank, through the condenser HX, and back to the tank (All-in-one).

From an installation perspective, **"All-in-one"** HPWH are contained within one housing, and simply need cold water supply, hot water outlet and electricity supply connections, while **"Split"** HPWH come in two or more housings, which also need to be connected by either refrigerant pipework (Split – refrigerant loop), water (Split – water loop) pipework, or both (Split – refrigerant and water loop) in addition to sensor/controller and electrical wiring connections. In the current market, most all-in-one HPWH are integral HPWH, however, there are All-in-one products, which are technically stand-alone HPWH due to the fact that water is pumped from the tank to the condenser and back, rather than the condenser being integral with the tank. Split-water loop HPWH and Split-refrigerant and water loop HPWH are, by definition, stand-alone HPWH.

The storage tanks are typically:

- vitreous-enamel lined steel or stainless steel;
- pressurised to 1000-1500kPa (although they can be vented to atmospheric pressure);
- insulated to reduce tank heat loss; and
- cylindrical in shape, oriented vertically with either plus-plus or minus-plus domes.

The materials and shape of the storage tank determine the amount of tank heat loss, and can influence the amount of tank stratification (the vertical temperature distribution of water inside the tank), which enables hot water to be stored at the top of the tank while cold water enters at the bottom and is heated by the heat pump.

For stand-alone HPWH a circulation pump is used to move water from the tank to the heat pump and return it to the tank. The height of the tank outlet and return, and the water flow rate influence the temperature of the water supplied to the heat pump, its outlet temperature and the corresponding efficiency of the heat pump.

Typically an overall system controller is used to receive signals from the air and water temperature sensors or thermostats, and manage when to turn the heat pump, circulation pump or electric element on and off, and what flow rate to operate the circulation pump at. More complex control systems may also interface with the heat pump controls to change its operation (such as for variable speed heat pumps). Increasingly overall system controllers include a user-interface which allows the consumer to adjust some parameters, such as:

- the times at which heating is allowed to occur, which enables water heating to be aligned with PV production or lower electricity rates;
- whether the electric resistance element is used (if present); and
- in some cases the set-point (turn-off) and turn-on temperatures (typically controlled by a deadband parameter, which describes the difference between the turn-on and turn-off temperatures).

The vertical position(s) of the water temperature sensor(s) determine the volume of water which is heated to and stored at the set point temperature(s).The electric resistance element is typically used for back-up when the heat pump becomes inefficient, such as at low ambient temperatures for some heat pumps; or when the heat pump can’t operate, such as at high ambient temperatures where the pressure in the refrigerant cycle becomes too high. They can also be used to provide additional heating capacity at peak hot water demand times. For some products the electric element provides a useful back-up for a few hours per year where extreme low temperatures drop below the heat pumps useful operating range, while for others the electric element is used for a significant portion of winter.