BRANZ

ISSUE 689 BULLETIN

WATER HEATING SYSTEMS

January 2024

- In Aotearoa New Zealand homes, water heating accounts for around one-third of total energy use on average.
- System selection should consider client needs, purchase/installation and operational costs, energy efficiency and embodied and operational greenhouse gas emissions.
- This bulletin replaces Bulletin 577 of the same name.

1 INTRODUCTION

1.0.1 Water heating accounts for approximately one-third of the energy use in a typical home on average. In some households, it represents around half the energy used. The selection of a water heating system can therefore have a big impact on operational energy use, household costs and embodied and operational greenhouse gas emissions.

1.0.2 The main types of domestic water heating systems available in New Zealand are:

- electric (storage and continuous)
- fossil gas (storage and continuous)
- heat pump (air-to-water or ground-to-water)
- thermal solar (with electric back-up)
- dedicated photovoltaic (with electric back-up)
- wetback connected to a solid fuel burner (with electric back-up).

1.0.3 While electric storage water heaters were the most common type of water heating system installed in New Zealand for many decades, over recent years, continuous-flow gas systems (califont systems) where water is heated as it is required have made up an increasing number of new installations (Figure 1).

1.0.4 Installations in new homes are almost all mains water pressure systems. The operating pressure is the same as the incoming supply, which can vary widely around the country but is typically around 350–500 kPa. This means that both hot and cold water is delivered to outlets at similar pressure. Mains-pressure fixtures and outlets such as taps should be compatible.

1.0.5 Low-pressure systems (in the range of 30–120 kPa) are still found in existing homes and can be replaced with new low-pressure systems. Before replacing an existing low-pressure water heater with a mains-pressure system, ensure that the pipework and fittings can cope with mains pressure. In most cases, a new replacement mains-pressure system will require additional valves, and fittings such as shower mixers and taps may need to be replaced.

1.0.6 When specifying a new domestic water heating system, consider:

- how many people the system will serve
- household composition and lifestyle (such as active children, teenagers or a retired couple)
- where the system should be located (including whether inside or outside the home)
- purchase, installation and operating costs
- embodied and operational greenhouse gas emissions
- whether the home has water/electricity/gas services to the boundary
- whether a smart system could provide the option of lower operating costs and help with future-proofing (see section 4)
- maintenance requirements.

1.0.7 Consideration of cost should always include operating costs as well as purchase and installation costs. For example, the higher upfront cost of an efficient heat pump water heater will be considerably offset by lower operating costs for the life of the system.

1.0.8 Installation of water-efficient fixtures and appliances will reduce the hot water requirements that need to be met by the hot water system. These can include water-efficient washing machines and dishwashers and efficiently designed showerheads. Many models have water and energy efficiency star ratings (Figure 2) – this is a legal requirement for some appliances.

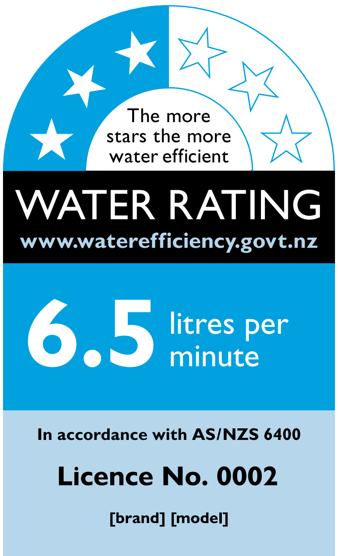

Figure 2. Water rating label.

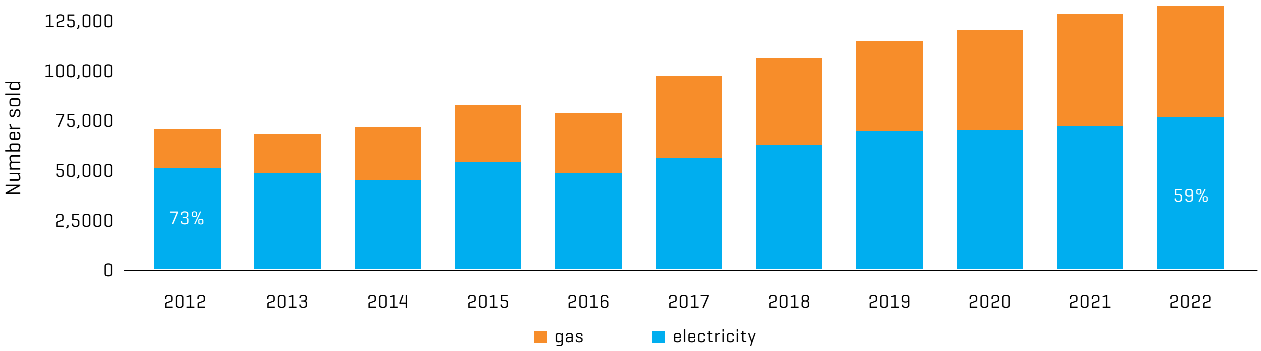

Figure 1. Sales for new hot water systems – gas vs electricity. (Data source: EECA)

1.0.9 There is a wide range of embodied and operational greenhouse gas emissions associated with different systems. In general, heat pumps, dedicated photovoltaic systems and thermal solar systems have lower operating emissions while fossil gas systems have comparatively higher operating emissions.

1.0.10 This bulletin focuses on water heating for kitchen, bathroom and laundry uses, but some of these systems (such as heat pumps) can also be used to produce hot water for radiator or underfloor space heating, spa pools or swimming pools.

2 ENERGY OPTIONS

2.1 ELECTRIC RESISTANCE WATER HEATERS

2.1.1 The most common electric water heating systems are electric resistance storage systems with a cylinder. These are generally installed inside a building, although external models are available. Continuous-flow electric water heaters are available but less common. They can be useful where space is extremely limited, there is a single or remote hot water outlet or remote bathroom or hot water demand is intermittent such as with a holiday home. With their limited capacity, continuous-flow electric water heaters work well for a hand basin but not so well for filling a bath.

2.1.2 Dual-element storage systems with a mid-cylinder element could be a good solution for many homes as this option may allow additional heating sources (such as solar PV) to be added to the system at a later date.

2.1.3 The key advantages of electric resistance water heaters are:

- electricity is an energy source already available in all new buildings
- its long-term supply is certain – we can't live without it
- grid electricity is already largely renewable, with plans for it to move closer to 100% renewable, producing lower greenhouse gas emissions than fossil gas.

2.1.4 Disadvantages or problems are:

- they have higher operational costs than heat pumps, thermal solar or dedicated PV systems
- electricity demand peaks at certain times of day (approximately 7–9am and 4–8pm), putting pressure on the grid and requiring additional generation, sometimes using fossil fuels, although this can be avoided using ripple control (if offered by local lines company) or a simple timer
- if large investment in new generation is required, electricity prices may rise.

2.2 HEAT PUMP

2.2.1 Heat pump water heaters transfer heat energy from outdoor air (or in some cases the ground) to the water in a storage cylinder. Figure 3 shows one configuration of how the heat transfer is done with air-to-water heat pumps. Outdoor air passes over an evaporator (heat exchanger), transferring heat to a liquid refrigerant. This vaporises the refrigerant, which then enters the compressor. The compressor increases the refrigerant pressure (and temperature) and circulates it around the condenser (heat exchanger) where the refrigerant cools as it heats the water. The condensed liquid refrigerant then passes

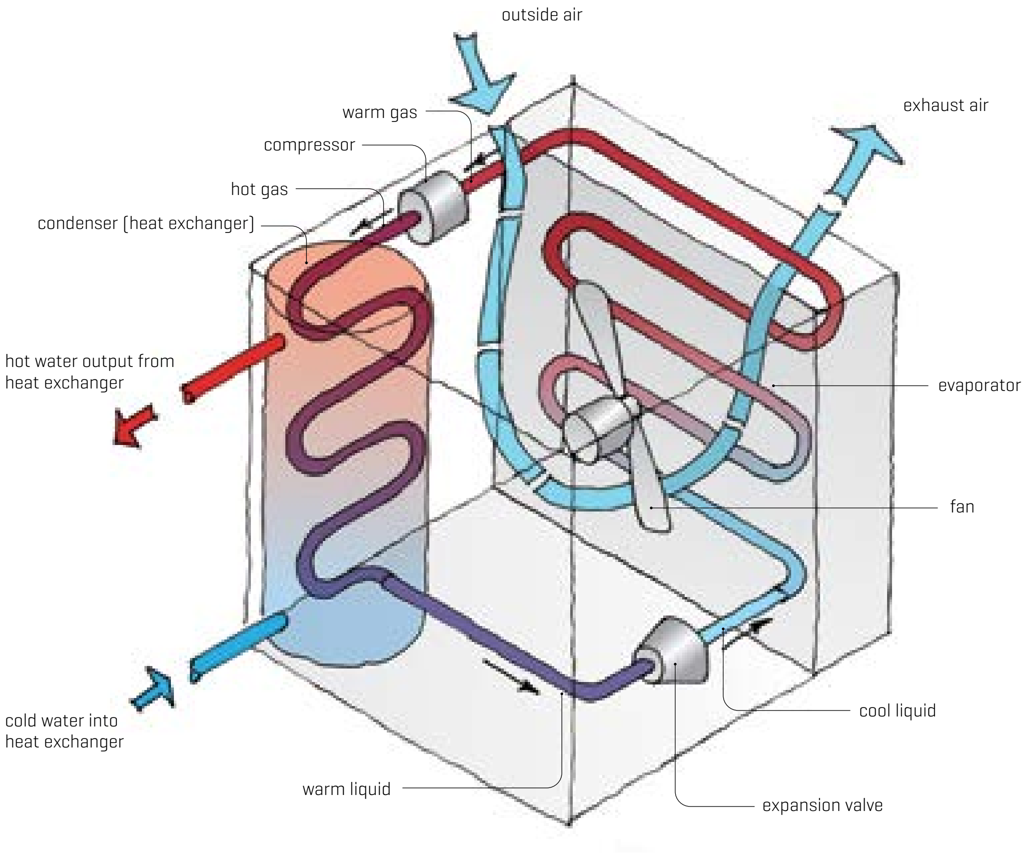

Figure 3. The water heating cycle of an air-to-water heat pump.

through an expansion valve, and the cycle continues. In addition to this approach, there are integrated systems where the heat pump sits on the top of the cylinder and the condenser is wrapped around the cylinder.

2.2.2 A heat pump should be selected to suit the climate it will be operating in. Some operate significantly better in cold climates than others.

2.2.3 Heat pump water heaters that use CO_2 as a refrigerant are currently more expensive than those using other gases, but they are more efficient, can heat water to higher temperatures and make a much lower contribution to climate change. The global warming potential (GWP) of a gas indicates the contribution to global warming resulting from the emission of one unit of that gas compared to one unit of CO_2, which has a GWP value of 1. For example, the gas R134A (a refrigerant used in air-to-water heat pumps in this country) has a GWP of 1430. If the gas escapes from a heat pump, it will contribute to much more damage (1,430 times more) than an equal amount of CO_2. In some research work, heat pumps are estimated to lose around 6% of their refrigerant per year, which works out to around half of their total refrigerant over a lifetime.

2.2.4 Ground-to-water heat pumps have a less-variable heat source than air-to-water systems – just a few metres below the ground surface, the year-round temperature is about 12°C. This makes them more efficient than some air-to-water heat pumps. However, with high set-up costs and ground area requirements, they are more suitable to multi-residential developments or cold climates.

2.2.5 The key advantages of heat pumps are:
- they are a highly energy-efficient method of water heating
- when they are operating, heat pumps are responsible for fewer greenhouse gas emissions than some other systems, particularly fossil gas
- their operating costs are lower than electric storage water heaters or fossil gas systems.

2.2.6 Disadvantages or problems with heat pump water heating systems are:
- they have higher purchase and installation costs than, for example, an electric storage system
- air-to-water heat pumps typically have reduced efficiency as the temperature falls below 6–7°C.

2.2.7 The high efficiency, lower operating costs and lower greenhouse gas emissions of heat pump water heating systems make them a preferred option for larger households.

2.3 DEDICATED SOLAR PHOTOVOLTAIC

2.3.1 With a dedicated photovoltaic generation system, the electricity generated by solar panels on a roof goes through a controller to a heating element in the hot water cylinder. (Unlike a regular solar photovoltaic system with an inverter, the electricity generated cannot be used elsewhere in the household or exported to the grid.) A supplementary heating system (typically grid-supplied electricity) is needed for when there is not enough sun.

2.3.2 Some PV systems are supplied with a stainless steel AC/DC heating element in the hot water storage cylinder that works with electricity from both the solar panels (which is DC) and back-up from the grid (which is AC). These systems do not require an inverter.

2.3.3 The controller is a key element of the system. It ensures the PV generation does not overheat the water (it typically cuts it off once the stored water reaches 75°C) and ensures the back-up operates in periods of insufficient solar generation.

2.3.4 The key advantages of dedicated solar photovoltaic are:
- appropriately sized and in sunny weather, it can supply all of a household's hot water requirements – BRANZ testing of a large PV water heating system found that, on a sunny Wellington day in July, a 3.2 kW system provided enough solar energy to meet the hot water needs of a four-person household
- in operation, dedicated solar PV water heating is a low-carbon option using a renewable energy source.

2.3.5 The key disadvantages of dedicated solar photovoltaic are:
- purchase and installation costs are higher than for electric hot water storage systems
- output is severely reduced in poor weather and is generally lower in winter than in summer
- dedicated PV water heating systems are relatively new to New Zealand with a limited number of available systems and suppliers at the moment.

2.4 SOLAR THERMAL

2.4.1 In solar thermal water heating systems, the sun heats water or heat-absorbing fluid that is circulating through panels typically installed on a rooftop. With an open loop (direct) system, water heated in the collector panels goes back to the cylinder and from there to taps and appliances for household use. In a closed loop (indirect) system, a heat transfer fluid carries the heat absorbed from the sun to a heat exchanger in the hot water cylinder, where the heat is transferred to the water.

2.4.2 On a sunny day, a well-designed and well-installed solar thermal system would typically meet all or most of a household's water heating needs. However, these systems typically do not provide all of a household's year-round water heating needs – a supplementary heater, often an electric element in the storage cylinder, will be needed.

2.4.3 The key advantages of thermal solar are:
- in operation, thermal solar water heating is a very low-emissions system
- thermal solar systems have lower operating costs than electric or fossil gas systems
- a well-designed and well-installed solar water heating system can provide about 50–75% of a household's water heating needs.

2.4.4 The disadvantages of thermal solar are:
- purchase and installation costs are higher than for electric hot water storage systems

- they have become less popular so there are fewer suppliers and installers available
- output is lower in winter and periods of bad weather
- the quality of design, specification and installation is crucial for effective performance – BRANZ has found instances where poor design and/or installation have severely impacted the efficiency of a system. In cases of poor installation, householders often will not be able to tell that their solar system is underperforming or the cause of it.

2.4.5 Building Code Acceptable Solution G12/AS2 applies specifically to thermal solar systems. It sets out requirements for structural support, materials, safety devices, protection from *Legionella* bacteria, system sizing, location of collector panels and installation. To comply with G12/AS2, thermal solar water heaters must also comply with G12/AS1. Solar systems outside the scope of G12/AS2 may need to be addressed as an Alternative Solution when applying for building consent.

2.5 WETBACK

2.5.1 Wetbacks use a solid fuel burner (burning dry wood or wood pellets) to heat water. A water jacket of typically 1.5–4 kW is installed in the back of the firebox. Water circulates through this and then back to the storage heater. Wetbacks can circulate water in two ways:

- With a thermo-siphon effect, warmer water rises, creating a natural flow through the water jacket. Manufacturers of these systems may specify a minimum gradient for the hot water supply pipe from the wetback to the storage cylinder. Wetback system pipework gradient provisions are also provided by Building Code Acceptable Solutions G12/AS1 (6.13 and Figure 15) and G12/AS3 (AS/NZS 3500.4:2021 section 7). The hot water cylinder should be close to the heat source to minimise heat loss (but see 2.5.2). The compromise may be that longer pipe runs are required to hot water outlets than would otherwise be needed.
- Some systems use pulse valves or a pump to allow the storage cylinder to be located further away from the solid fuel burner.

2.5.2 The November 2023 Building Code update included amending Acceptable Solution G12/AS1 to cite Part 4 of NZS 4603:1985 *Installation of low pressure thermal storage electric water heaters with copper cylinders (open-vented systems)*, which provides more comprehensive provisions for designing and installing wetback water heating systems using natural circulation. Part 4 Figure 5 includes details of an over-and-under wetback water heating system that can be used where the storage cylinder is not installed adjacent to the solid fuel heater.

2.5.3 The circuit between the wetback and the storage cylinder must be open-vented for safety – vent pipes must be provided at every high point in the circulating pipework. The isolated open-vented supply line must incorporate a valve to allow the water to be replenished if overheating occurs. Only copper piping can be used. Storage cylinders that are specifically designed for use with a wetback are available.

2.5.4 Wood burners must meet a minimum thermal efficiency of 65% on properties smaller than 2 hectares. Burners that meet this requirement can be found on the list of authorised burners at environment.govt.nz/guides/authorised-wood-burners. Some regions around New Zealand have their own specific requirements. Installing a wetback water heating system requires building consent.

2.5.5 The key advantages of wetbacks are:

- they can have a very low operating cost if households have access to free or low-cost wood
- in operation, wetbacks can be a relatively low greenhouse gas emissions form of water heating if the timber fuel for the wood burner is sourced from forests where harvested trees are replaced.

2.5.6 The key disadvantages of wetbacks are:

- solid fuel fires are the biggest source of the very fine particles that are a major element of air pollution in New Zealand
- wetbacks generally only make a substantial contribution to water heating in cold climates where a lot of space heating is used
- water needs to run through the wetback whenever the fire is burning
- the input from the wetback must be supplemented by other means of water heating when the solid fuel burner is not being used
- some local authorities have very tight restrictions around the selection and installation of solid-fuel appliances.

2.6 FOSSIL GAS

2.6.1 Fossil gas water heaters are available as storage systems with cylinders or more commonly as continuous-flow systems. Gas storage water heaters are much less efficient than continuous-flow water heaters because of standing losses. Condensing gas systems are more efficient than conventional gas systems.

2.6.2 Reticulated natural gas is available in parts of the North Island and gas can also be supplied as bottled LPG, although using LPG to heat water is more expensive than using reticulated natural gas.

2.6.3 Gas water heating systems require ventilation to provide for combustion. A large proportion of continuous-flow burners are installed on the outside wall of a home, but when installed internally, they require a flue.

2.6.4 The key advantages of fossil gas are:

- it provides a high-capacity heating source that can heat water faster than electric storage cylinders
- continuous-flow gas water heaters can provide a greater volume of heated water than continuous-flow electric water heaters
- continuous-flow gas water heaters are typically installed outside or in attics/ceiling spaces, saving space within a home.

2.6.5 The disadvantages of fossil gas are:

- natural gas and LPG are fossil fuels and burning them contributes to climate change
- the long-term future of gas supply is uncertain.

2.6.6 In 2021, He Pou a Rangi Climate Change Commission recommended that the government work out how to eliminate fossil gas use in residential, commercial and public buildings. It said the government should set a date to end the expansion of pipeline connections and work out how to transition existing fossil gas users towards low-emissions alternatives. While New Zealand has not yet stopped allowing gas connections in new housing, this is starting to happen overseas. In the Australian state of Victoria, new homes requiring a planning permit must be all-electric from 1 January 2024. New homes and residential subdivisions that require a planning permit will not be able to connect to the gas network.

2.6.7 In New Zealand, the Ministry of Business, Innovation and Employment is working with the gas industry co-regulator Gas Industry Company Limited to develop a gas transition plan to phase out use of fossil gas over time. Renewable gases may replace fossil gases but there is considerable uncertainty around this.

3 WATER STORAGE LOCATION AND SIZE

3.1 LOCATION

3.1.1. Storage water heaters were traditionally located in an airing cupboard accessed from a hall or laundry or bathroom, with a few located in the roof space (which should only be considered where there is easy access for repair or maintenance – manufacturers typically recommend the owner gently activate the temperature and pressure relief valve easing lever every 6 months). Today, an increasing number of hot water systems – and in particular heat pump water heaters – are located outside the building.

3.1.2 Water heating systems should ideally be located close to where the hot water is used to reduce the length of hot water distribution pipework required.

3.2 STORAGE CYLINDER SIZE

3.2.1 A hot water cylinder must have enough capacity to provide for a household's peak hot water demand but should not be larger than necessary. Larger cylinders have a greater surface area and therefore greater standing losses, take up more space and have higher upfront costs. If the cylinder is too small, the hot water will run out.

3.2.2 The appropriate size depends primarily on the lifestyle and requirements of the household. Typical hot water usage is around 40–60 litres per day per person, but this hides a vast range of water use and there is no simple rule-of-thumb way of determining the appropriate size just from the number of occupants. For example, one three-person household – a retired couple and their adult daughter – may have completely different hot water needs to another three-person household made up of an active single parent with two teenage children.

3.2.3 Another aspect to consider is whether the cylinder will be connected to controlled electricity supply and how frequently and for what durations electricity supply and therefore reheating will be interrupted. Hot water electricity supply that is only on for certain periods of the day or only overnight requires larger cylinder volumes.

3.2.4 While hot water storage cylinders should ideally be short and wide to reduce surface area and give better energy efficiency, from a design perspective, taller and slimmer cylinders are likely to be preferred as they occupy less horizontal space. Cylinder sizes vary enormously, but most are typically around 480, 550 or 580 mm in diameter.

3.2.5 Taller cylinders may be better where heat is exchanged to and from other sources to the cylinder such as from a solar collector or wetback. For example, a wetback may draw cold water from the bottom of the cylinder and return it as hot water to the top of the cylinder. A taller cylinder will allow a greater temperature difference to be maintained and therefore improves the effectiveness of the wetback.

4 SMART APPLIANCES, SMART HOMES AND A SMART GRID

4.0.1 A smart thermostat or energy meter on a hot water cylinder can map consumption patterns, allowing it to turn power off when consumers are unlikely to use water or only switch it on during periods of low-cost electricity. (One electricity distributor trialling these meters found they could save households an average of $128 per year.) Some new cylinders have a smart thermostat built in, but in many cases, existing cylinders can also be retrofitted with a device that does this job.

4.0.2 Use of these devices must comply with Building Code clause G12, which states that a hot water system must be capable of being controlled to prevent the growth of *Legionella* bacteria. G12/AS1 (at 6.14.3) states that: "Irrespective of whether a delivery temperature control device is installed, the storage water heater control thermostat shall be set at a temperature of not less than 60°C to prevent the growth of Legionella bacteria."

4.0.3 Smart devices can increase the benefits of owning a solar photovoltaic generation system. For example, water heating can be switched on when a PV system is generating sufficient electricity, minimising electricity purchase from the grid and reducing the need to sell PV-generated electricity to the electricity distributor for a relatively low price. Some overseas research suggests that hot water storage systems may offer an overall more cost-efficient way to store energy than batteries.

4.0.4 An electricity supply feature called demand flexibility has just started being rolled out to domestic electricity users. With demand flexibility, consumers receive a financial incentive to reduce consumption in periods of high demand. For example, if there is a cold snap and lots of people turn on heaters at breakfast or dinner time, causing a spike in electricity usage, the system could switch off certain appliances or equipment (which could include a water heating system) to compensate. This reduces the need for big power generators to burn coal or other fossil fuels. Demand flexibility in New Zealand is optional and features a manual override button that a consumer can use to opt out if necessary. It resets after a few hours.

4.0.5 The new technology is likely to gradually replace the simpler and less-flexible ripple control that has been a feature for managing electricity demand for many decades. With ripple control, electricity distributors turn off domestic hot water systems during peak demand to manage network capacity, and consequently the charge for controlled electricity is cheaper. The number of households that still have ripple control has been declining.

5 BUILDING CODE AND STANDARDS REQUIREMENTS

5.1 ACCEPTABLE SOLUTIONS AND VERIFICATION METHODS

5.1.1 G12/AS1 applies to piped water supply systems, including (in section 6) hot water supply systems. Table 5 in G12/AS1 lists different types of water heaters and the standards and regulations covering them. As noted above, G12/AS2 covers thermal solar systems.

5.1.2 The November 2023 Building Code updates included citing AS/NZS 3500.1:2021 *Plumbing and drainage – Water services* and AS/NZS 3500.4:2021 *Plumbing and drainage – Heated water services* in a new Acceptable Solution, G12/AS3. These standards are no longer cited by G12/VM1.

5.1.3 AS/NZS 3500.4:2021 sets out requirements for the design, installation and commissioning of heated water services using drinking water or rainwater or a combination. It applies to new installations as well as alterations, additions and repairs to existing installations. It applies to the installation of:

- storage water heaters with a rated delivery or capacity of up to 700 L per heater
- heat exchange water heaters
- continuous-flow water heaters.

5.1.4 A water heating system that does not follow an Acceptable Solution may need to be submitted and assessed for building consent as an Alternative Solution.

5.2 ENERGY EFFICIENCY REQUIREMENTS

5.2.1 The Energy Efficiency (Energy Using Products) Regulations 2002 cover water heating systems, which need to meet minimum energy performance standards (MEPS). The MEPS set minimum energy efficiency requirements for electric hot water storage units and gas water heaters (and other appliances).

5.2.2 Acceptable Solutions H1/AS1 and H1/AS2 section 3.1 states that hot water systems for sanitary fixtures and sanitary appliances having a storage water heater capacity of up to 700 litres must comply with NZS 4305:1996 *Energy efficiency – Domestic type hot water systems*. They must also meet MEPS or use an alternative pathway to Code compliance. EECA has published a list of electric storage water heaters that comply with MEPS (see section 7). An electric storage water heater is defined as any hot water cylinder that contains an electric resistive element, so the definition includes solar and heat pump hot water cylinders unless they meet exclusion requirements.

5.2.3 In new building work, NZS 4305:1996 requires thermal insulation for specific areas of hot water pipes. These include:

- from the water heater to the kitchen sink
- to 300 mm above the standing water level in a low-pressure open-vented storage water heater vent pipe
- for a horizontal hot water distribution pipe, the first 2 m (see Figure 3 in the standard)
- connecting pipes between a hot water storage cylinder and a separate heating device such as a heat pump, solar panel or wetback.

5.2.4 BRANZ recommends that all hot water pipes should also be insulated for their full length. Pre-formed closed cell foam insulation is readily available and is just pushed over the pipe. Check the inner diameter of the insulation matches the pipe diameter. At right-angle bends, butt two lengths of insulation together, with the ends cut at 45° angles. For smaller diameter pipework, where possible, slide insulation over pipes before the final connection(s) are fitted so the insulation remains continuous at bends. Pipe lagging made from materials such as sheep's wool is also available.

5.3 HEALTH AND SAFETY REQUIREMENTS

5.3.1 *Legionella* bacteria can grow in temperatures of 25–45°C, and inhaling water mist contaminated with *Legionella* can cause the potentially fatal Legionnaires' disease. *Legionella* bacteria are killed at temperatures of 60°C and higher, so there are requirements in Acceptable Solutions that water in water heating systems be periodically heated to at least 60°C (see G12/AS1 6.14.3 and 6.14.4 and G12/AS2 3.5).

5.3.2 Building Code clause G12.3.6 requires that, where hot water is provided to sanitary fixtures and sanitary appliances used for personal hygiene, it must be delivered at a temperature that avoids the likelihood of scalding.

5.3.3 G12/AS1 sets maximum temperatures for water delivered to the tap of sanitary fixtures used for personal hygiene – outlets such as basins, baths and showers. For most types of building including dwellings, the maximum hot water delivery temperature is 50°C. This maximum temperature was introduced in an amendment to G12/AS1 in November 2023 with a 12-month transition period. (The figure was previously 55°C.) The maximum hot water delivery temperature is 45°C for other buildings such as early childhood education and care centres, aged care facilities, institutions for people with intellectual or physical disabilities and hospitals.

5.3.4 For kitchen sinks and laundries, maximum temperatures of around 55–65°C are acceptable, although this is no longer necessary – modern detergents have been developed to be effective at lower temperatures.

5.3.5 Temperatures at which water is delivered can be reduced by installing a tempering valve or a thermostatic mixing valve. A tempering valve is installed in the hot water line close to the cylinder and has a cold water connection to provide a pre-set hot water temperature at fixtures. Valves are factory pre-set but are able to be adjusted to cater for specific temperature requirements.

5.3.6 As water may be delivered at any temperature to non-personal hygiene fixtures such as sinks and laundries, a tempering valve is not required to these fixtures. However, if a wetback water heater or other uncontrolled heat source is used, tempering the supply to all fixtures is good practice.

5.3.7 Many dishwasher and washing machine manufacturers require the installation of a tempering valve for warranty purposes where the unit does not heat its own water.

5.3.8 All work on water heating systems must be undertaken by an authorised person such as a licensed or certifying plumber.

5.3.9 In Schedule 1 of the Building Act, Part 2 sets out sanitary plumbing and drainlaying work that is exempt from the requirement for building consent when carried out by people authorised under the Plumbers, Gasfitters, and Drainlayers Act 2006. The work specifically listed does not need a consent if carried out by an authorised person. Examples of work that does not require a building consent include:

- a licensed or certifying plumber can repair and maintain water heaters associated with buildings without requiring a building consent provided the work uses comparable materials, comparable components or a comparable assembly
- replacing an open-vented water storage heater with a comparable open-vented water storage heater in the same position using the same pipework and connected to solar water heating collectors
- replacing an external water storage heater with a heat pump water storage heater (for example, replacing an open-vented water storage heater with another open-vented storage heater) in the same position using the same pipework and connected to a heat pump.

6 RETROFITTING WATER HEATING SYSTEMS

6.0.1 The extent to which an existing hot water system can be upgraded depends on the age and type of system in place and the type of upgrades intended. Most older low-pressure systems have a separate header tank in the roof space. Some new water heating systems require dedicated storage cylinders and cannot be retrofitted to existing electric storage cylinders. With others, such as some dedicated PV systems, a suitable existing cylinder can be left in place with the heating element replaced.

6.0.2 In many cases, retrofitting smart devices will be the most practical and cost-effective option for an electric storage system. This could be through adding a smart thermostat to an existing tank or, in the rare case where a cylinder is not hard-wired, using a smart plug (see Bulletin 687 *Introduction to smart homes*). This approach allows a system to be operated at periods of low-cost electricity and potentially even allows for households to look for savings through a demand flexibility agreement with an electricity distributor.

6.0.3 Electric storage water heaters installed since 2002 must have A-grade insulation. These have a layer of insulation of around 50 mm between the water jacket and the outside of the cylinder. Cylinders that were installed before this date are likely to benefit from having a cylinder wrap added. (Even A-grade cylinders benefit from a cylinder wrap being added, just less so than older cylinders.) Widely available as DIY kits, cylinder wraps are commonly made of polyester, fibreglass or sheep's wool insulating blanket with a foil jacket on the outside. Before buying a cylinder wrap, check that there is sufficient space around the cylinder perimeter to fit it.

7 MORE INFORMATION

BRANZ

www.level.org.nz

BU524 Solar water heating (2010)

BU589 Heat pump water heating (2015)

BU687 Introduction to smart homes (2023)

EECA

NZ MEPS-compliant products

Water heating options

INDUSTRY BODIES

Solar Association of New Zealand

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