Victorian Energy Upgrades Proposed Activity

Commercial and Industrial Heat Pump Water Heating Issues Paper

VICTORIA State Government | Environment, Land, Water and Planning

Author
This document has been prepared by the Department of Environment, Land, Water and Planning.

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Acknowledgment

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.

Accessibility

If you would like to receive this publication in an alternative format, please telephone the DELWP Customer Service Centre on 136186, email energy.upgrades@delwp.vic.gov.au, or via the National Relay Service on 133 677 www.relayservice.com.au. This document is also available on the internet at www.delwp.vic.gov.au.

Overview

About the Victorian Energy Upgrades (VEU) program

The Victorian Energy Upgrades (VEU) program is established under the *Victorian Energy Efficiency Target Act 2007* to help Victoria reduce its greenhouse gas emissions, reduce the use of electricity and gas and invest in industries that provide energy demand management technology and services. The program provides subsidies for residential and business consumers to reduce their energy use by upgrading appliances, processes or buildings.

The VEU program works by creating financial incentives for households and businesses to undertake energy saving activities. When accredited businesses (known as accredited providers) undertake eligible energy efficiency improvements in homes or businesses, they create Victorian Energy Efficiency Certificates (VEECs). Each VEEC represents one tonne of greenhouse gas emissions saved over the lifetime of the activity or product installed. VEECs can then be sold to energy retailers who must meet an emission savings target each year based on their annual electricity and gas sales.

The VEU program includes energy saving activities for both households and businesses. Activities currently available for business in the program include lighting upgrades, installation of high efficiency motors, upgrades to gas-fired boilers, and energy efficiency projects whose impacts are measured through project-based activity methods (e.g. measurement and verification).

A collaborative approach to creating VEU activities

The Department of Environment, Land, Water and Planning (DELWP) has been working with the NSW Department of Planning, Industry, and Environment to identify and further investigate opportunities for achieving energy and emissions savings through installation of heat pump water heaters (HPWHs) at commercial and industrial premises across Victoria and NSW. We are working together to create activities for the VEU program and the NSW Energy Savings Scheme (ESS) that are as similar as possible in order to harmonise requirements and make compliance simpler for stakeholders.

Purpose of the heat pump water heating issues paper

DELWP is seeking to expand the range of energy efficiency upgrades (activities) available under the VEU program and is seeking feedback from stakeholders on a potential new activity; installation of an efficient HPWH or boiler at a commercial or industrial facility.

The purpose of this document is to set out options to introduce the installation of HPWH at commercial and industrial premises as an activity in the VEU program and to seek the views of interested stakeholders.

Public consultations for VEU and ESS in parallel

The ESS and VEU programs have planned on consulting on the proposed new commercial and industrial heat pump activity at around the same time. The consultation approach and questions have been aligned as much as possible. In the case of potential differences in the number of submissions and specific responses, the VEU program intends to share the findings of stakeholder submissions with the ESS. This will be done in the interest of better and more efficient activity development. If you do not wish for your responses to the questions contained in this issues paper to be shared with the ESS, please indicate this in your submission.

Have your say

Stakeholders can submit their feedback using the **survey** available on the Engage Victoria website https://engage.vic.gov.au/commercial-and-industrial-heat-pump-water-heating. Please submit your feedback to the questions in the HPWH issues paper by completing the new activities consultation response template and/or the survey and uploading your submission to the Engage Victoria website. Feedback from stakeholder submissions will be used to guide the creation and implementation of the new VEU activities.

Submissions can also be emailed to energy.upgrades@delwp.vic.gov.au or sent as a hard copy submission to: *Victorian Energy Upgrades, Department of Environment, Land, Water and Planning, PO Box 500, East Melbourne, VIC 8002*. If you make a submission by email or post, please ensure to state whether DELWP can publish your submission.

This consultation will close on 12 July 2021.

Introduction

Water heating and energy consumption

Heated water is a universal end-use and energy service. It is found in office buildings, hotels, leisure centres, hospitals, schools, apartment blocks, manufacturing, food processing, sanitisation and in a variety of other commercial and industrial spaces. Water as a medium can be used to distribute heat from a heater or boiler throughout a facility and either the water itself or the heat the water carries can then be used.

A significant amount of energy is required to heat water, often provided by a gas-fired or electric resistance water heater or boiler. For example, approximately 36 per cent[1] of the energy use in commercial buildings in Victoria is in the form of gas consumption and this mainly used in gas boilers to provide space heating or hot water. The proportion of energy coming from gas is typically even higher in industrial facilities, where a major gas end-use is boilers that produce hot water, steam, or other heated fluids.

Older gas-fired water heaters often only achieve efficiencies of less than 80 per cent, and electric resistance water heaters around 98 per cent. Electric heat pumps are a technology which use the vapour compression cycle to heat water three to seven times more efficiently than can be achieved with older technologies. Installation of heat pump water heating can save energy and reduce demand, saving businesses money and reducing emissions.

Heat pump water heater technology

Heat pump water heaters (HPWH) work by moving heat from a heat source (generally the ambient air near the unit) to a heat sink (e.g. water for use in a building). The use of this process is what allows HPWHs to be so efficient, because rather than making heat, they are moving heat from one place to another. This means that for every 1kW of electricity they can typically produce 2.5 to 5 kW of heat. This measure of efficiency is called a ‘coefficient of performance’ (COP).

Most commercially available air-to-water HPWHs achieve temperatures of up to 90ºC, making them suited to lower temperature applications such as space heating, potable hot water, and sanitation. Despite the efficiency gains and the wide potential for application of this technology, there has been limited uptake of heat pump technology in the industrial setting in Australia.[2]

[1] Strategy Policy Research, October 2019, Electrification Opportunities in Victoria’s Commercial Sector.

[2] Jutsen, J. Pears, A. Hutton, L. (2017) High temperature heat pumps for the Australian food industry: Opportunities assessment. Sydney: Australian Alliance for Energy Productivity.

Heat pump water heater (HPWH) installation as a potential VEU activity

Overview

The proposed new activity rewards emissions reductions achieved by installing a new, efficient HPWH system at a commercial or industrial premises, or in the common area of a multi-residential building.

The proposal includes a series of activity requirements that will need to be met before it can be considered eligible to receive a VEU program incentive, as follows:

1. Installation of an air source HPWH to:
    - replace an existing gas boiler/water heater
    - replace an existing electric resistance boiler/water heater
    - serve a new end use.
2. Installations must occur at:
    - commercial premises
    - industrial premises,
    - common areas of multi-residential buildings.
3. Installations must be carried out by an appropriately licensed or registered plumbing practitioner, registered for refrigerated air-conditioning work as outlined by the Victorian Building Authority.
4. Equipment installed for the purposes of the activity must be:
    - modelled in TRNSYS[3] according to the proposed product application guide to determine annual energy consumption
    - installed in the configuration used in the modelling
    - exactly identical to the components used in the modelling, with the exception of allowing sites to retain an existing storage tank if it is in good order
    - certified to AS/NZS 2712 if the system has an insulated storage volume of 700L or less.

Consultation questions:

1. Do you think there is a market for a deemed activity that incentivises the installation of HPWHs in commercial and industrial sectors? What are your views on the demand for the activity and supply chains now and in the next three years?
2. What are the benefits and potential drawbacks or risks to making HPWH systems that serve multiple private residences eligible under the proposed activity?

Proposed technical requirements for VEU participation

Before a product can be incentivised under the VEU program it needs to meet certain requirements. It is proposed to use a similar approach to that used for residential-scale HPWH (systems less than 700L), which must be modelled according to AS/NZS4234 and that the Clean Energy Regulator requires for commercial and industrial solar water heaters.

[3] TRNSYS (Transient System Simulation Tool) is a graphically based software environment used to simulate the behaviour of transient systems. This program is used to determine energy savings for the VEU program residential water heating activities and the Commonwealth Small Scale Renewable Energy Scheme water heating activities. www.trnsys.com

For HPWHs, it is proposed that the product's technical details are entered as inputs into a TRNSYS simulation and the outputs are required to meet the following criteria:

- 60 per cent energy savings relative to an assumed baseline gas or electric resistance boiler or water heater; and
- ability to continuously supply water at a temperature of 45°C or greater.

The product must meet these criteria in the climate zone(s) in which it will be installed. The AS/NZS 4234 climate zone files are used to define air temperature and humidity for these climate zones.

Evidence that a product or system meets these criteria would be provided to the Essential Services Commission (ESC) for approval. Following approval by the ESC, the product would be listed on a register of approved products maintained by the ESC. Each different combination or configuration of products would be required to be submitted for approval to be listed on the register.

Demand response is becoming an important feature of our electricity grid. In order to support a resilient electricity grid in the coming years, the VEU program is considering making demand response capability an eligibility requirement for the proposed activity. We note that many of the products installed under this activity may be too large to be covered under demand response standard AS/NZS 4755. It may be preferable to require a statement of demand response capability and technical specifications to verify this from the manufacturer with each system as it applies to be listed on the ESC register of approved products.

Standards

It is important to clearly define what an activity entails and to develop methods for predicting the probable energy saving from the activity. The consideration and use of Australian standards is an important part of this activity definition process. Relevant standards for HPWH performance and construction include:

- *AS/NZS 4234 Heated water systems – Calculation of energy consumption* details a method for estimating the annual energy consumption of electric resistance, solar, gas, and heat pump water heaters. This standard also defines a heat pump. There are no product design or operation requirements in this standard.
- *AS/NZS 2712 Solar and heat pump water heaters – Design and construction* sets out performance-based requirements for design and construction of components of solar and heat pump water heating systems for household scale installations.

It is proposed that these standards are used as a basis to calculate energy consumption in TRNSYS and to define compliant equipment for the proposed VEU commercial and industrial HPWH activity. Details for testing equipment which is not covered under *AS/NZS 2712* are covered in the application guide drafted for the purposes of the activity.

Consultation questions:

3. Do you agree with including product eligibility requirements that will enable demand response for the proposed activity?
    a. *Yes / No*
    b. If Yes, please provide further detail, e.g. what capabilities do you think should be required and how should compliance be evidenced?
    c. If No, please explain why you do not agree with inclusion of demand response.
4. If you have downloaded and tested the draft guidance materials and TRNSYS modelling files which have been developed for the product registration process please provide feedback here.

VEU activity uptake and the market

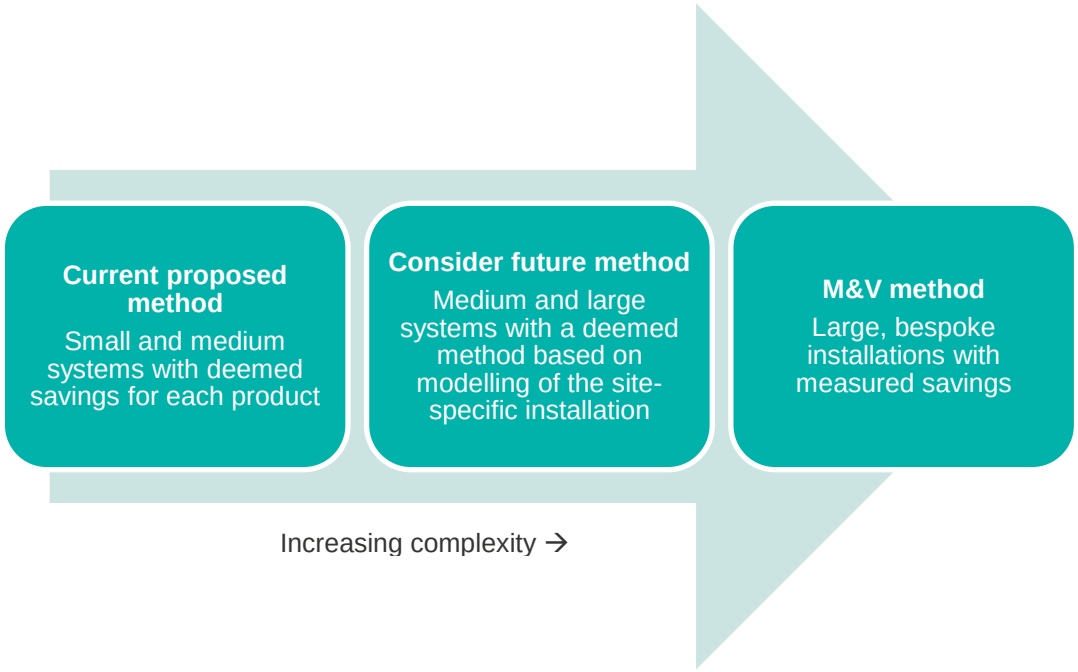
Industry research

Industry research suggests that a deemed approach – providing an incentive based on the installation of approved products – would support small to medium sized commercial and industrial air source heat pump installations. A system's thermal capacity is the rate at which the system can provide heat, this is measured in kilowatts. Units with a smaller thermal capacity are typically cheaper and less complex to install, accordingly they require a less complex method of incentivisation.

A simple deemed activity would use a conservative incentive level, making it suitable for relatively simple evidence requirements. This is the key option being considered for introduction.

Larger industrial HPWH installations are already supported by the VEU program's Measurement and Verification (M&V) method. This requires longer lead times and has higher project costs but can provide larger and more accurate levels of VEEC creation, in line with the larger and more complex projects which use this method. There are currently no capacity restrictions proposed for this deemed activity, but the conservative savings calculations mean that larger projects are likely to favour an M&V approach.

Industry research also suggested that a third tier exists in the market – HPWH upgrade projects which are not large enough to warrant the increased effort and cost of an M&V project, but which would be significantly under-credited through the more conservative product-based activity proposed here. An option being considered for these projects is an application-specific incentive. This would require TRNSYS modelling to be done for each installation rather than for each product. The accredited provider would be required to provide more information specific to the installation and site operations, but VEEC creation would be able to more accurately reward sites with longer operating hours or site-specific configurations that improve efficiency.



Consultation questions:

5. What range of HPWH capacities (kW) do you think will be supported by introducing the proposed activity and why?

6. Do you think there is a demand for an application-based deemed activity that incentivises the installation of larger capacity HPWHs than the current proposed activity, but smaller capacity than what is suitable for the M&V method?
    a. *Yes / No, please explain why/why not*
    b. What range of HPWH capacities do you think would be supported by this third activity?

The role of the VEU program in supporting energy efficient technology industries

The VEU program aims to support best practice in industry while supporting energy efficient technologies. The proposed activity addresses a gap in government support for water heating technology, which is provided for homes through the VEU and Solar Homes programs as well as the Small-scale Renewable Energy Scheme (which includes units with 425 L storage or less), and provided to businesses installing larger and more complex upgrades through the VEU program's M&V method.

DELWP also recognises a responsibility to avoid the potential for financial incentives to drive poor practice or poor behaviour if not implemented or designed appropriately. Examples of this include installation of incorrectly sized or installed equipment, and equipment which is not suited to the final application due to system designs which have been employed to maximise generation of financial incentives.

Consultation questions:

7. Do you see any potential for the proposed HPWH activity to result in undesired outcomes or incentivise unsuitable installations?
    a. Yes/No
    b. If yes, please provide further information about the concerns you have.
    c. How do you think these undesired outcomes can be avoided?

Accredited providers and activity uptake

It is expected there are enough HPWH installers and associated professionals to support the proposed HPWH activity. Uptake of an activity will also require interest from product manufacturers and VEU accredited providers so that appropriate products and sales information can be provided to consumers. You are encouraged to share any potential barriers you seen in the activity and solutions that could be used to overcome them.

Consultation questions:

8. Would the proposed HPWH activity incentivise you to become accredited to provide this activity through the VEU program?
9. What types of businesses or industries would you expect to provide this activity?

10. Do you see barriers to the uptake of the proposed HPWH activity?
    a. *Yes / No*
    b. If yes, what barriers do you anticipate?
    c. What solutions do you see for overcoming these barriers?

Calculating energy and emissions savings

The proposed HPWH upgrade activity will produce predictable energy savings and is considered suitable as a potential deemed VEU activity. This means that the emissions savings from the lifetime of the activity can be calculated and VEECs awarded after a product installation has been completed. The proposed lifetime for this activity is 15 years. The energy saving that results from any specific HPWH activity will depend on this and several other factors, which the calculation of the deemed energy saving will need to take into consideration.

Consultation questions:

11. What do you think is the most appropriate deemed equipment lifetime for HPWHs in commercial and industrial settings?
    a. Answer (in years)
    b. Please explain your answer.

Proposed base case energy consumption

It is proposed for installations which are replacing an existing gas or electric resistance boiler or water heater that baseline systems are defined by their thermal efficiency and system losses (estimated at 5 per cent). These figures are adjusted to match the load delivered by the HPWH system being used to replace them, based on the assumption that the new system will be sized to serve the same load as the old system. At the point of calculating emissions reductions, incentives will be scaled down to fit the smaller of the two system sizes (new or incumbent) to ensure that installations claiming the replacement incentive are not upsizing. The following equations are proposed to calculate the base case energy consumption of existing electric resistance and gas boilers respectively.

$$B_{ref,elec} = 365 \times 0.905 \times 1.05 \times Peak\ Load$$

$$B_{ref,gas} = 365 \times 0.905 \times 1.05 \times {Peak\ Load}/{\eta_{gas}}$$

Where:

$B_{ref,elec}$ is the annual electrical energy consumption of the reference electric water heater

$B_{ref,gas}$ is the annual gas energy consumption of the reference gas water heater

365 is the number of days in a year

0.905 is the annual average seasonal multiplier, as per AS/NZS 4234.

1.05 is the tank heat loss multiplier to account for additional energy required to offset tank heat loss. It is estimated for the range of systems in this scheme that tank heat loss will be approximately 5 per cent of the energy delivered to the load. This is more conservative than the 15 per cent currently used by the CER methodology.

$PeakLoad$ is the daily energy load of the new HPWH system (MJ/day) in the middle of winter, as determined by the TRNSYS modeller, such that the performance requirements (60% electric energy savings and minimum delivery temperature of 45°C) are met.

η_{gas} is the reference gas thermal efficiency

Please note:

- an incumbent system's thermal efficiency is taken as 78.8 per cent as per AS/NZS 4234: 2008

- for new HPWH installations the base case thermal efficiency is taken as 85 per cent as per AS/NZS 4234: 2021 which is also consistent with other VEU/ESS hot water boiler activities.

Modelling of HPWH energy consumption

For a HPWH system to be listed on the ESC's product register they must be modelled using TRNSYS in accordance with the instructions contained in the Commercial and Industrial HPWH Product Application Guide. A draft of this guide will be made available to stakeholders who request to test the simulation files and supporting materials. The modelling in TRNSYS must capture the HPWH system as it is to be installed, including component parts (e.g. pumps or heat exchangers located between modelled sections of the system) in the configuration that they are to be installed in. For example, if the system registered includes a tank to store heated water, the system must also include any pump which is required to deliver heated water from the HPWH's condenser to that tank.

HPWHs to be installed as a pre-heater with an in-line gas or electric boost plant must be modelled as such.

There are two exceptions proposed:

- Multiples of the same system: Initial modelling of systems with multiple HPWH units and tanks showed that the energy savings was very close to the savings from a single HPWH and tank multiplied by the number of HPWH units and tanks installed. Therefore, it is proposed that systems using multiple HPWHs and tanks do not need to perform further modelling but will be allowed to claim the incentive of the base HPWH system multiplied by the number of HPWHs and tanks installed.
- Existing storage tanks: Sites with an existing storage tank that is able to be configured to be used with a new HPWH may be permitted to continue using the existing storage tank provided it can be evidenced that the incumbent tank is:
    - of equal or greater storage volume than the tank used in the TRNSYS modelling
    - insulated
    - manufactured ten (10) or less years ago.

The difference between modelled annual energy consumption and calculated baseline annual energy consumption is then multiplied by the respective gas and electricity emissions factors and deemed lifetime of the equipment (proposed at 15 years) to determine the number of VEECs created. If the new system has a greater thermal capacity than the incumbent system then the incentive is scaled back by the ratio of the two capacities.

Consultation questions:

12. Do you think it will be achievable to provide sufficient evidence to meet the eligibility requirements of a pre-existing hot water storage tank?
    a. Yes/No?
    b. If not, please explain why and suggest what evidence may be more suitable (e.g. proving the condition of the tank rather than the age).

Electric resistance back-up

Some HPWHs use an electric resistive element for when atmospheric temperatures are outside of safe operating conditions. For example, some units cannot safely operate when ambient temperatures are above 38°C. A unit experiencing conditions above this temperature will either cease to produce hot water or begin using the electric resistance element until ambient temperatures are within safe operating conditions. This functionality is not always clearly stated in technical specifications, and no allowance has been made in the simulation for how this feature affects energy consumption.

Consultation questions:

13. What share of the commercial and industrial HPWH market do you think includes an electric resistance heating element for use when ambient temperatures are outside of safe operating conditions?
    a. Answer as percentage
    b. Do you think VEU program incentives should account for this electric resistance back-up function?

Fugitive emissions

The term 'fugitive emissions' refers to greenhouse gases which are released because of leaks or damage to refrigerant lines. This is common for any appliances or equipment using a vapour compression cycle, with losses occurring during normal operation each year, during maintenance, at the end of product life (if not decommissioned correctly), and in some units when a catastrophic loss of refrigerant happens.

The global warming potential of refrigerants is expressed as a multiple of the global warming potential of carbon dioxide. The most common refrigerants in Australia today have global warming potentials around 1,500 to 2,000 times greater than carbon dioxide over a 100-year time period (e.g. R-134A and R-410A). There are classes of refrigerants available with global warming potentials between 0 and 5 over a 100-year time period. Installation of systems which use refrigerants with a lower global warming potential can mitigate the impact of fugitive emissions.

The VEU program is considering proportionally rewarding or penalising VEEC creation based on the global warming potential of the refrigerant used rather than excluding the use of more damaging refrigerants. To award the relative difference in fugitive emissions a baseline global warming potential and assumed leakage rate needs to be selected.

The literature review found a range of values for annual leakage rate, typically between 3-20 per cent.[4,5,6,7] Using that information, this issues paper proposes a leakage rate for this activity of 15 per cent per annum, and a baseline global warming potential of 1,430 which corresponds to refrigerant R-134a. Estimates of incentive generation due to refrigerant choice are shown in Table 1.

Table 1: Estimated fugitive emissions incentive levels for three example systems, assuming a VEEC price of $30.

	30kW HPWH CO2	18kW HPWH R134a	3 x 3.6 kW HPWH R410A
Refrigerant charge (kg)	8.5	4.9	2.4
Incentive	$820	$0	(-$110)

[4] IPCC Good Practice Guidelines and Uncertainty Management in National Greenhouse Gas Inventories, International Panel of Climate Change, 2006

[5] "Refrigerant emissions in Australia, Sources Causes & Remedies 2010", Expert Group, https://www.environment.gov.au/system/files/pages/2d21a5df-020d-4416-8925-8d0277acb22d/files/refrigerant-emissions.pdf

[6] Report of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee, 2006 Assessment, UNEP Nairobi, Ozone Secretariat, 2007

[7] IPCC/TEAP Special Report: Safeguarding the Ozone Layer and the Climate System, Switzerland 2005

Consultation questions:

14. Do you agree with incentivising the installation of HPWHs which use lower global warming potential refrigerants?
    a. Yes/No?
    b. If not, please explain why.
15. Do you agree with the proposed method for rewarding/penalising refrigerant choice?
    a. Yes/No?
    b. If not, please explain why.

Expected VEEC incentive level

Estimates of the level of incentive that could be generated by this activity vary significantly based on HPWH performance, the baseline scenario (replacing gas, replacing electric resistance, new installation), the emissions factor (see detailed discussion in the next section), and VEEC price.

Replacement of an electric resistance water heater or boiler creates the highest incentive level, followed by replacing a gas boiler or water heater and new installations at a similar incentive level.

The VEEC prices used in modelling presented here are $30, $50, and $70 representing prices experienced in the past year and prices that may be expected in future years.

Estimated incentive levels for three example HPWH systems are shown in Table 2. Note that these figures are for installations after 31 July 2021 and that the values of incentive generated converge as emissions factors change in the 2021 - 2025 period.

Table 2: Estimated incentive levels for three example systems, assuming a VEEC price of $30 in 2021 and both $50 and $70 in 2025, installation in climate zone 4, and using the 2021 and 2025 15 year 'un-smoothed' emissions factor.*

	30kW HPWH 1,000L storage (COP~3.5)	18kW HPWH 1,000 storage (COP~3.7)	12 x 5kW HPWH 4,000L storage (COP~2.5)
Gas replacement (2021)	$5,190	$2,130	$3,660
Electric resistance replacement (2021)	$16,350	$6,330	$17,550
Gas replacement (2025) VEEC price $50, $70	$11,950 $16,730	$4,700 $6,580	$11,700 $16,380
Electric resistance replacement (2025) VEEC price $50, $70	$18,600 $26,040	$7,200 $10,080	$19,950 $27,930

**These estimates do not include any incentive related to fugitive emissions.*

Emissions factors

The emissions reduction awarded for any activity under the VEU program relies on the emissions factors assumed for the activity (a factor which converts energy savings to avoided emissions). The VEU program emissions factors are currently 0.05523 per megajoule of gas and 1.095 per megawatt hour of electricity.

In December 2020, the VEU program released the electricity emissions factors to be applied over the 2021-25 period. These provide a 'smoothed' transition to updated emissions factors to address stakeholder concerns about business impacts from updating emissions factors too rapidly.

This 'smoothed transition' approach is appropriate for existing activities but for new activities there is an opportunity to apply from the outset (i.e. at the point of their introduction) an updated emissions factor that is expected to more accurately represent the emissions.

Table 3~~Table 1~~ below shows the final 'smoothed transition' emissions factors alongside these more accurate emissions factors that are based on the analysis undertaken for the 2019 RIS[8]. Adopting these more accurate emissions factors would provide a greater reward for activities switching from gas to electricity.

[8] This analysis included predicted uptake of renewable energy (including the Victorian Renewable Energy Target, Victorian net zero emissions by 2050, and Solar Homes), predicted closure dates for ageing generation infrastructure, and marginal versus average emissions factors.

Table 32: More accurate and "smoothed transition" ten-year average electricity emissions factors

Emissions factor (CO_2e/MWh)	2020 (current)	31 July 2021	31 Jan 2022	31 Jan 2023	31 Jan 2024	31 Jan 2025
More accurate emissions factors	1.095	0.8055	0.516	0.473	0.433	0.393
Smoothed emissions factors*	1.095	0.9546	0.81242	0.6738	0.5334	0.3930

** As announced, the only exception to this is for annual certificate creation under the project-based activity methods, where annual National Greenhouse Accounts factors will apply.*

Consultation questions:

16. Do you think it is appropriate to use more accurate electricity emissions factors similar to those proposed in the 2019 RIS (averaged over the deemed HPWH lifetime) for commercial and industrial HPWH activities?
    a. Yes/No
    b. Please explain your answer.

Submissions

Summary of consultation questions

1. Do you think there is a market for a deemed activity that incentivises the installation of HPWHs in commercial and industrial sectors? What are your views on the demand for the activity and supply chains, now and in the next three years?
2. What are the benefits and potential drawbacks or risks to making HPWH systems that serve multiple private residences eligible under the proposed activity?
3. Do you agree with including product eligibility requirements that will enable demand response for the proposed activity?
    a. Yes / No
    b. If Yes, please provide further detail, e.g. what capabilities do you think should be required and how should compliance be evidenced?
    c. If No, please explain why you do not agree with inclusion of demand response.
4. If you have downloaded and tested the draft guidance materials and TRNSYS modelling files which have been developed for the product registration process please provide feedback here.
5. What range of HPWH capacities (kW) do you think will be supported by introducing the proposed activity and why?
6. Do you think there is a demand for an application-based deemed activity, that incentivises the installation of larger capacity HPWHs than the current proposed activity, but smaller capacity than what is suitable for the M&V method?
    a. Yes/No
    b. What range of HPWH capacities do you think would be supported by this third activity?
7. Do you see any potential for the proposed HPWH activity to result in undesired outcomes or incentivise unsuitable installations?
    a. Yes/No
    b. If yes, please provide further information about the concerns you have.
    c. How do you think these undesired outcomes can be avoided?
8. Would the proposed HPWH activity incentivise you to become accredited to provide this activity through the VEU program?
9. What types of businesses or industries would you expect to provide this activity?
10. Do you see barriers to the uptake of the proposed HPWH activity?
    a. Yes/No
    b. If yes, what barriers do you anticipate?
    c. What solutions do you see for overcoming these barriers?
11. What do you think is the most appropriate deemed equipment lifetime for HPWHs in commercial and industrial settings?
    a. Answer (in years)
    b. Please explain your answer.
12. Do you think it will be achievable to provide sufficient evidence to meet the eligibility requirements of a pre-existing hot water storage tank?
    a. Yes/No

b. If not, please explain why and suggest what evidence may be more suitable (e.g. proving the condition of the tank rather than the age).

13. What share of the commercial and industrial HPWH market do you think includes an electric resistance heating element for use when ambient temperatures are outside of safe operating conditions?
    a. Answer as percentage
    b. Do you think VEU program incentives should account for this electric resistance back-up function?
14. Do you agree with incentivising the installation of HPWHs which use lower global warming potential refrigerants?
    a. Yes/No
    b. If not, please explain why?
15. Do you agree with the proposed method for rewarding/penalising refrigerant choice?
    a. Yes/No
    b. If not, please explain why?
16. Do you think it is appropriate to use more accurate electricity emissions factors similar to those proposed in the 2019 RIS (averaged over the deemed HPWH lifetime) for commercial and industrial HPWH activities?
    a. Yes/No
    b. Please explain your answer.

Have your say

Stakeholders can submit their feedback using the survey on the Engage Victoria website https://engage.vic.gov.au/commercial-and-industrial-heat-pump-water-heating. Feedback from stakeholder submissions will be used to guide the creation and implementation of the new VEU activities.

Submissions can also be emailed to energy.upgrades@delwp.vic.gov.au or sent as a hard copy submission to: *Victorian Energy Upgrades, Department of Environment, Land, Water and Planning, PO Box 500, East Melbourne, VIC 8002*. If you make a submission by email or post, please ensure to state whether DELWP can publish your submission.

The ESS and VEU programs have planned on consulting on a new commercial and industrial HPWH activity at around the same time. The consultation approach and questions have been aligned as much as possible, however, in the case of potential differences in the number of submissions and specific responses, the VEU program intends to share the findings of stakeholder submissions with the ESS. This will be done in the interest of better and more efficient activity development. If you do not wish for your responses to the questions contained in this issues paper to be shared with the ESS please indicate this in your submission.

Next steps

Key milestones in the introduction of the HPWH activity into the VEU program are:

• Open stakeholder consultation on the proposed activity	15 June 2021
• **Close stakeholder consultation on the proposed activity**	**12 July 2021**
• Response to stakeholder consultation on the proposed activity	August 2021
• Finalise Regulations and Specifications	Second half 2021
• C&I HPWH activity introduced into the VEU program	Second half 2021

Appendix: Commercial and industrial air source heat pump water heater upgrades – Draft Regulations and Specifications

The *Victorian Energy Efficiency Target Regulations 2018* commenced on 10 December 2018 and provide for deemed activities in the program. Details of the technical requirements for these regulations are contained in the publication Victorian Energy Upgrades – Specifications.

The Regulations set out the activities that attract incentives and the methodologies for calculating greenhouse gas (GHG) emissions reductions, while the Specifications document provides further technical details of the GHG emissions calculations. The technical elements in the Specifications can be more responsive to changing circumstances and be updated more frequently, without foregoing appropriate consultation processes.

The three proposed heat pump water heater upgrade scenarios have been defined in the draft Regulations and Specifications. Please see the following sections for:

1. Draft Victorian Energy Efficiency Target Regulations 2018 – Heat Pump Water Heater Upgrades
2. Draft Victorian Energy Upgrades – Specifications – Part 44 – Heat Pump Water Heater Upgrades.

The draft Regulations and Specifications are being consulted on as part of this process.

DELWP welcomes your views and any technical feedback on these documents.

Draft Text – Victorian Energy Efficiency Target Regulations 2018 – Commercial and industrial air source heat pump water heaters

Definitions

In regulation 5 of the Principal Regulations, **insert** the following definitions—

air source heat pump water heater means a heat pump water heater with an evaporator collecting latent energy and sensible heat from the atmosphere;

heat pump water heater means a water heater using a vapour compression cycle and incorporating a compressor, and evaporator and a condenser that delivers heat to water either directly or indirectly;

licensed or registered plumber means a licensed plumber or register plumber within the meaning of the **Building Act 1991** who is authorised under that Act to carry our refrigerated air-conditioning work;

thermal capacity means thermal capacity determined in accordance with the Commercial and Industrial Heat Pump Water Heater Application Guide 2021.

Creation of certificates

After regulation 10(4) of the Principal Regulations **insert**—

> "(4A) For the purposes of section 15(1) of the Act, an activity set out in Part 44 of Schedule 2 is also a prescribed activity if it is undertaken in compliance with that Part in the common areas of a building that is classified under Part A3 of Volume One of the Building Code as a Class 2 building."

Part 44 – Commercial and industrial air source heat pump water heaters

1) The prescribed activity is
    a) The following
        i. Decommissioning, in accordance with subregulation (2), one or more gas-fired hot water boilers or gas-fired water heaters; and
        ii. Having one or more products specified in subclause (4) installed by a licensed or registered plumber; or
    b) The following
        i. Decommissioning, in accordance with subclause (2), one or more electric resistance hot water boilers or electric resistance water heaters; and
        ii. Having one or more products specified in subclause (4) installed by a licensed or registered plumber; or
    c) Having one or more products specified in subclause (4) installed by a licensed or registered plumber.
2) A product to be decommissioned must be—
    a) in working order; and
    b) at least 10 years old at the date it is decommissioned.

3) If a product to be decommissioned includes insulated storage tanks that are less than 10 years old at the date the product is decommissioned, the specifications may provide that the storage tanks may be used with the products to be installed.

4) The specified products are the following—

   a) a product listed on the ESC register as belonging to a product category whose category number is specified in column 1 of Table 44.1;

   b) an unlisted product that complies with the criteria specified in column 2 of an item in Table 44.1.

Table 44.1 – Product categories

Column 1 Category number	Column 2 Criteria applying to product category
44A	An air source heat pump water heater that is either – a) a product that – (i) has an insulated storage volume not exceeding 700 litres; and (ii) is certified by an accredited body as complying with AS/NZS 2712; and (iii) provides a minimum delivery temperature of 45 degrees C; and (iv) achieves the specified minimum annual energy savings; and (v) is modelled against the specified heat pump modelling requirements; or b) a product that – (i) has an insulated storage volume exceeding 700 litres; and (ii) provides a minimum delivery temperature of 45 degrees C; and (iii) achieves the specified minimum annual energy savings; and (iv) is modelled against the specified heat pump modelling requirements.
44B	An air source heat pump water heater that is either – a) a product that – (i) has an insulated storage volume not exceeding 700 litres; and (ii) is certified by an accredited body as complying with AS/NZS 2712; and (iii) provides a minimum delivery temperature of 45 degrees C; and (iv) achieves the specified minimum annual energy savings; and (v) is modelled against the specified heat pump modelling requirements; or b) a product that – (i) has an insulated storage volume exceeding 700 litres; and (ii) provides a minimum delivery temperature of 45 degrees C; and (iii) achieves the specified minimum annual energy savings; and (iv) is modelled against the specified heat pump modelling requirements.

44C	An air source heat pump water heater that is either – a) a product that – (i) has an insulated storage volume not exceeding 700 litres; and (ii) is certified by an accredited body as complying with AS/NZS 2712; and (iii) provides a minimum delivery temperature of 45 degrees C; and (iv) achieves the specified minimum annual energy savings; and (v) is modelled against the specified heat pump modelling requirements; or b) a product that – (i) has an insulated storage volume exceeding 700 litres; and (ii) provides a minimum delivery temperature of 45 degrees C; and (iii) achieves the specified minimum annual energy savings; and (iv) is modelled against the specified heat pump modelling requirements.
44D	A product that meets the requirements of the Secretary's specifications for this item.

44 Commercial and industrial air source heat pump water heaters – Schedule 2, Part 44

The time specified for the purposes of regulation 11(1) and (2) for a prescribed activity set out in Part 44 of Schedule 2 is the later of

a) the day on which the installation and commissioning of the product are complete; or

b) if the prescribed activity involved decommissioning an existing gas-fired hot water boiler, gas-fired water heater, electric resistance hot water boiler or electric resistance water heater, the day on which that existing boiler or water heater is decommissioned.

Draft Victorian Energy Upgrades – Specifications – Part 44 – Commercial and industrial air source heat pump water heaters

Definitions

Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide means the Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide published by the Department of Environment, Land, Water and Planning.

EEF means electricity emissions factor;

GEF means gas emissions factor;

HPElec means the annual electrical energy used by an air source heat pump water heater;

HPGas means the annual gas energy used by an air source heat pump water heater;

NewEff means the reference gas water heater efficiency for a new commercial or industrial air source heat pump water heater system;

RepEff means the reference gas water heater efficiency for a commercial or industrial gas water heater system that is at least 10 years old;

RefElec means reference electric resistance water heater energy consumption;

44: Part 44 Activity– Commercial and industrial air source heat pump water heaters

Activity Description

Part 44 of Schedule 2 of the Regulations prescribes the upgrade to an air source heat pump water heater for commercial (including multi-residential) and industrial and applications as an eligible activity for the purposes of the Victorian Energy Upgrades program.

Table 44.1 lists the eligible products that may be installed, upgraded or replaced. Each type of upgrade is known as a scenario. Each scenario has its own method for determining GHG equivalent reduction.

Over time, the department may determine that there are other equipment changes that reduce GHG equivalent emissions when implemented. In such a case, product requirements and installation requirements for these changes will be listed by the department as scenario number 44D once specified.

VEECs cannot be created for this activity unless products installed are listed on the ESC Register by the time VEECs are created. Products already on the register at the time of installation can be taken as satisfying all those product requirements that can be determined prior to the installation of a product.

Table 44.1 – Eligible Commercial and Industrial air source heat pump water heater scenarios

Product category number	Scenario number	Decommissioning requirements	Product to be installed	Historical schedule number
44A	44A	One or more: • gas-fired hot water boilers; or • gas-fired water heaters Boiler or heater decommissioned must not be less than 10 years old	One or more air source heat pump water heaters: • that: ○ have an insulated storage volume not exceeding 700 litres; and ○ are certified to AS/NZS 2712; and ○ provide a minimum delivery temperature of 45°C; and ○ are installed by a licensed or registered plumber; or • that: ○ have an insulated storage volume exceeding 700 litres; and ○ provide a minimum delivery temperature of 45°C; and ○ are installed by a licensed or registered plumber	N/A
44B	44B	One or more: • electric resistance hot water boilers; or • electric resistance water heaters Boiler or heater decommissioned must not be less than 10 years old	One or more air source heat pump water heaters: • that: ○ have an insulated storage volume not exceeding 700 litres; and ○ are certified to AS/NZS 2712; and ○ provide a minimum delivery temperature of 45°C; and ○ are installed by a licensed or registered plumber; or • that: ○ have an insulated storage volume exceeding 700 litres; and ○ provide a minimum delivery temperature of 45°C; and ○ are installed by a licensed or registered plumber	N/A
44C	44C	None	One or more air source heat pump water heaters: • that: ○ have an insulated storage volume not exceeding 700 litres; and ○ are certified to AS/NZS 2712; and ○ provide a minimum delivery temperature of 45°C; and ○ are installed by a licensed or registered plumber; or • that: ○ have an insulated storage volume exceeding 700 litres; and ○ provide a minimum delivery temperature of 45°C; and ○ are installed by a licensed or registered plumber	N/A

Specified Minimum Energy Efficiency

The product installed must meet the relevant additional requirements set out in Table 44.2

Table 44.2 - Additional requirements for commercial and industrial air source heat pump water heaters to be installed

Product category number	Requirement type	Efficiency requirement	
44A, 44B, and 44C	Minimum annual energy savings	If the product is installed in climatic zone 4*	60%, determined in accordance with the Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide, when modelled in climate zone HP4-Au
		If the product is installed in climatic zone 5*	60%, determined in accordance with the Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide, when modelled in climate zone HP5-Au

*See the Location Variables list to determine what climatic zone applies to any premises

Other specified matters

The product installed must meet the relevant additional requirements set out in Table 44.2.

Table 44.3 Other specified matters for commercial and industrial air source heat pump water heaters

Product category number	Requirement type	Specification details
44A, 44B and 44C	Heat pump modelling requirements	The product must be modelled in accordance with the Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide so that minimum annual energy savings are determined for both HP4-Au and HP5-Au climate zones. These must be provided to the ESC.*
44A and 44B	Installation requirements	The product must be installed as modelled except that an existing storage tank may be used as storage in place of a modelled component if evidence is provided to the ESC that the tank: • was manufactured less than 10 years before the existing product is decommissioned; • has a volume that is greater than or equal to the volume of the modelled component; • is insulated
44C		The product must be installed as modelled
44A, 44B and 44C	Application	Installation must be at: • business premises or industrial premises; • the common areas of a building that is classified under Part A3 of Volume One of the Building Code as a Class 2 building.

Method for Determining GHG Equivalent Reduction

Scenario 44A: Decommissioning a gas product and installing an air source heat pump water heater

The GHG equivalent emissions reduction for each scenario is given by Equation 44.1, using the variables listed in Table 44.4.

Equation 44.1 – GHG equivalent emissions reduction calculation for Scenario 44A

$$GHG\ Eq.Reduction = \sum systems[GEF \times (RefElec/RepEff) - GEF \times HPGas - EEF \times HPElec] \times Capacity\ Factor \times Lifetime$$

Table 44.4 – GHG equivalent emissions reduction variables for Scenario 44A

Input Type	Condition	Input Value
Lifetime	If using existing storage with a new system	10
	In any other case	15
EEF	For upgrades in Metropolitan Victoria*	1.0731**
	For upgrades in Regional Victoria*	1.1388**
GEF	For upgrades in Metropolitan Victoria*	0.05523**
	For upgrades in Regional Victoria*	0.05523**
Capacity Factor	if heat pump thermal capacity (kW) ≤ existing system thermal capacity (kW)	1
	if heat pump thermal capacity (kW) > existing system thermal capacity (kW)	(Existing system thermal capacity (kW))/(heat pump thermal capacity (kW)),
HPElec	In every instance	As determined in accordance with the Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide in GJ/year
HPGas	In every instance	As determined in accordance with the Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide in GJ/year
NewEff	In every instance	0.85
RepEff	In every instance	0.788

*See the Location Variables list to determine what climatic zone applies to any premises

** Emissions factors subject to change

Scenario 44B: Decommissioning an electric product and installing an air source heat pump

The GHG equivalent emissions reduction for each scenario is given by Equation 44.2, using the variables listed in Table 44.5.

Equation 44.2 – GHG equivalent emissions reduction calculation for Scenario 44B

$$GHG\ Eq.Reduction = \sum systems[EEF \times RefElec - GEF \times HPGas - EEF \times HPElec] \times Capacity\ Factor \times Lifetime$$

Table 44.5 – GHG equivalent emissions reduction variables for Scenario 43B

Input Type	Condition	Input Value
Lifetime	If using existing storage with a new system	10
	In any other case	15
EEF	For upgrades in Metropolitan Victoria*	1.0731**
	For upgrades in Regional Victoria*	1.1388**
GEF	For upgrades in Metropolitan Victoria*	0.05523**
	For upgrades in Regional Victoria*	0.0523**
Capacity Factor	if heat pump thermal capacity (kW) ≤ existing system thermal capacity (kW)	1
	if heat pump thermal capacity (kW) > existing system thermal capacity (kW)	(Existing system thermal capacity (kW))/(heat pump thermal capacity (kW)),
HPElec	In every instance	As determined in accordance with the Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide in GJ/year
HPGas	In every instance	As determined in accordance with the Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide in GJ/year
NewEff	In every instance	0.85
RepEff	In every instance	0.788

***See the Location Variables list to determine what climatic zone applies to any premises**

****Emissions factors subject to change**

Scenario 44C: Installing an air source heat pump water heater

The GHG equivalent emissions reduction for each scenario is given by Equation 44.3, using the variables listed in Table 44.6.

Equation 44.3 – GHG equivalent emissions reduction calculation for Scenario 43C

$$GHG\ Eq.Reduction = \sum \mathbf{systems}[\mathbf{GEF} \times (\mathbf{RefElec}/\mathbf{NewEff}) - \mathbf{GEF} \times \mathbf{HPGas} - \mathbf{EEF} \times \mathbf{HPElec}] \times \mathbf{Lifetime}$$

Table 44.6 – GHG equivalent emissions reduction variables for Scenario 44C

Input Type	Condition	Input Value
Lifetime	If using existing storage with a new system	10
	In any other case	15
EEF	For upgrades in Metropolitan Victoria*	1.0731**
	For upgrades in Regional Victoria*	1.1388**
GEF	For upgrades in Metropolitan Victoria*	0.05523**
	For upgrades in Regional Victoria*	0.05523**
HPElec	In every instance	As determined in accordance with the Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide in GJ/year
HPGas	In every instance	As determined in accordance with the Commercial and Industrial Air Source Heat Pump Water Heater Product Application Guide in GJ/year
NewEff	In every instance	0.85
RepEff	In every instance	0.788

***See the Location Variables list to determine what climatic zone applied to any premises**

****Emissions factors subject to change**