ESSENTIAL SERVICES COMMISSION

Annual Solar Energy Calculation Method for Domestic Solar and Heat Pump Water Heater

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Introduction

This guide provides product applicants with guidance on how to apply for solar and heat pump water heating products to be listed on our Register of Products, so that they are eligible to be installed and create Victorian energy efficiency certificates (VEECs) under the Victorian Energy Upgrades (VEU) program.

About this guide

This guide provides instructions for modelling of products to calculate the annual solar energy savings when applying for product approval of solar or heat pump water heater to be listed on the Register of Products.

The products covered by this guide are:

- Electric boosted solar water heater (product category 1C)
- Heat pump water heater (product category 1D)
- Gas or LPG boosted solar water heater (product categories 1F and 3B)

Applicants must also read our Application Guide for Product Applicants and Water Heating and Space Heating/Cooling Product Application Guide, which provide additional information on:

- Our Register of Products.
- Our product application and assessment process, including things to bear in mind throughout the process.
- Product application functionality.
- Product performance criteria.
- Documentation requirements.

Who should use this guide

You should use this guide if you are:

- applying for solar or heat pump water heating products to be listed on our Register of Products under the Victorian Energy Upgrades program.
- interested in understanding the product application requirements for solar or heat pump water heating products under the Victorian Energy Upgrades program

You must hold a VEU account to apply for a product listing. Find out more about creating a VEU account at www.esc.vic.gov.au/veu-become-accredited

Seeking assistance

If you encounter difficulties with your application that cannot be answered using this guide contact us on (03) 9032 1310 or VEU@esc.vic.gov.au

We appreciate the time and effort that businesses put into their applications and product officers will endeavour to work with you during the assessment process.

If you have submitted a product application, please use the designated 'notes' field in the online product assessment tool to communicate directly with the product officer responsible for assessing your application.

Legal context for this guide

We have prepared this guide as a general summary of relevant parts of:

- Victorian Energy Efficiency Target Act 2007 (the Act)
- Victorian Energy Efficiency Target Regulations 2018 (the VEET Regulations)
- Victorian Energy Upgrades Specifications 2018 (the VEU specifications)
- Victorian Energy Efficiency Target Guidelines (the guidelines)

View these documents at www.esc.vic.gov.au/veu-legislation

This guide should not be relied upon as substitute for legal advice and should be read in conjunction with the above source documents. In the event of inconsistency between this guide and the source documents, the content in the source documents apply.

1. Modelling Requirements

1.1. TRNSYS

Modelling shall be conducted in accordance with AS/NZS 4234:2008 (Heated water systems – Calculation of energy consumption) using the TRNSYS program or extensions of the software in the TRNSYS modelling package. This is required to ensure that the system can deliver the selected load in the middle of winter and to determine the annual energy savings in Southern Victoria (Zone 4). Modelling should be carried out using a simulation time step of 0.1 hour or less.

Modelling shall employ either the small or medium load size as described in AS/NZS 4234:2008.

1.2. Key model parameters

The calculation of energy consumption shall use the method set out below:

- Collector inclination = 25°, azimuth = 0° North (as per the "North Orientation" in AS/NZS 4234:2008). Note the alternative "representative average installation" can also be used.
- Weather data to be used in the simulation shall be climate zone 4 (Melbourne).
- The night time effective air temperature used to determine solar collector, roof mounted tanks and piping heat loss during night time (solar radiation on horizontal surface <1 kJ/h•m2) shall be $T_{aeff} = T_a - (T_a - T_{sky})/5$, where T_a denotes the ground level air temperature and T_{sky} the sky temperature as given by Equation 3.2 of AS/NZS 4234:2008. The effective air temperature during daytime (solar radiation on horizontal surface ≥1 kJ/h•m^2) shall be $T_{aeff} = T_a$.

1.3. Boosting regime

The boosting regime modelled must be consistent with the way the product will be installed. See Appendix A for further guidance on user override of time limited boosting.

1.3.1. Off-peak boosting

Most electric boosted solar water heaters installed in Victoria are boosted off peak and should be sized to minimise boosting required during peak times. The model shall separately report the total energy supplied in each boost mode (peak and off peak) throughout the modelling calculation.

Off-peak electric boost availability times

For off-peak electric boost availability times, refer to the AS/NZS 4234:2008 "night rate".

Off- peak electric boost systems with one element

Off-peak electric boost systems with one element may be set to allow the booster to be energised with a 'one shot' boost if the delivered water temperature falls below a set threshold, with the

control reverting to regular operation after one boost cycle. This feature may only operate once per day.

1.3.2. Continuous boosting

For electric boosted solar water heaters and heat pumps that are to be installed on the more expensive continuous boosting tariff, the system should be modelled with the boost control in continuous mode. The results must note that the modelling assumed a continuous tariff.

1.4. Variable thermostats

Products with variable thermostats which facilitate user override are acceptable. The commission does not specify which thermostat setting should be used in the model, provided that:

- the model setting is within the range of settings available for the actual product; and
- the model achieves the following related Australian Standards requirements:
  - minimum delivery temperature of 45°C; and
  - the product must control for legionella (various options are available).

1.5. Mid- winter load delivery

The system must report the minimum delivery temperature under the selected load as specified in AS/NZS 4234:2008. The purpose of this requirement is to ensure the consumer has sufficient hot water through periods of low solar gain.

The modelling procedure allows for one-shot boosting where installations connected to off-peak supply will enable this to occur as outlined in section 1.3.2 above. If the product fails to meet this condition, a lower load should be selected. If the product fails to meet this condition under the small load, the product is not eligible.

1.6. Special considerations for air-source heat pump storage water heaters

An amendment to AS/NZS 4234:2008 was published in 2011 and key changes relevant to the calculation of energy savings for air-source heat pump storage water heaters have been identified. The heat pump water heater task performance evaluation described in AS/NZS 4234:2008/Amdt 1:2011 will be accepted as the basis for modelling air-sourced heat pump storage systems.

1.7. Presentation of results

Results shall be presented in the current version of the Solar and Heat Pump Water Heater Product Application Form available at www.esc.vic.gov.au/veu-product-applicants. A separate row

shall be used for each system. Please enter only the required data marked by light blue cells. Do not modify formulas or hidden data.

Annual purchased energy consumption data should be entered with a precision of four significant figures. The final result of “annual purchased energy savings (%)" is published with a precision of two significant figures.

Appendix A: User over-ride of time-limited boosting and one-shot boosting

The concept of time limited boosting used in off-peak electric water heaters has been adopted in solar/gas-storage water heaters. The purpose of using time-limited boosting in solar/gas storage water heaters is to separate the solar and gas energy inputs in time so that the solar input can occur over the day without the gas boost operating and diminishing the solar performance. Schemes that have been adopted to maximise the solar performance of solar/gas storage water heater include:

- time clock limit of gas operation
- intelligent controller that senses solar availability and the quantity of hot water in the tank and minimises gas operation during solar input periods.

These systems can be configured to achieve reasonable solar contribution. However, if the time clock or controller settings are adjustable by the user then there may be a significant reduction of solar contribution. User adjustment of the boost control could occur during periods of bad weather or when there is a short-term high demand.

Automatic resetting controls off-peak boosting

The current methodology accounts for the potential user adjustment of the auxiliary boosting by requiring that the controls automatically reset to the conditions used for the rating analysis within 24 hours of any user adjustment of the controller.

Both gas and electric products that allow user over-ride of an auxiliary booster control that automatically resets within 24 hours should be modelled using a ‘one-shot’ boosting option that is initiated when the delivery temperature drops to a level where the product would fail the minimum delivery temperature requirement. This feature may only operate once per day. The one-shot threshold temperature should be 45°C or higher depending on the product design.

Permanent user over-ride controls off-peak boosting

Products that allow the user to reset the boost controller and that do not automatically reset to the operating conditions used during the rating calculation should be modelled with the boost control in continuous mode.

Document version control

The RM reference for this document is: C/18/29679

Version	Amendments made	Date published
1.0	First release under the 2018 VEET Regulations	10 December 2018
1.1	Deleted one requirement in 1.3.1 section regarding “peak (day rate) boost energy for off-peak electric boost systems	6 November 2019