ESSENTIAL SERVICES COMMISSION

Victorian Energy Upgrades

Explanatory note – annual solar energy calculation methodology for domestic solar water heaters

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The Department of Environment, Land, Water and Planning develops policy for the Victorian Energy Upgrades program. The program provides incentives for Victorian households and organisations to make energy efficiency improvements that save money on their energy bills and reduce Victoria's greenhouse gas emissions

The Essential Services Commission administers the program as the 'Victorian Energy Efficiency Target scheme' under the *Victorian Energy Efficiency Target Act 2007*.

For more information, visit veet.vic.gov.au.

Contents

1. Introduction

1.1. Purpose of this document

This document is designed to guide Victorian Energy Efficiency Target (VEET) scheme account holders applying for product approval of solar hot water heaters, including heat pumps, under Schedules 1E, 1F/3B, 2 and 4. This document outlines the TRNSYS modelling methodology that should be followed to calculate the annual solar energy savings for a new or modified solar water heater system to be listed on the Register of products.

Applicants should consider this explanatory note when completing their application to ensure that the application is successfully submitted.

1.2. TRNSYS

Modelling shall be conducted to AS/NZS 4234:2008 using the TRNSYS program or extensions of the software in the TRNSYS modelling package, 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.

2. 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 over ride of time limited boosting.

2.1. 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.

2.1.1. Off-peak electric boost availability times

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

2.1.2. 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.

2.1.3. Peak (day rate) boost energy for off-peak electric boost systems

Peak (day rate) boost energy for off-peak electric boost systems must be less than 25% of the total reference conventional system energy use. For the purposes of this clause, “day rate” applies to all hours outside the AS/NZS 4234:2008 “night rate” period.

2.2. 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 continuous tariff.

3. Other matters

3.1. 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 2.2 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.

3.2. Energy savings compared to a conventional water heater

The calculation of energy savings compared to a conventional system (known as the relative solar fraction) shall use the methodology set out below:

1. 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
2. Weather data to be used in the simulation shall be climate zone 4 (Melbourne)
3. The calculation for "purchased energy savings relative to reference water heaters" shall be taken from AS/NZS 4234:2008
4. 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 day time (solar radiation on horizontal surface ≥1 kJ/h•m^2) shall be $T_{aeff} = T_a$

3.3. 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.

3.4. Presentation of results

Results shall be presented in the current version of the application spreadsheet which is available on the VEET website. 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 heaters 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.

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1.1	Document created	26 June 2014
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