Guidelines to calculate annual solar energy savings for domestic solar water heaters produced by adding a Retrofit Kit (collectors and pump) to an existing tank

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Annual solar energy savings calculation methodology for domestic solar water heaters

RETROFIT DOMESTIC SOLAR WATER HEATER MODELS

To determine the annual solar energy savings for a solar water heater retrofit kit not listed on Sustainability Victoria's list of kits approved for Rebate, use the following methodology:

1. OVERVIEW

Modelling shall be conducted in the same manner as for a complete packaged solar water heating system as specified in the document "Guideline to calculate annual solar energy savings for domestic solar water heaters rebate" available on the Sustainability Victoria Website. As there is no tank included as part of the retrofit kit, a generic tank model shall be used for the modelling of annual solar energy savings.

Modelling shall be conducted to AS/NZS 4234:2008 using the TRNSYS program or extensions of the software in the TRNSYS modelling package, to determine the relative solar fraction in Southern Victoria (Zone 4). The command file Retrofit.dck for TRNSYS shall be used for modelling, available for download on the Sustainability Victoria website. The results should be reported on the same spreadsheet as for the full system modelling.
The characteristics of the components to be used in the model are specified below.

2. COLLECTOR AREA

In order to limit the possibility of overheating in high solar conditions the maximum collector aperture area allowed in any retrofit kit is given below;

Size of tank	Maximum collector aperture area	
	Flat plate collectors	Evacuated tube collectors
200 - 300 litres	2 m^2	1.5 m^2
300 - 440 litres	4 m^2	2.5 m^2
Greater than 440 litres	6 m^2	3.5 m^2

3. COLLECTOR CHARACTERISTICS

The annual performance calculation shall use the actual performance and area of collectors in the model including;

- The collector performance measured to AS 2535.1 requirements (or equivalent eg ISO 9806-3)
- The number of collectors as defined in the kit specification
- The measured aperture area of each collector (or the area consistent with the collector performance curve characteristic if not the aperture area).

4. PUMP AND CONTROLLER CHARACTERISTICS

The model shall use the actual measured performance of the pump and the controller in the model, including;

- Pump controller differential temperature settings for both switch on and switch off conditions and any other controller functions.
- Maximum temperature at bottom of tank allowed by the controller to avoid overheating in the tank.
- Pump flow rate, measured in pumping the collector fluid through a circuit configured consistent with the pipe lengths given in the plumbing between tank and solar collector table below
- Pump power measured in the above configuration

5. TANK CHARACTERISTICS

The characteristics of the tank and the auxiliary boost regime are defined in the table below.

TANK

Tank inner diameter	500	mm
Tank volume	315	L
Tank wall thickness	2.5	mm
Tank wall material	Carbon steel/glass	
Tank standing heat loss (AS1056)	3.06	kWh/day for ΔT=55K

AUXILIARY BOOSTING

Volume of water above the electric element.	315	L
Volume of water above the thermostat.	300	L
Element heating capacity	4.8	kW
Thermostat set temperature	70	°C
Thermostat dead band	8	K
Electric boost times	11pm to 7am	Night rate

6. PLUMBING CHARACTERISTICS

The characteristics of the plumbing between tank and solar collector(s) are defined in the table below.

PLUMBING BETWEEN TANK AND SOLAR COLLECTOR

Connection to tank	**Direct**	**Direct or heat exchanger**
Volume of water above collector flow input to tank	300	L
Collector supply (inlet) pipe inner diameter	10.9	mm
Inlet pipe length	10	m
Inlet pipe insulation material thermal conductivity	0.038	W/(m K)
Inlet pipe insulation thickness	10[1)]	mm
Collector outlet pipe inner diameter	10.9	mm
Outlet pipe length	10	m
Outlet pipe insulation material thermal conductivity	0.038	W/(m K)
Outlet pipe insulation thickness	10[1)]	mm
External heat loss coefficient	10	W/(m2 K)

Note: [1)] If a higher grade of insulation is supplied as part of the Retrofit Kit the thickness of the supplied insulation material may be used

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