

THE BUSINESS CASE FOR EVACUATED SOLAR TUBES

TECHNOLOGY OVERVIEW

Evacuated solar thermal tubes are one of the most widely used renewable energy systems in the world. They have provided a cost-effective heating of water for domestic applications in Australia for over 20 years. The systems are simple and reliable, some with no moving parts. There is a well-developed manufacturing, service and installation industry in Australia.

Evacuated tube technology can be between 50% and over 100% more efficient than flat panels (depending on seasons) for nearly all water heating applications. This is because the heat pipe collectors can more easily attain the higher temperatures needed, they can collect and retain heat even when it is very cold outside, and due to their superior Incidence Angle Modifier they collect solar energy more evenly throughout the day resulting in a lower buffer or thermal storage requirement.

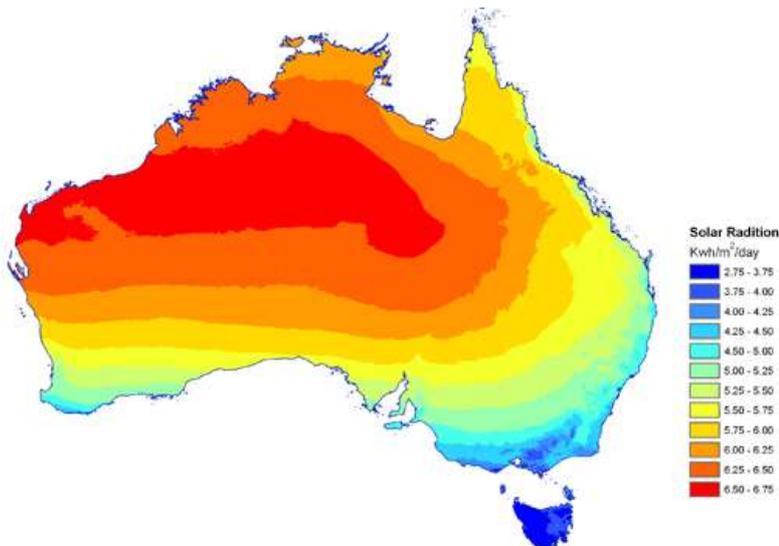


IS IT SUITABLE FOR YOUR FACILITY?

Solar thermal systems can heat water from ambient to around 70°C. If a site requires water at 130°C for rendering, this technology can be used to raise the temperature of water from ambient to 70°C, with the remainder provided by other heating sources such as an instant gas water heater. The collector heats water during the day which is stored in a tank. When hot water for rendering or sterilizing is required the water flows from the tank through the gas heater, which checks the temperature. The water is heated further if required.

These systems are most suitable for:

- Areas with high insolation (i.e. high amount of solar energy received per unit area)
- Colder climates – compared to flat panel collectors which are less efficient
- Sites with high or increasing heating energy costs
- Sites with large hot water or steam loads



Australian mean annual solar radiation levels (data and map supplied by CRES, ANU)

HOW TO DEVELOP YOUR BUSINESS CASE

The steps to consider include:

- Determine the amount of sun received at the site (insolation)
- Identify suitable buildings or areas for the tubes
- Calculate the energy saving of the tubes
- Estimated savings and the investment required
- Approach the market for a quote

DETERMINE YOUR INSOLATION

Insolation is the amount of solar energy received per unit area. It varies around Australia and is generally presented as a map, like the one below. These values are often normalised to equivalent midday insolation

received per day, to make the comparison between areas easier. Higher values indicate more favourable solar conditions.

IDENTIFY SUITABLE BUILDINGS OR AREAS FOR THE EVACUATED TUBES

Assess whether you have a large enough north facing roof surface or unused land with good, direct sunlight. Based on an insolation of 5kWh/m²/day, each square metre of evacuated tubes can heat a tonne of water about 4°C.

CALCULATE THE ENERGY SAVINGS OF THE TUBES

Collection efficiency of evacuated tubes approaches 80% for most units. This can be used with the insolation data above to estimate the energy saved throughout a year. These data are averaged over a year, so to calculate the energy collected, find the insolation of your site, multiply by the number of days per year, the area of tubes proposed and the efficiency. This will be covered in more detail below.

ESTIMATE SAVINGS, INVESTMENT REQUIRED AND FUNDING SOURCES

Typical systems retail at about \$400/m² of collector, with discounts possible for large purchases. The cost to install a solar hot water system can be significantly reduced through generous government rebates. You could be eligible to receive Small-scale Technology Certificates (STCs). An STC is a measure of renewable energy which can be traded for money or a discount on the purchase price.

A new solar hot water system is eligible if:

- it is a new system and is listed on the register of solar water heaters on the website of the Clean Energy Regulator (<http://ret.cleanenergyregulator.gov.au/Hot-Water-Systems/eligible-swhs>)
- small-scale technology certificates are created within 12 months of installation. If you choose to go through an agent they will create the certificates on your behalf.

Agents registered with the Clean Energy Regulator will offer you a financial benefit for your small-scale technology certificates, such as a discount off the invoice, in exchange for the right to create and sell certificates.

You can determine the number of certificates your system is eligible for by using the solar water heater calculator on the website of the Clean Energy Regulator (<https://www.rec-registry.gov.au/swhCalculatorInit.shtml>).

Alternatively, you can ask your registered agent about the number of certificates your system is eligible for, and the price they are offering for each small-scale technology certificate. The financial benefit is usually based on the small-scale technology certificate price at the time of the offer, as this fluctuates depending on supply or demand. The Clean Energy Council publishes the small-scale technology spot price on its website; however different traders may offer different prices depending on the buyer. You may wish to conduct an internet search for 'STC price' or 'REC price' to find other traders and prices.

EXAMPLE COST-BENEFIT ANALYSIS

An abattoir in northern NSW wants to reduce their fuel costs for water heating. They are currently using natural gas which is provided at \$8/GJ. Their current boiler has an efficiency of about 90% and consumes 5,000GJ of gas annually, which provides 4,500GJ of heat to water annually and an annual gas bill of \$40,000. They have a large warehouse with good northerly solar access. They want to deliver about 90% of their load with solar thermal tubes, so they are determining what area of tubes can deliver this load.

Annual Gas GJ	At 80% collector efficiency	Daily Requirement GJ	Conversion to kWh	Area required at 5kWh/m ² (m ²)	Cost at \$400/m ²	Simple Payback
4,500	5,625	15.4	4281	856	\$342,400	8.5 years

A method to calculate the energy savings for solar hot water systems in Australia is covered in great detail in Australian Standard AS4234 and summarised well by the Green Building Council of Australia. The pdf of this method can be found at the link below.¹

¹ <http://www.gbca.org.au/uploads/221/1757/Green%20Star%20-%20Solat%20Hot%20Water%20and%20Heat%20Pump%20Booster%20Energy%20Calculation%20Methodology.pdf>