

## why solar water heating has failed in Australia

Fifty years ago, two countries led the world in the development of the technology for heating water from the sun: Israel and Australia. Both countries had government sponsored research departments as well as private enterprise working on the flat plate technology of darkened copper or other metals behind glass that would heat the water and store it in a tank either mounted above the solar absorber, or on a tank mounted remotely in the roof or on the ground. Given the plentiful sunshine in both countries it seemed a 'no-brainer' that this technology would be quickly developed and implemented.

Fast forward 50 years and if you travel in the Middle East there is hardly a building that doesn't have some form of solar water heating, but in Australia it is less than 5%, or 1 in 20, of houses that are fitted with a solar water heater. The question has to be asked: When both countries started out with the same enthusiasm, technology and access to sun, why did one succeed and Australia failed?

Most commentators believe that the answer is financial: that the cost of energy supply in Australia is so cheap that there is little financial incentive to reduce energy demand by using the sun's rays to heat the water. And further, the cost of manufacture of the panels was very expensive in its own right, let alone in relation to the return on the investment of reducing energy costs. Over the last 50 years, the number of years for return on the investment has remained steady or slightly lengthened to a period that is in excess of 10 years.

Added problems were some technological issues, particularly the failure of the flat plate absorber in very cold conditions where the temperature would fall below zero or the radiation to the dark night sky would cause the temperature of the panel to fall to below freezing and the water in the panel would burst the pipes and seams. The solution to this, using a separate circuit of liquid with an antifreeze agent in it increases the price and, in the early models, increased the problem of cross contamination. There were also the issues of damage to the panels from hail storms, which are much more common in Australia than they are in the Middle East. Almost all designs used a flat plate of glass which was not reinforced either by tempering or laminating in the early models and this was susceptible to smashing from even moderate sized hail stones.

But more over, I believe, the failure of the take up of solar energy in Australia has been a design failure. Whilst the technological issues were overcome, and mass production and better manufacturing techniques could reduce the price of production and make solar water heaters more cost competitive nevertheless the

public resisted installing them. This is largely because they perceived the solar water heaters to be clunky, clumsy and extremely costly to install.

The most common solar water heater that was offered to the public was an integrated tank model, where one or two absorber panels, often measuring about 2m x 1.5m would be connected directly to the storage tank that was mounted horizontally above them. The sun would heat the water in the panels which would naturally rise into the tank dragging cold water from the tank through a pipe to the bottom of the panel where it would be further heated setting up a circulation system known as thermosyphon. Simple, self-regulating, and easy to manufacture and without long pipe connections, it only required some form of booster heating to the tank, by most commonly electricity but more recently gas, in order to make up the hot water when conditions were cloudy or rainy. But the design of these systems was woeful. From the aesthetic sense, right through to the more important practicality of their installation and use.

The horizontal storage tank would need a booster of gas or electricity to provide the energy in cloudy and rainy conditions. The problem however was that the booster system would never know when the sun was about to come out or when the users were about to use the water, so the system was usually set to heat the water overnight in case there was demand early in the morning for showers and the like. However, if there was early morning sunshine, or unless the owners delayed their bathing to later in the day to take advantage of the sun, then all the solar energy input for that day would have been wasted by the tank already having been pre-heated. In areas where early morning fogs and morning cloud in winter was burnt off in the afternoon to give sunshine, the tank would have already been heated to the required temperature and all the solar input would be wasted.

Even on the most banal level of its looks, no manufacturer made any effort to integrate the design into the house designs in Australia. No attempt was made to visually soften the impact of the system: quite the contrary the tanks were often finished in aluminium or polished stainless steel fitted with garish huge signs naming the manufacturer. No other product in house design took this approach. Home owners and designers would resist any labelling and branding of materials and would seek to harmonise the colours, finishes and textures of a house into a modulated hole. The designers of these tanks had gone in the other direction, producing a garish bright shining tank with an advertising sign blaring out from the roof. No wonder some Council's balked at their visual pollution. In Sydney, Leichhardt Council has had a policy requiring the installation of solar water heaters for the last 15 years, but in all that time, another part of their code requires that these tanks not be visible from the road. So valuable was their contribution but so ugly was their aesthetic that the Council codes highlights the contradiction that faced most home owners and designers that would have preferred not to install a system that was not worth the trouble. A homeowner with a north facing terrace or house in Leichhardt, as in many other locations, was required to build a separate frame

mounted at the rear of the house where the panel was more likely to be overshadowed, less efficient and even more cumbersome and ugly when viewed from the private open space of the house.

But more critical than the aesthetic failure was the functional failure in its design for installation or rather its non-design. Having integrated the panel and tank the plumber was required to install a half a dozen or more fixings to hold the panels in place and to support the weight of the tank that could be up to 300kg or more when full. Further, pipe connections for cold water supply, the cold water to the panels and hot water return as well as the hot water supply to the house and relief valves all had to be fitted. And this on Australian roofs that are predominantly made out of fragile terracotta or concrete tiles making the penetrations through these fragile materials is difficult and would often lead to breakages, not only of the tiles where the penetrations were made, but the tiled roofs are famous for their brittleness with age so the possibilities for retro-fitting the panel and tank onto an older tile roof simply invited a nightmare of roof repairs along with the solar water heater installation.

The manufacturers ease of making a connected panel and tank to reduce costs was more than off-set by the increased difficulty of holding the weight of the water and fixing it to a roof that repelled most attempts to support aerials, masts and the like, making solar water heaters difficult on a metal roof such as corrugated steel, but an absolute nightmare on a tiled roof. It is almost as if the manufacturers were solely looking at the science and the technology of manufacture and had ignored entirely the processes for installation. It was this failure that largely rendered the plumbers animosity to solar water heating: a good idea in theory, but terrible in practice.

What is even more amazing is that the manufacturers persisted with this design for over 35 years, spending more time seeking government rebates and support rather than looking at the failures of their own product.

Fortunately wiser heads have prevailed and what we may call the 3<sup>rd</sup> generation systems now use panels that are better suited for installation on Australian home roofs and are more resistant to hail damage. More importantly the tank is now located in the roof or more commonly on the ground where it is more able to be monitored and maintained, and where gas, the preferred booster energy, can be more easily installed. Indeed the most efficient system is the use of solar water into a large storage tank which then feeds an instantaneous gas booster. In this way, the maximum amount of solar contribution is used and only the water that fails to meet the delivery temperature of 50 degrees is being heated by the gas.

However, the horse may have bolted. Two generations of plumbers, the most expensive sub-contractor on a building site, have become anured to the attractions of solar water heating. And the costs of energy are still ridiculously low in regard to the greenhouse gas and environmental issues, particularly for coal fired

electricity. Given that water heating is the largest single producer of greenhouse gasses in most Australian homes, the installation of a solar water heater should be a “no brainer”. It shouldn’t need complicated Government subsidies for something that could return a very quick benefit to the homeowner, if energy was priced appropriately, and would provide the single biggest reduction in energy use and greenhouse gas production (E2G2) that is being demanded by the Kyoto Protocol. Having now sorted out the aesthetic and technological failures of the past, Australia is ready to adopt solar water heating to 95% of its dwellings, rather than 5%, particularly given the preponderance of suburban housing that is widely spread out and has direct access to sunlight on almost every roof. Given that the Rudd Government has signed up to the Kyoto Protocol, it is imperative that Australia embark on a serious campaign for energy efficiency and greenhouse gas reductions and solar water heating offers the largest, quick gains to be made for the minimum amount of outlay. All that is needed is a Government with the courage to price electricity appropriately and to use the increase in income to provide small subsidies to encourage everyone to have a solar water heater.

Ten years from now, travellers arriving by plane should remark on three things: The terracotta roofs, the blue swimming pools and the black solar water heaters that are offsetting the energy demands of the former two.