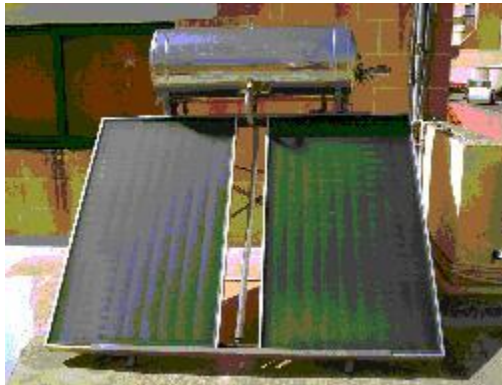


Solar Water Heating Systems under the Lens Published in the Times of Malta (Dec. 2004)

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The recent rise in oil prices and the inevitable increase in electricity rates may soon wake Maltese society to look for remedies to control its electricity consumption. The Institute for Energy Technology of the University of Malta is currently working on several fronts regarding the technical optimisation of solar water heating (SWH) systems and other related topics



Present Situation:

At the moment there are 20 local suppliers of solar water heaters and prices range from as low as Lm 180 up to Lm 1000 depending on size and model. The solar systems are presently charged at a VAT rate of 18% and Lm 3 Eco-tax Contribution. The only incentive available applies exclusively to first-time applicants to electricity meters, whereby the installation costs are waived by Enemalta, if a SWH is installed beforehand. Moreover, it is estimated that only about 5% of domestic households have solar systems and very few central systems are installed in communal buildings or industries.

The Questionnaire:

In its efforts to pin-point drawbacks that are keeping SWH systems from widespread diffusion, the Institute embarked on a technical evaluation exercise on installed solar systems coupled with a survey on the current trends of hot water usage in Maltese homes. A survey on seventy operating domestic solar heaters gave preliminary indications on some critical factors that have adversely affected the performance of SWHs:

- 20% of the installed systems were facing away from the ideal South orientation by more than 15°.
- 21% were found to be inclined at angles well away from 45° to the horizontal. This angle is ideal for collecting adequate hot water during winter, late autumn and early spring.
- 57% of the systems had no insulation on the hot water delivery pipes. Only 35% of the remainder had proper insulation applied to their systems while the rest had broken or cracked thermal lagging. In many cases, it was noted that the installer connecting the system to the residence was different from the supplier of the SWH system.

Due to these shortcomings, most SWHs that were inspected had a combined loss ranging between 15 and 24% of their potential heating capabilities. Only 20% of all systems were considered to operate at acceptable conditions.

Moreover, it was found that over 50% of the systems had hot water storage tanks that were too large for the supplied solar collector (panel) area. Under the climatic conditions of Malta, one square metre of flat plate collector area is capable of heating 50-60 litres of water per day to adequate temperatures. This increases to about 90 litres for the more efficient evacuated-tube collectors. In other words, a 150 litre SWH would need 2.5 square metres of flat-plate collectors or 1.5 square metres of evacuated-tube collectors corresponding to 20, 1.5 metre long tubes.

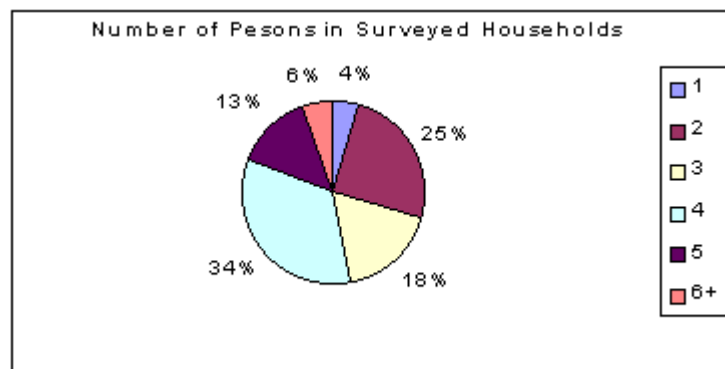
More than 40% of the SWH systems had a pressure booster water pump connected to the cold water inlet. In all cases, the pump was oversized leading to mixing of delivered cold water with the stored hot water. Furthermore, the high pressure could cause irreparable damage to the solar system and the associated piping works. One temporary solution would entail installation of a pressure-reducing valve between the pump delivery and the SWH cold water inlet, in order to control the water pressure and flow. Ideally, a low-flow low-head water pump should be used, but only if deemed necessary.

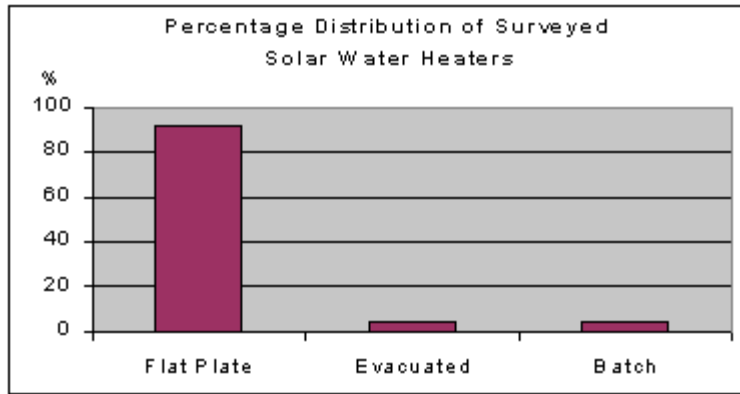
Misconceptions on the feasibility of solar water heaters do not only stem from the above-mentioned technical observations. They can be further compounded by the owner's over-expectations of the installed SWH system. A system that is designed to cater for the washing needs of four persons should not be connected to three bathrooms, the washing machine, the kitchen sink and possibly a dish washer too, otherwise the SWH performance will be unsatisfactory. Sizing of solar systems does not relate to the number of users only, but also to the number and location of hot water outlets. The relevance of proper insulation of all hot water pipes on the roof and running along the external perimeter walls becomes even more critical for long runs.

About 40% of users take showers in the morning rather than in the evening, and this does not match the solar water heating cycle. Showers taken early in the morning would ultimately require the electric booster to switch on, since water in the solar tank would have cooled somewhat overnight especially in winter. The booster heats all of the 150 litres or so of water in the tank and by the time the sun comes up, the water would still be too hot to absorb more energy from the sun. Due to this vicious cycle, some families ended up paying more for their electricity consumption. In general, the use of timers on the electric booster or manual switching can reduce the risk of electric heating of the water tank unnecessarily. Otherwise, one would have to adapt and take the main shower in the evening when the SWH has had time to collect enough energy from the sun throughout the day. The best option would be to allow the SWH to operate without intervention from electric boosters. Water from the SWH could then be fed into a small backup – electric *geyser* or otherwise – heating system that would only operate and boost the temperature of a smaller quantity of water when the need arises.

An amazing 88% favoured the installation of solar heating systems with few regretting having bought one. Some others noted an increase in their electricity bill. These few bad experiences are usually enough to cast a shadow on the viability and future prospects of solar water heating systems.

The Institute for Energy Technology of the University of Malta continues to offer this service of inspecting installed solar systems. Appointments may be made through the website: <http://home.um.edu.mt/ietmalta>, by e-mail: ietmalta@um.edu.mt or by phone on: 21650675. The Institute has also prepared a brochure that could offer a guidance to those intending to buy a solar water heating system.





References:

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