IMPROVING ENERGY PERFORMANCE

Computer modelling of domestic hot water systems has informed this discussion about the relative merit of different ways of improving the energy performance of hot water systems. This is discussed in Part 5.

Collector slope. Raising the slope of solar collectors allows collectors to perform more consistently across the year. For example, in Melbourne (latitude 38°), solar collectors at 15° and at 63° will perform very differently as shown in the study described in Part 5. The steeper collector slope results in a small net reduction in annual yield. However this is outweighed by the flattening of the annual yield. It is common for solar hot water systems to, at times, have surplus energy in summer. Unlike solar PV systems, solar hot water systems cannot utilize their surplus. Indeed surplus summer-time heat gain can be a problem leading to venting and loss of water.

Temperature regulation. The bio-safety requirements in AS/ NZS 3500.4:2010 have been finessed and now permit the hot water service to apply a control regime of a periodic sterilising heat pulse. This allows temperatures to be maintained at lower temperatures (say 50 °C) instead of greater than 60 °C, for large amounts of time. This has the potential to reduce standing heat loss.

Insulation. There is considerable scope for hot water systems to have improved insulation, and for the insulation of valves and pipes to be improved. One very simple retrofit improvement is to insulate the pressure relief valve. These valves are normally left exposed, and act as a thermal bridge which allows heat to be lost. Suitable insulation can be achieved with a valve cover, such as the ValveCosy, which are inexpensive and easy to fit as shown in Figure 3.34. In the context of possibly regulating water temperature at 50 °C instead of 60 °C, it becomes important to ensure minimal temperature drop along the pipes to the hot water taps. This can be achieved by applying pipe insulation at or above the minimum standards. [129 Table 4.2]

Winter peak demand. Conventional electric-boosted solar systems, even if they can reduce annual energy needs by 65%+ in southern Australia, still have the problem of high winter peak demand. For example, the system modelled for Melbourne conditions (see Section 5, hot water, Experiment 14) suggests there would be an electric-boost demand of greater than 140 kWh/month for May to August inclusive. Heat pumps under the same circumstances (Experiment 13), have a much-flatter peak in demand during winter. Managing winter-time aggregate energy demand is a crucial consideration when adapting to an all-renewable electric supply proposed under the Zero Carbon Australia model.

Modelling indicated that in winter time, the mains energy requirement for solar hot water is about double that for heat pump hot water in temperate climate zones.

Other conclusions

Heat pump vs baseline. Compared to a baseline electric hot water system, the combined effect of improved tank insulation, improved control, and heating with a heat pump reduces the annual energy requirements by about 80%.

Heat pump plus solar. Combining heat pump and solar thermal gives the greatest demand reduction, but at considerable cost. This combination is not considered economically viable given that both heat pump and solar thermal can, by themselves provide sufficient levels of demand reduction.

Heat pump plus PV. Modeling results (see Part 5, Hot water, Experiment 13) suggest that 1 kW of PV capacity in Melbourne could provide more electricity than the heat pump needs all year round (on a net monthly basis). Given the low incremental price of 1 kW of capacity on a house that is already buying P V, this suggests that the best solar technology for hot water may be about 1 kW of extra PV capacity for these households.

Source: http://decarboni.se/publications/zero-carbon-australia-buildings-plan/5-hot-water-systems