# SOLAR WATER HEATING UPSKILL # 17

## Selling the Right Solar System

**Ian Sumner**

**Ian Sumner's solar upskilling series continues. In the previous article, he looked at using solar collectors for heating swimming pools. The next three articles in this series address the relationship between the customer and the plumber or the person selling the system, the first of these articles will look at selling the advantages of solar water heating, what the customer can expect from the system and selecting the right system, the next articles will address training the customer how to use and make the most of the system and documentation to be left with the householder including operation and maintenance manuals.**

Selling the system and in particular informing the customer what they can expect from the solar water heating system and selecting the right system for a particular client are key to the success of the installation.

**Selling the benefits of solar water heating**
If the system and its benefits are over-inflated by the person selling the system to the customer, then the customer will have unrealistic expectations and is unlikely to be satisfied with the installation.

A correctly designed, installed and maintained solar water heating system will provide effective savings on the energy consumption of a household, of around 70 percent of the electricity consumed for water heating. As a rule of thumb, delivering around 90 percent of the hot water in Summer, 50 to 75 percent in Spring and Autumn and 25 to 40 percent in Winter.

There are many levels of efficiency being promoted to customers however, the bottom line is that a correctly designed, installed and operated system will have an annual efficiency in the order of 30 to 40 percent, this is the percentage of the solar gain that the sun delivers compared to the amount of heat supplied to the hot water cylinder. The efficiency of a system is often overstated or misinterpreted, two of the most common overstated efficiency levels are outlined below;

1. 97 percent efficiency – we have heard salespersons promoting that a system is 97 percent efficient. This level of efficiency is only for the absorber within the collector i.e. the absorber within a collector, which historically was a matt black high temperature paint is often now a selective coating which is able to receive high levels of solar gain and only reflects back a very low percentage.
2. 70 percent efficiency – this level of efficiency is often the peak collector efficiency and will certainly not be delivered and maintained in practice.

This collector efficiency reduces as the water is heated above the ambient (outside) temperature.

**Selecting the most appropriate system**

Selecting the right system for a customer can be split into three;

1. Type of system – the type of system is key to ensure system reliability and is dependent upon the climatic conditions of the site and how the customer will use the system.
2. Size of system – this is key to the performance of the system and delivering acceptable energy savings
3. System operation and control – there are several levels of system operation and control, the selection of these is dependent upon how much the customer is willing or able to manually intervene and control the system.

**Type of system**

Our previous articles have detailed the types of solar hot water system, these include, thermosyphon systems, pumped systems, drainback systems, indirect and direct systems. Each of these systems has advantages and disadvantages that should be understood so that by the most appropriate system is recommended to the customer. For instance, a remote site without reliable power could have a thermosyphon system installed (see Figure 1 below) which requires no power but will probably have a lower efficiency and may require increased maintenance, alternatively a pumped drainback system could be installed (see Figure 2 below) that would potentially utilise a 12Volt controller (see Figure 3 below) and pump, the system would be more efficient, would address the issues of freezing and overheating but may be more expensive to install than a thermosyphon system.

A batch with an intermittant hot water demand or a house with a variable hot water demand would probably have a drainback system installed, see Figure 2, as this system is able to manage overheating in a fail-safe manner

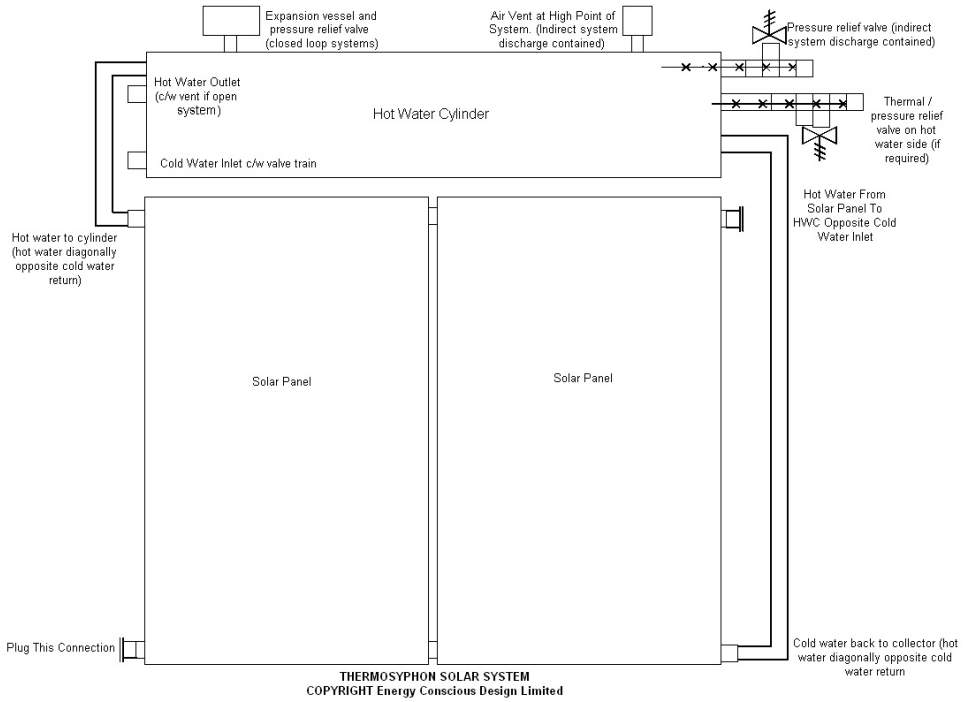



*Figure 1 Thermosyphon system.*

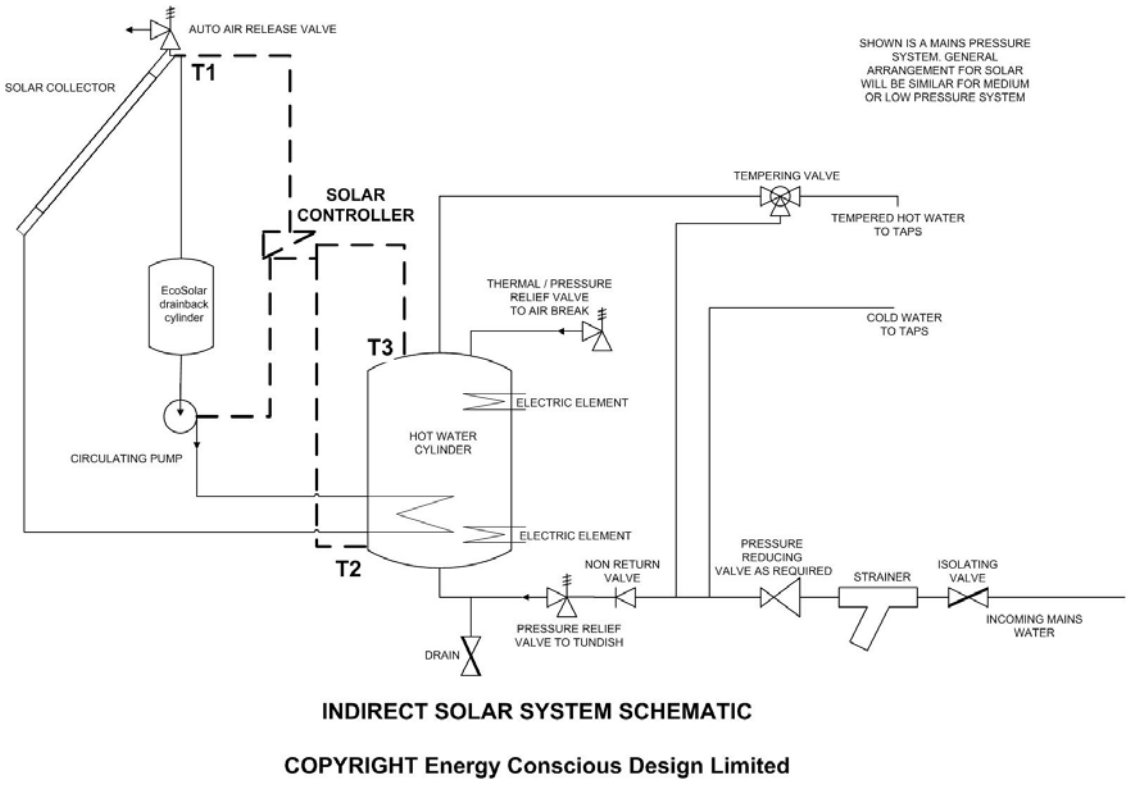



*Figure 2 Indirect pumped drainback system.*


*Figure 3. EcoSolar 12Volt UVR61 controller.*

**Basics of system sizing**

As a rule of thumb, solar hot water systems are often sized on the basis of 1m$^2$ of collector area per 50 to 75 litres of water storage or per person. For instance, based upon 75 litres of water storage per person a two person house hold should be able to comfortably utilise an existing 135 or 180 litre cylinder. In many cases solar collectors are able to be retrofitted on to an existing cylinder and providing the issues associated with frost protection, backup heating, excessive temperatures and volume of water storage are effectively managed, can provide the most cost effective solution with very favourable returns for the consumer. Such retrofitted systems should be installed such that they can be extended and the cylinder replaced with a larger one once hot water useage increases i.e. the couple start a family. A four person household would require a larger system with a 300 litre hot water cylinder and multiple collectors.

The sizing of solar water heating systems for conventional housing is fairly well known, however, sizing of commercial or larger scale multiple residential sites is less well known or understood and often requires extensive engineering. The engineering of such systems would require computer simulation of hot water loads and solar gain to refine the system design. Energy Conscious Design has completed many engineering, feasibility reports and system designs for high rise multi tenancy dwellings, hotels, retirement villages, offices, schools, as well as other commercial applications and swimming pools. This engineering utilises computer software, this together with our historical experience are able to

determine if solar is suitable and deliver well engineered designs for each aplication.

**System operation and control**
System operation and control was discussed in previous articles last year. The solar water heating system will operate automatically by recovering heat from the solar collector to the hot water cylinder. However, all solar water heating systems need a backup heating system, this needs to be adequately managed to maximise energy savings and to ensure that excess heat is not provided to the cylinder increasing the risk of overheating.

There are numerous methods of providing backup heating:

1. Electric elements in the cylinder
2. Boiler or other heat source heating the water in the cylinder
3. Wetback
4. An instantaneous water heater with the solar system acting as a preheater
5. A boosting cylinder with the solar system acting as a preheater.

The first two options highlighted above are usually controlled through a time clock or manual intervention by the customer, these options are commonly used in domestic systems and will not suffice in the commercial environment where the solar water heating system has to act as a preheater as highlighted in items 4 and 5 above.

**Electric elements or boiler heated cylinder**
These are byfar the most common methods of providing backup water heating but its use is rarely optimised. Solar cylinders often have multiple electric elements, one at the bottom to be used for Legionella control and one in the upper half of the cylinder for boosting the water temperature. The use of the electric elements, the boiler or other heat source should be minimised and ideally should only be switched on at the end of the day if the sun was unable to heat the water to the desired temperature. There are several methods of controlling the backup heating system.

*User intervention* – ie the customer determines if the water is up to temperature, modern controllers, such as the one shown above in Figure 3, display the water temperature in the cylinder, if below a predetermined temperature, the customer manually switches the element or boiler on and switches it off once the water is up to temperautre. Historically, this has been a manual process for instance using the main element isolator and the problem has been that the customer forgets to turn the element off thereby leading to increased energy useage. The installation of the EcoSolar “One shot” controller makes this control method much more user friendly and eliminates the problem of the electric element being left on. The “One Shot” controller as shown below in Figure 4 allows the customer to press a button to switch on the backup heating and once the water is up to temperature the heating is automatically switched off.


*Figure 4 "One Shot" Backup heating controller, allows manual control of the backup heating. The heating is manually turned on and will be automatically turned off, maximising the savings from the solar system.*

*Timeclock* – the electric elements or boiler are switched on at a predetermined time towards the end of the day, once the cylinder has been heated by the sun, and only in the event that the water is not up to the desired temperature. The modern solar controller (as shown in Figure 3 above) is able to determine cylinder temperatures and turn the electric elements or boiler on if required.

**Wetback**

Combined solar and wetback heated installations are becoming increasingly common. The solar system heats the cylinder in the normal way either as a direct or indirect circuit and the wetback heating is provided directly in an open vented cylinder, or via a heat exchanger in a valve vented cylinder.

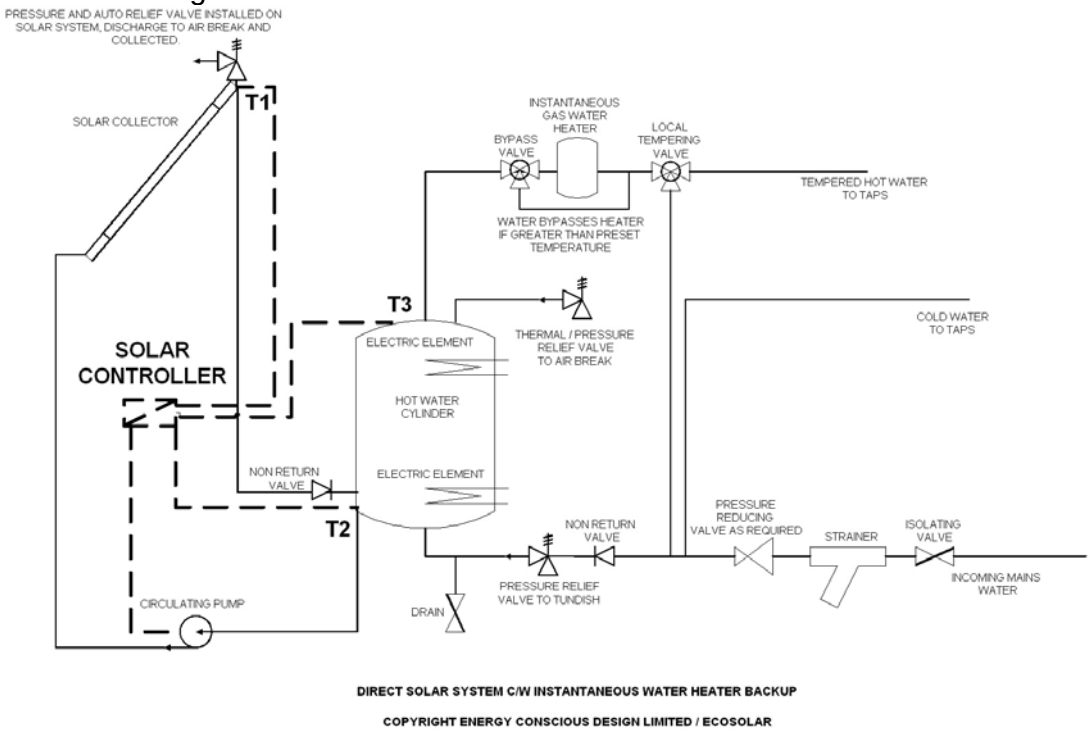
If the wetback is some distance from the cylinder and unable to operate as a thermosyphon system, the water is able to be pumped between the wetback and cylinder. Some solar controllers, such as the one shown in Figure 3 above, are able to not only control the solar system, but are also able to control the wetback circulating pump. The solar controller monitors the temperatures in the wetback system and automatically switches the wetback pump on only when there is heat available in the wetback.

**Solar water heating as a preheater**

In most cases, a solar system installed in either a commercial or higher specification domestic system will have to act as a preheater. A solar preheated system ensures that there is hot water on demand, the temperature of the hot water drawn off at the taps is not dependent upon the amount of solar gain available, in this type of system the customers see a seamless supply of hot water delivered to the points of use.

The solar preheated water can be supplied to the following boosting systems:

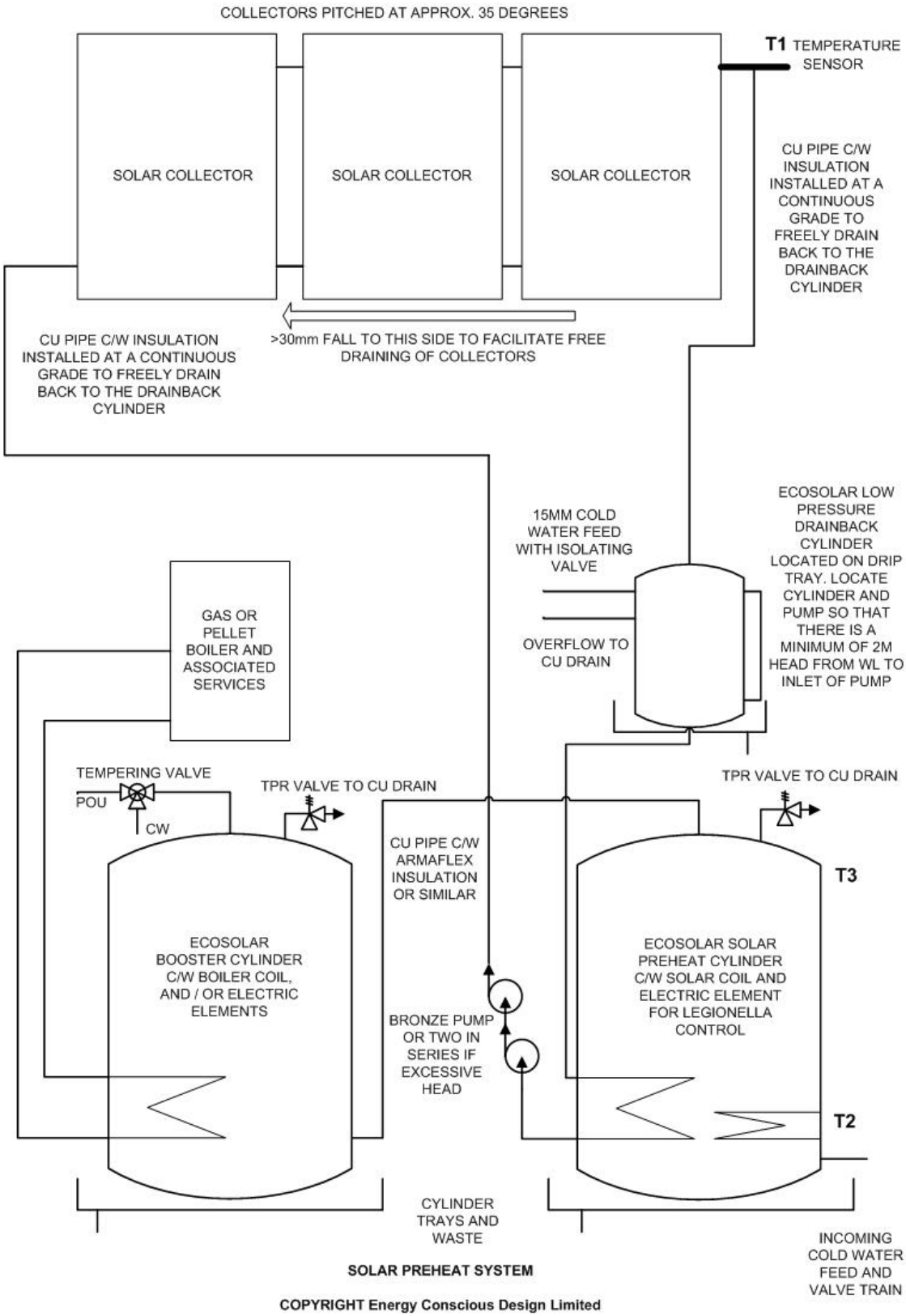
1. *An instantaneous gas water heater (*as shown in Figure 5 below). If the water being heated by the solar system is up to temperature, the bypass valve in the hot water supply diverts the water around the instantaneous gas heater, if the water is not up to temperature the bypass valve directs the water through the instantaneous heater to be heated.




2.

*Figure 5. Direct solar water heating system being used as a preheater to an instantaneous gas heater.*

3. *A backup heated cylinder* (shown in Figure 6 below). The solar heated water is supplied from the preheat cylinder to the boosting cylinder as its cold water supply. The boosting cylinder may be heated by electric elements, gas boiler or another heat source. Figure 6 below shows an EcoSolar drainback system operating as a solar preheating system with a boiler heated booster cylinder. See our previous articles for the benefits of the drainback systems.




**SOLAR PREHEAT SYSTEM**

*Figure 6. EcoSolar drainback solar preheat system c/w boiler heated booster cylinder.*

In summary the solar water heating system must be promoted with the correct level of savings else, it is unlikely that the cusomer will be satisfied with the system. The type of system is key to the reliability of the system and the sizing and control of the system are key to the performance of the system and energy savings achieved.

- ***About the author:*** *Ian Sumner is the Technical Director of Energy Conscious Design Limited and EcoSolar. Ian used to work as a plumber who subsequently completed a degree in building services design and has completed thesis on trying to get solar hot water to be cost effective in the UK. Ian also has significant local experience in solar system design and installation and is currently the only solar water heating system designer accredited by the Solar Industries Association in New Zealand.*

For more information or advice for specific projects please contact us. Also for more detailed information on solar installations please request a free copy of the latest EcoSolar Solar hot water installation guide or send any questions or requests for topics to be covered to Ian Sumner. Email on ian@ecosolar.co.nz or 0800 ECOSOLAR that's 0800 32676527.

**Energy Conscious Design and EcoSolar, in conjunction with several trade and professional industry associations are in the final stages of preparing training sessions that will tour New Zealand, these training sessions are suitable for both specifiers, designers and installers, please contact Energy Conscious Design for dates and seminar locations.**