SOLAR WATER HEATING UPSKILL #15

Options for data logging the performance of the solar water heating system

Ian Sumner

Ian Sumner's solar upskilling series continues. In the previous article, he looked at why a conventional domestic solar water heating system is not suitable for commercial applications. In this article, he looks at the options for data logging the performance of the solar water heating system and confirming how much energy the system has saved.

The main three main reasons for installing data logging on to a solar water heating system are;

1. To support a financial decision to install a system, recording energy savings and energy useage
2. Education, for instance a school may want to provide education of sustainable practices, displaying to pupils the systems installed, why they were installed and how they operate and save energy
3. Fault diagnosis, as more and more systems are installed, especially as they become more and more costly and complex, it is important that fault diagnosis and remote interogation are installed as good practice.

There are several levels of data logging ranging from simplistic solutions to comprehensive and experimental data logging, these options are outlined below;

Solar controller with integral data logging facility
This is the most simplistic method, the solar water heating system will have a solar controller for it to operate correctly. A modern solar controller such as that shown below is able to record the total and instantaneous heat collected from the solar water heating system to provide a picture of the system performance. A flow meter with pulse output is installed on the solar flow pipe and connected to the solar controller. This level of data logging is cost effective, the additional cost to the client is in the region of $200.

Figure 1 Modern solar controller with instantaneous displaying and data logging of, the heat being collected.

Solar controller with integral data logging facility connected to computer
To maximise the capability of the above modern solar controller it can be installed with and connected to a USB Data Logger. This data logger is small in size, around the size of a small match box and is either temporarily connected to the solar controller, being removed and connected to a computer for the data to be downloaded, or is hardwired into the system and connected to the computer through a USB connection. A USB interface allows an easy connection to a normal computer to provide daily data graphs of the monitored sensors and system performance, this data can also be exported in to a spreadsheet for further analysis.

This data logging option is able to provide full and continuous data logging of up to six inputs and three outputs, plenty for most applications. The logged inputs could include collector temperature, top and bottom cylinder temperatures, amount of solar radiation falling on to the collector surface, ambient temperatures, water flow rates and heat collected. The logged outputs could include multiple solar pumps or electric elements. These logs can be analysed to determine the system efficiency and how productive the system has been.

This is the most common form of data logging system we install, it is cost effective, costing from around $350 to $700 if the full capability of the logging is taken advantage of with ambient temperatures and solar radiation sensors.
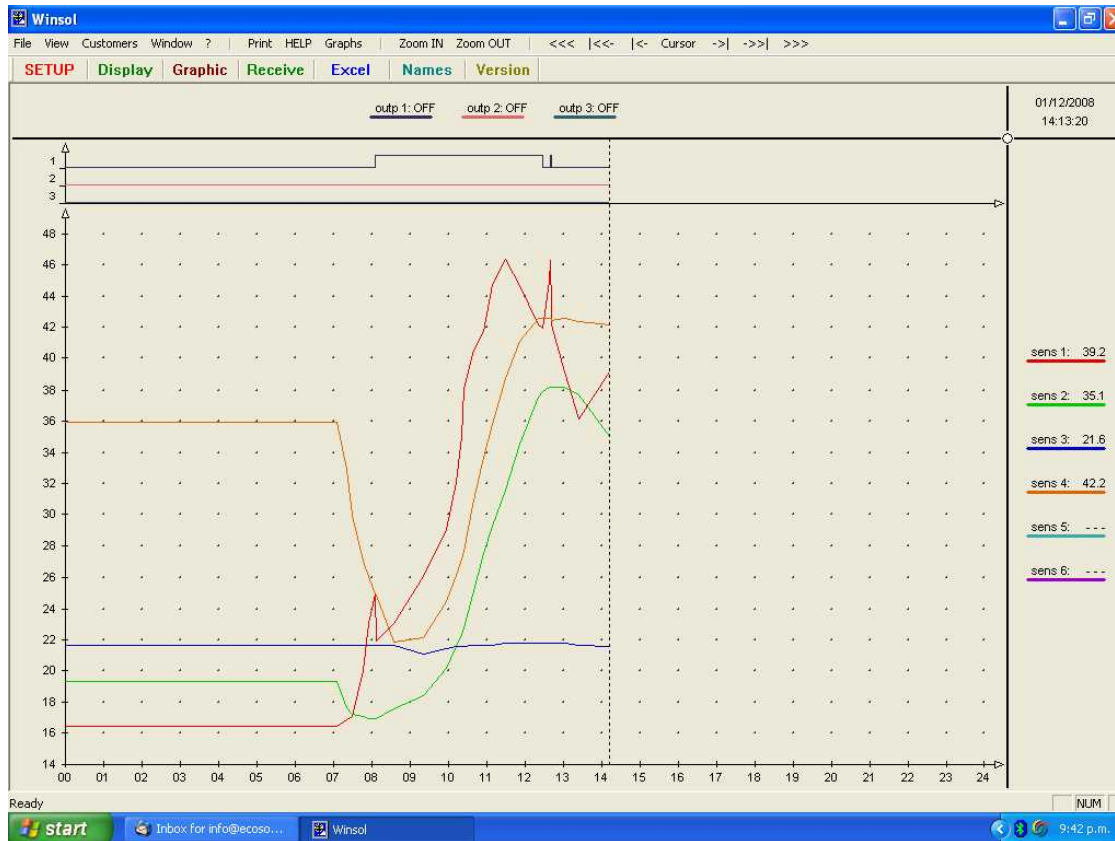
Figure 2 Computer screen dump from EcoSolar Winsol Solar water heating data loging software. Sensors and outputs can be assigned names such as collector temperature.

Logging on to a Local Area Network
The next level of data logging has been designed specifically for local area networks (LAN), the EcoSolar UVR1611 controller is connected to the LAN and assigned an IP address. The solar controller is able to be interogated remotly from offsite and the data from each sensor is able to be extracted as independent information. The controller can be expanded to data log twenty or more inputs and outputs.

Whilst this level of data logging is often beyond that required for many applications, where there is a requirement for remote access or interogation of the system performance it is invaluable and saves on travelling to site. This system is also well suited to applications where there is a specific need for education.

We have recently installed multiple solar water heating systems on a school, each of these systems has an EcoSolar UVR1611 solar controller connected to the site wide BMS system and LAN with its data shown together with a graphical representation of the system such as that shown in Figure 3 on a display within the library. Other data from the systems are also displayed such as energy supplied to reheat the water and hot water consumption etc. This provides a detailed picture of the site's energy consumption and energy saving measures.
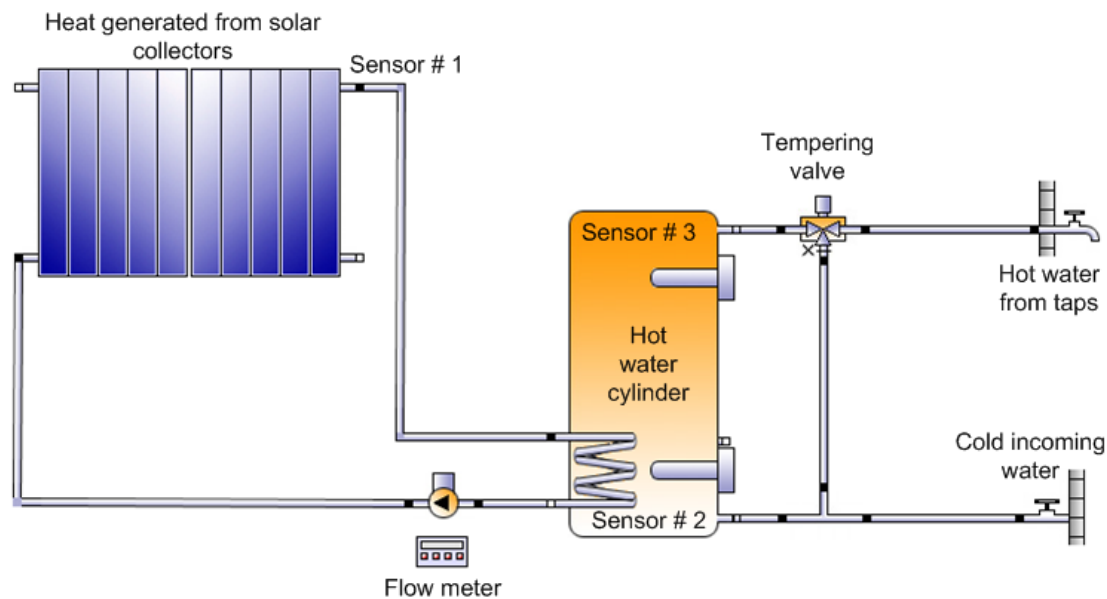
Figure 3 Sample system schematic able to be used in educational displays.

In summary, it is important when installing large or complex systems or systems which are able to provide a valuable level of education to consider installing a data logging facility. There are various levels of data logging from the simplistic cost effective systems to extensive site wide or remote accessible systems, such data logging is important to either support the financial decision to install such a system or provide education to technicians or occupants of the buildings.

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. Ian says, "This series of articles is intended to be an introduction to solar water heating only and I do not intend to provide specific design advice."

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.