Solar Solutions

Bristol Stickney, technical director, Cedar Mountain Solar Systems, Santa Fe, N.M.

OG-300 solar water heater system comparisons

Review of SRCC & OG-300

Solar water heater (SHW) systems are the low hanging fruit for designers, installers and building owners who want to deploy solar heating equipment. Virtually every occupied building has a water heater, and this hot water is needed all year round not just in winter. Solar water heater systems tend to be small and therefore more affordable and easier to install than space heating systems. So anyone who is attracted to solar heating can potentially start small by installing a solar water heater.

Packaged solar water heater systems are becoming more commonplace and more standardized, which makes specification and installation faster and easier as well. It stands to reason that increasing numbers of packaged systems will be installed in the future as solar water heating becomes more commonplace. When choosing a SHW system, it is a good idea to compare one to another to be sure that when installed, it will meet the needs of the user. In the U.S., the effort to compare solar water heating systems in a standardized way is being lead by the SRCC (Solar Rating and Certification Corporation) using a method they call OG-300. I introduced the SRCC and OG-300 water heater test standards in earlier articles in the spring of 2009. See the web archives at *Plumbing Engineer* and *Phc News* magazines for copies of these articles.

Since that time, the SRCC website has improved with searchable test results and performance comparisons for various city locations. Their ratings and comparisons used to be presented as PDF publications with long tables of data, but now, it is more interactive with system types and city locations chosen by the user.

When viewing the results, the solar water heaters are labeled according to their "system type" using the following shorthand:

DF= Direct Forced, IF= Indirect Forced, IT= Indirect Thermosyphon, DI= Direct Integral

(These are the types I look up most often. Others are also available as well.)

Also, while we are clarifying the SRCC shorthand…

OG= Operating Guidelines, Q= Energy

EF= Energy Factor, SEF= Solar Energy Factor (SEF)

Qsolar= (Annual) Solar Savings is presented in KiloWatt Hours (kWhr) when compared to conventional Electric water heaters and Therms when compared to Gas.

SF= (Annual) Solar Fraction is presented for various city locations as a Decimal value.

(e.g. 0.65 means 65 percent of the annual hot water load provided by solar.)

The fact that a SHW system has been certified by the OG-300 test is, in itself a testament that the components and construction of the system comply with certain standards of safety, performance and durability that are part of the testing and inspection procedure. Each SHW system that is listed by the SRCC is presented with a one-line piping diagram, and the study of these piping diagrams alone can be a worthwhile education in itself for anyone interested in the proper placement of collectors, storage tanks, pumps, heat exchangers, valves and other components in a large variety of configurations.

The SEF rating

SRCC uses the Solar Energy Factor (SEF) as its primary performance rating for solar domestic water heating systems. The SEF is defined as the energy delivered by the system (as useful hot water) divided by the electrical or gas energy put into the system. And while this rating is modeled after the Energy Factor (EF) used by the gas water heater industry, it more closely resembles a Coefficient of Performance (COP) used to rate refrigeration heat pumps where the value is generally always greater than one. It is calculated using the formula:

SEF = Qdel/(Qaux + Qpar)

Where:

Qdel = Energy delivered to the hot water load: Using the SRCC rating conditions, this value is (41,045 Btu/day). This is a reasonable amount of hot water heat for a residential application when about 64.3 gallons are provided by a conventional water heater each day. A 50-gallon conventional water heater tank, for example, could provide this amount of hot water easily under these test conditions.

Qaux = Daily amount of energy used by the auxiliary water heater or backup element with a solar system operating, (Btu/day). To convert to kWh, divide this value by (3,412). To convert to therms, divide this value by (100,000).

Qpar = Parasitic energy: Daily amounts of AC electrical energy used to power pumps, controllers, shutters, trackers, or any other item needed to operate the SHW system, (Btu/day). To convert to kWh, divide this value by (3,412).

Using this rating method, there is a direct relationship between solar collector size and SEF test results. The bigger the collectors, the larger the SEF rating value will be. Also, the highest possible rating on the SEF scale would be a system that has no Qaux and no Qpar. In other words divide Qdel by zero. This can occur when a

Continued on page 61