Solar-Hot-Water Apartment House

System Description

Baseline Solar Solutions installed a commercial solar hot water system to provide supplemental hot water for the 12-unit apartment building located at 300 Broce Drive at Progress Street in Blacksburg, Virginia. The system consists of a 150-vacuum-tube solar collector mounted to the outside of the south facing wall of the building, a heat exchanger mounted in the attic space, a copper pipe circulation loop connecting each of the 12 hot water tanks to the heat exchanger, a new PEX-pipes distribution loop to provide hot water from the tanks to the existing domestic hot water supply, and an electronic controller and all necessary pumps, valves and fittings.

The solar collector is made up of 5 Apricus AP-30 evacuated tube arrays, combined into one bank of 90 tubes (3 AP-30 arrays) and one bank of 60 tubes (2 AP-30 arrays). The collector is mounted near the top of the outside of the south wall at an angle of approximately 45 degrees to maximize winter production and reduce the chance of overproduction in the summer. The collector partially shades the top floor windows.

The solar collector is connected to a single heat exchanger appropriately sized to handle the maximum solar heat gain expected on the hottest summer day at the location. The heat exchanger is connected to the 12 existing 40-gallons hot water tanks, in two series of 6 tanks each. Each series of 6 tanks is plumbed in a single PEX-pipes loop to the existing domestic hot water supply for the corresponding 6 apartment units. This design will allow the system to function essentially as a single 150 tube collector with two 240-gallons hot water storage tanks.

The piping allows a single hot-water heater in an apartment to be isolated from the solar system for repair or use as a stand-alone hot-water heater.

System Performance

Since solar-hot-systems are subject to variable patterns of weather and sunshine, there is no way to predict their exact performance over any specific period of time. The Apricus AP-30 has been certified by the Solar Rating Certification Corporation (SRCC) to produce approximately 21,000 available Btu of heat per day in the form of hot water under Standard Laboratory Test Conditions intended to simulate average weather conditions for an entire year.

Based on this certification, the 150-tube collector proposed here should produce approximately 105,000 Btu per day, which is equivalent to 30.8 kWh of electrical energy per day. It is important to note that this is an annual average and will be considerably higher in the summer and lower in the winter.

Based on utility data for the year before installation, and assuming hot water accounts for 30% of the total electricity usage, the energy supplied by the solar collectors is approximately 50% of the total average daily electricity usage allocated to hot water production for the lowest usage month (June-July 2007 data). Allowing for solar gain in the summer to be twice the annual average would mean that solar hot water production in the summer could approach 100% of the building's usage. System production and usage will be monitored closely to determine if a heat dissipater on the north side of the building is warranted for the summer months.

(OVER)

Owner's Comments

Rough calculations have indicated that the payback period for this system will be about 15 years. However, that is not at the top of my list of reasons for doing this project.

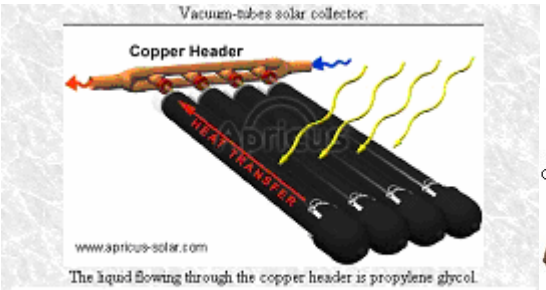
My main concern is to reduce the amount of carbon dioxide that I am responsible for putting into the atmosphere, the consequences of which my descendants, along with all other people, will have to deal with in the future. (That is also the reason I own a plug-in Prius hybrid, a Highlander Hybrid and an electric pickup.) This solar-hot-water system is estimated to save about 14 tons of carbon-dioxide emissions per year, assuming the saved electricity is made from burning coal.

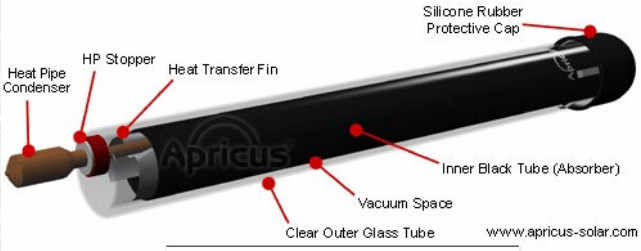
My second reason for doing this project is to be a test case that other apartment-house owners might follow to reduce their carbon emissions.

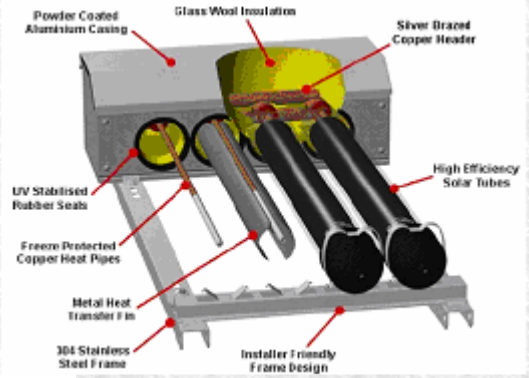
My third reason is that the science of doing it is very interesting and educational. Having been a physics educator for thirty-one years at Virginia Tech until 1998, this project continues my devotion to teaching physics to the general public.

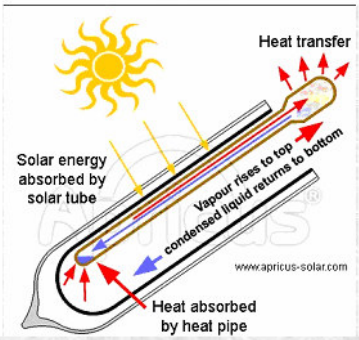
Back to monetary concerns: Some rough calculations have shown that investing in solar energy now gives as good or better returns as investing in the stock market did over the last twenty years. If one could reliably estimate the financial savings per capita of not putting carbon into the atmosphere, the solar-energy investment return would be even greater.

http://www.roperld.com/science/SolarHotWaterApartmentHouse.htm









Pipes layout: