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Evacuated Technology

Shaping Segment's Future

Market drivers are in place to signal growth for the solar thermal industry.

It may not have approached an awareness level within the mindset of today's consumers or policy makers to the degree of photovoltaics (PV), but the solar thermal segment also looks to be heating up for future growth, according to manufacturers and industry professionals.

It's due to a number of factors that have impacted the market at the right moment for these applications, in addition to improvements in the production, design and installation of modern vacuum tube, or "evacuated tube," collectors being manufactured.

The product improvements, combined with the fact that these systems represent a cost-effective alternative to meet energy demands and address climate change issues, has solar thermal professionals "poised for a future boost," according to Serge Adamian of SunChiller Inc. and a rep for Sunda brand tube collectors. "We'll be able to ride the wave, but I think we also have to help push the wave a bit," says Adamian, referring to the interest and incentives for renewable energy sources among consumers and government agencies alike.

The traditional flat-plate panel systems have been around longer, and remain a very effective alternative for homeowners and small businesses to economically address some heating and hot water demands. But evacuated tube technology has become a viable complement in the market that should help to enhance solar thermal applications, states Adamian.

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Michael Humphreys, general manager for Apricus, manufacturer of collectors for solar thermal applications, agrees that the future looks bright and expects solar thermal technology to meet even greater demands with auxiliary and related applications due to the efficiency and performance of evacuated tubes.

The concept for evacuated tube technology for this application has been around for more than 20 years, with the idea developed by Sydney University, according to Humphreys, describing the thermal collectors that absorb the sun's energy to convert it directly into usage heat.

"Development of the twin-glass evacuated tube, which is the most widely used form, was completed primarily in China, where the annual production exceeds 50 million tubes," he adds.

Evacuated tube solar collectors function in a manner similar to traditional flat-plate panels, in that water is circulated through the collectors, absorbing heat and returning that to a hot water storage tank, directly or via a heat exchanger.

Solar thermal collectors can be used to provide supplemental heating for domestic hot water, providing between 50% and 70% energy savings, depending on a location's solar radiation levels and hot water usage. In colder areas, the use of solar thermal for central heating is also very popular, especially given the ever-growing cost of natural or LP gas, notes Humphreys.

Evacuated tubes provide excel-

lent heat absorption due to the selective absorption coating on the inner tube, similar to that used on many flat-plate panels. As Humphreys notes, the differences between the current tubes and traditional flat plates include:

■ the evacuated design, which includes a vacuum between the two layers of glass to provide insulating properties. Thus, when the tubes are as hot as 230 degrees inside, the outside is cool to the touch.

'Evacuated tube technology has become a viable complement in the market that should help to enhance solar thermal applications'

Flat plate collectors do not have a vacuum insulating layer, and so, when the panel becomes hot, it can lose heat to the outside environment. Due to the insulating layer, evacuated tubes can be beneficial in colder climates.

■ the round shape of the tubes means they passively track the sun throughout the day. This means that heat production is achieved from early morning to late afternoon. Flat-plate panels and evacuated tube designs with a flat absorbed plate are very effective, but the collectors only face the sun at mid-day, which can limit daily heat production levels.

Product problems

"Because the tubes are glass, hail damage is often a question that is raised," says Humphreys. "Evacuated tubes are very strong - able to withstand one-inch hail without damage, and much larger if installed at an angle greater than 40 degrees."

Humphreys notes that product quality issues can rise when evacuated tubes are imported from unknown sources. He advises dealers and installers to always look for a product that is SRCC-certified, and supplied by manufacturers that have international ISO9001:2000 certification (accedited with an all English certificate by SGS, SAI or another global body).

The production process with evacuated tube collectors has offered another advantage for these products. A drawback with solar thermal in the past was the fact that older collector panels were not as conducive to mass production as a PV product, which also hindered its growth.

Mass production is now possible with the evacuated tubes, which has brought unit costs down to a level based on material, labor and a small profit margin for the factory. This mass production has made evacuated tubes more affordable and resulted in wide use in worldwide markets. It has also led to manufacturing of higher-quality tubes using U-tube or heat-pipe designs that allow the system to withstand mains pressure, and be connected to a domestic or commercial hot water system.

"Evacuated tube solar collectors are also excellent for commercial hot water supply, especially if higher temperatures are required," says Humphreys. "Hotels, laundromats and nursing homes and other applications that have high-volume hot water use can benefit greatly from the use of thermal solar, providing tangible long-term energy saving."

The attainment of higher temperatures with evacuated tubes also enables these systems to now be incorporated into absorption or adsorption chilling and cooling applications. "Many companies are working hard on increasing the efficiency of such chilling machines," says Adamian.

Cooling process

Within these setups, the hot water is sent to an absorption chiller to meet the desired temperature change for cooling purposes. "The process is similar to refrigeration technology that includes compression and condensing stages, yet incorporates various types of solutions to release vapor and lead to the resultant temperatures of 45 to 48 degrees, which enables the output to go into the building's cooling systems.

"Thus, the thermal system can be linked right into an existing system, which can be especially beneficial for commercial buildings," notes Adamian. The lithium-bromide-water solutions in the chiller process are well-suited for these tempature-level applications. In winter, the chiller can be bypassed with a valve setup, with heat sent to the water heater tank.

This possibility is another factor leading many to believe in the expanded possibilities for solar thermal systems, providing additional benefits for the end user. Yet the newer-model collectors also create advantages for dealers and installers, according to Steve Elkin.

Involved in distribution capacities within the solar industry since the 1980s, Elkin is now a director of marketing for Apricus. He notes that evacuated tubes have been well-received among the installers who have employed them.

"What was a two- to three-man installation is now a one-man installation," Elkin says, "because they are delivered broken down as manifolds, and evacuated collectors are much lighter to carry."

Further, when an evacuated tube fails or breaks, replacing the components can be a relatively simple operation.

"If an evacuated tube collector fails, it is a 15-minute job for one man, who unplugs the tube and plugs in a new one," he remarks.

The modern tube collectors "are essentially 'plug-and-play,'" agrees Adamian, who points out that the heat-pipe technology involved in these products function much like a fluorescent light bulb, with heat being brought to the tip. There is no contact with water and no moving parts, so maintenance of the tubes is mangable. However, while 60% to 70% efficiencies are

achieved with the evacuated tubes, some loss is seen in system lines.

He views solar thermal as the "low-hanging fruit" that is reachable to satisfy growing energy demands, making the analogy of a good vacuum tube solar thermal system to an online UPS setup for other sectors that cannot afford the intermittency of the power grid, and where battery banks

The attainment of much higher temperatures with evacuated tubes also enables these systems to now be incorporated into absorption or adsorption chilling and cooling applications.

are used to maintain power for the the various loads required.

"The system architecture for a vacuum tube solar system is similar to this UPS setup, with the sun the alternative grid and the hot water tank serving as battery bank (storage), from which various heating loads can be served," he says.

Estimating that 50% of a building's energy consumption is cooling/heating/hot water demands, he says that "solar thermal can be that auxiliary source to cost-effectively meet those demands for residential and commercial applications.

PHOTO COURTESY OF APRICUS SOLAR CO.

"It really requires no major investment or undertaking for solar thermal to be incorporated, because it can be a 'cash-flow positive situation' from day one for homeowners able to have upfront costs incorporated into or taken care of by mortgage/equity loan arrangements.

"In my mind, there should be no 'payback period' questions because of this positive scenario from the start, along with long-range performance and environmental benefits," states Adamian. "With the sun as a free energy source, it is prudent financial planning and hedging, since it also provides insurance against energy cost hikes, and adddresses climate change issues.

Whether dealing with flat-panel or evacuated tube collectors, there is a tremendous potenital market for solar thermal in the near future, concludes Adamian, "since the market drivers are there – climate change issues/benefits, incentives available and the efficient technologies that are now available for our mature segment." AER