Solar Energy Potential Grows

The next price jump in oil may well usher in the age of solar energy for contractors

To the average wall and ceiling contractor who feels that solar energy has little to do with his business now or in the future, the day of reckoning may be fast approaching.

It’s true that solar heating of buildings is in its infancy with most installations representing more of an experimental approach than a serious new technology or response to the fuel shortage. But, most energy experts say a renewed emphasis is just around the corner.

Federal energy specialist Arthur M. Tanenhall told Construction Dimensions that “...the majority of effort in the solar energy area right now is experimental.

“To say that this kind of emphasis will continue is to miss the importance of the next go-around on oil prices. Let the oil producing states push through another big price hike and solar energy will come into its own as a viable, legitimate energy source capable of competing cost-wise, too.”

Where wall and ceiling contrac-
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tors obviously will encounter solar energy technologies first will be in exterior walls and curtain walls. Many construction people say that major shifts in building techniques are already under way and another oil price hike will accelerate these shifts.

The changes include more glass exposure on south-facing walls (to pick up more of the sun’s winter radiation) while reducing window space on other walls; more reflective materials are being incorporated into exteriors, and protrusions to control summer temperatures.

“Every architect in the country,” Tannenhall continued, “is now on a crash educational course to learn more about solar energy—and it will be the wise wall and ceiling contractor who familiarizes himself with solar heating technology. Sooner or later, whether in a bidding situation or as a result of his own activities, he’ll be running into such a job.”

Relatively Easy

Actually, the technology of solar heating is not all that difficult. Similar to any other heating system, the technology involves a heat source (in solar heating it’s done by panels which absorb the sun’s radiation), a piping or ducting system for delivering the captured sun’s energy to a structure, and also a means of storage for heat.

Much attention has centered on the so-called collector plates, but even here there is an easily understood break in technique.

Two kinds of collectors—flat-plate collectors and focusing collectors—are used. For temperatures above 120° C, focusing collectors are required—and it is this type of collector which uses only direct radiation and which is effective only when the sun is clear.

Focusing collectors must also track the sun, and are difficult to make and operate in large sizes.

For most building heating purposes, the flat-plate collector is the best known, most feasible, and least costly. They also have other advantages in that flat-plate collectors can produce heat energy even on cloudy, overcast days, need no elaborate tracking mechanisms (they can be oriented once for best efficiency and pretty much left alone after that), and are relatively easy to construct.

All solar collectors, though, have problems because of their large size. A major factor in any design is to assure that they are strong enough to withstand the most severe winds in their localities. They must also be arranged so cleaning can be performed easily because minor elements such as wind damage and dust particles on the surface of the collector may mean success or failure in a solar energy project.

Flat-Plate Collectors

Construction of a flat-plate collector represents essentially a box which collects diffuse solar radiation as well as direct radiation and then transfers it to a more usable medium such as water or air.

Made usually of sheet metal, usually iron, copper, or aluminum to give good heat conduction, the collectors’ surfaces are blackened with a dull black paint often containing carbon black, or they are covered with a black coating produced chemically.

The black plate absorbing the radiation rises in temperature and transfers the heat to a fluid, flowing on the back side—usually—of the collector where the attachment is made to assure good thermal contact.

The reason for the addition of glass or plastic plates in a collector is to reduce the heat losses and maximize the collector’s heating efficiency. At the same time the heated collector is transferring heat to the fluid carrier, it is also wasting heat to the surroundings by convection to moving air currents, by conduction to the air and to colder parts of the structure which holds the receiver, and by infrared radiation.

These emissions are reduced significantly by the glass/plastic

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covers and two covers are more effective than one. Each transparent covering, though, reduces the incoming solar radiation by absorption in the glass or plastic by 8 per cent because of reflection at the glass-air interface.

When multiple transparent plates are used they are usually placed about 1 inch apart to minimize air circulation. Furthermore, the reflectivity of the covering plates can be reduced by application of a thin transparent coating.

Orientation Important

Just as important as the collector construction is the orientation of the plates. They may be horizontal, vertical, or tilted and this will depend on the size and weight of the collector units.

It has been found that collectors tilted toward the equator collect a greater fraction of the solar heat. In the northern hemisphere, collectors are faced south and are tilted at an angle with the horizontal equal to the latitude.

In the winter, the collectors are tilted at the angle of latitude plus 15° and in summer at the angle of latitude minus 15°.

One of the major drawbacks of solar heating—especially in the northern latitudes—is the absence of sunlight for extended periods and there thus arises a need for heat storage.

Most of the heat storage systems currently in use include a vessel holding a liquid, a pebble bed, or a substance—such as various salts—which undergo a physical or chemical change. Lately, there has been considerable experimentation with two-vessel systems, one hot and the other cold, because it allows for storage of larger quantities of heat.

For example, if a concentrated solution of sulfuric acid and water is heated sufficiently the water will be distilled out and can be condensed as liquid water in another part of the closed system, which is cooled either by circulating water or air.

At a later time the residue of sulfuric acid with a small amount of remaining water may be cooled and the liquid water then evaporates and returns to the very concentrated sulfuric acid solution which now has a lower vapor pressure.

In re-entering the sulfuric acid, the water vapor gives up its heat of condensation plus the considerable amount of heat from mixing with the sulfuric acid.

A two-vessel system such as the one described above or one similar to it has great application potential when it comes to heating and cooling by solar energy.

“I don’t see how a wall and ceiling contractor can avoid solar energy technology in the next five to 10 years,” Tannenhall explained. “The involvement in exterior walls, in insulation, and the building processes that involve the entire enveloping of a structure means that the wall specialist probably will become the installation expert.”