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**71. Solar heat is not an option, yet.** Bartok, J. W., Jr. Greenhouse Management and Production 27(10):66. 2007.


# Solar heat is not an option, yet

I'M FREQUENTLY ASKED WHETHER there are any solar collector systems that will help heat greenhouses. A look around the industry should provide a slight clue. Other than a few solar hobby greenhouses, very few commercial installations have a solar system in place.

The reason is most solar systems have a long payback. A conventional system using hot water or hot air collectors generally costs $25 to $50 per square foot to install. If a solar system could collect 100,000 Btu per square foot over a six-month heating season and the price of fossil fuel is $25 per 1 million Btu, the payback would be 10-20 years.

There are other heating alternatives that give a much shorter payback and may be a better choice. If the price of fuel doubles, then the payback shortens and solar may become more attractive.

## Reduced heating needs

Since the energy crisis in 1973, there has been a considerable amount of research conducted and many new heat alternative products developed. As the price of conventional fuels continues to rise, some of these ideas may have application in the greenhouse industry.

Heating needs are much less in today's greenhouses. During the last century, greenhouses were relatively inefficient. Today, greenhouses can be equipped with double- or triple-layer glazing, multiple energy curtains, perimeter insulation, condensing boiler systems and floor heat. Greenhouses can also be built to produce multiple layers of plants. These reduce heating needs and conserve fuel.

Previously, it frequently required 2-3 gallons of fuel oil (2.75 to 4.15 therms of natural gas) to heat a square foot of old glass greenhouse. A well-constructed and managed modern gutter-connected greenhouse should be able to be heated with about a 0.5 gallon of oil (0.7 therm of natural gas) per square foot. This makes solar more attractive as it will provide a larger percentage of the daily heat needs.

## Passive and active systems

Solar systems can be classified as passive or active. A greenhouse is a great passive solar collector. If kept closed, the temperature inside can reach 100°F during winter and 150°F during summer. This heat could be captured and stored in the greenhouse floor or in barrels of water. But research has shown that in a full greenhouse, about half of the solar energy that reaches the inside of the greenhouse is used to evaporate water from the leaf and soil surfaces. This reduces the amount of heat available for storage.

Orientation of the greenhouse to get maximum solar pickup and insulation of non-solar gathering surfaces are important. Placing the greenhouse partially below-ground would also allow the heat collected to be used more efficiently.

Another relatively low-cost, passive system is a solar-heated salt pond. The pond is similar to an in-ground swimming pool filled with water and covered by a greenhouse. Sodium chloride or other salt is dissolved in the water to form a uniform concentration in the lower half and decreasing concentration gradient from the pond middepth to the surface. The water, which is heated all summer, reaches a temperature above 150°F and is drawn off when heat is needed during the cooler parts of the year. Water is pumped from the pond to heat exchangers in the greenhouse. Research on this system was conducted at the Ohio Agricultural and Research Development Center in Wooster.

## Active solar system

An active solar system to heat a greenhouse requires a collector, heat storage and method of transferring the heat to the greenhouse. Here are a few of the systems that may have application for greenhouse heating.

Active collector systems made from sheet metal painted black could be added to the side of a head house or storage building if the orientation is correct.

Another system consists of water solar collectors similar to the EPDM mats used for bench heat. These can be placed along the back wall of a greenhouse. The heated water, which can reach 80°F, could be stored in insulated tanks either inside the head house or buried below ground. These same collectors could be used for radiation at night to transfer the heat back to the greenhouse.

A low-cost, collector system developed by Rutgers University researchers in the late 1970s used five layers of 6-mil plastic, a black layer surrounded by an inflated layer of clear on the top and bottom. Water is supplied by a perforated pipe at the top and collected by a gutter at the


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