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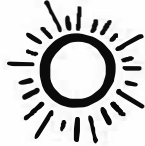
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ACTIVE RESIDENTIAL SOLAR HEATING

Prepared by Blaine F. Parker, Richard Hiatt
and Sandy Holland

This outline on active solar heating has been prepared for extension agent use in Kentucky. It includes some judgments by the authors based on their best professional opinion and the current state of knowledge concerning active solar heat systems.

Active solar heating systems, as opposed to passive systems, are characterized by a pump, blower or some mechanical device which circulates a fluid through the system. These active solar systems are discussed in the following four categories:

- I. Commercially available solar collector panels which are placed on top of a completed roof including associated pumps or fans, heat storage and controls.
- II. Active solar collectors which are built as an integral part of the building with associated pumps or fans, heat storages and controls.
- III. The solar attic consisting of a transparent roof on the south side of the attic with the hot air being drawn from the top of the attic for storage in rock.
- IV. Portable solar collectors usually home constructed with the intention for multiple use.

Domestic Solar Water Heating

It is presumed that all active space heating systems will include domestic water heating since water can be heated all year. This will improve the economics of the system.

Domestic solar water heaters may be installed separately using commercially available packaged systems. For this purpose only 15 to 20 square feet of collector area per person is needed. Making use of this investment year round plus use of the 40% federal tax credit may result in an economic investment if electricity is the alternate fuel.

Commercially available residential heating

Several heating and ventilating firms as well as solar heating companies (particularly near the larger cities) offer a commercial installation of residential active solar heating. The manufactured collector units are mounted on top of completed roofs, of usually newer buildings designed with a slope of 45° to 55° toward the south. Due to the low volume of solar systems being manufactured and sold by any one company, and the individual engineering and architectural attention needed for a given installation, these solar systems are relatively expensive.

Manufactured active solar collector heating for residences in Kentucky can be considered an economic investment only if: a) one of the higher priced fuels such as electricity is currently being used; b) the person can take advantage of the 40% federal tax credit; and 3) the inflation rate of fuel is in the range of 15- to 20 percent per year.

Collectors as an integral part of a building

The materials and cost of building the solar collector portion of a manufactured active system can be considerably reduced by building the collectors as an integral part of the building. The Agricultural Engineering Department has plans which can be used for building a few such collectors in Kentucky. However, this system requires that the individual learn a considerable amount about how to build the collectors and that he be a good enough craftsman to do the job. This is an air-type system and it requires the same fan, rock storage and controls as the manufactured units.

Solar attic

The Rural Housing Research Unit of the United States Department of Agriculture located at Clemson, South Carolina has developed a plan for a solar attic which provides for a transparent roof on the south side of the attic. The collection of the heat requires the fan, storage and controls similar to the manufactured systems. The particular house developed at South Carolina consists of building a trussed roof with a flat section at the center on which a triangular solar attic is added. This triangular section has two transparent covers through which sunlight passes and is converted to thermal energy (heat) in the dark-painted attic. This is inherently a low temperature collector (Refer to:

Ext. Energy Series AEES-3) with air in the collector exposed to the transparent cover. Building the complete collector including the frame on top of platform requires nearly as much material as the manufactured collectors and at the same time exposes the back side of the collector (the north side of the roof) to the outside environment. In addition, during warm Fall and Spring days, or during the summer, overheating of the attic space might occur if this space is not adequately ventilated. This can add to cooling costs and the repeated heating of them may weaken structural members and add to the fire hazard. Generally, we do not recommend this solar attic system for construction in Kentucky.

Portable collectors

Several attempts have been made to construct portable collectors, either on a used truck or wagon frame. The concept is to utilize the collector for the residence during the winter and for grain drying or other purposes on the farm when not needed at the residence. There are several difficult problems with such an arrangement.

1. The entire collector frame must be paid for as a part of the collector cost whereas building a collector as a part of a building requires only the solar absorber-heat exchanger as an additional specific cost.
2. If the collector is made large enough to be effective (certainly greater than 200 sq. ft.) then the problem of wind requires a firm anchoring at each location.
3. Ducts to and from the house result in extra cost and some heat loss.

Conclusions

Except for unusual circumstances we do not believe that portable collectors or the solar attic will be suitable solutions for residential solar heating. The manufactured commercially available solar heating systems which will probably cost in the vicinity of \$10,000 can be economically justified only for the higher priced fuels in Kentucky and if the individual can take advantage of the 40% federal tax credits, and if the individual believes the fuel inflation rate will be in the 15-to-20 percent range. Constructing a collector system as an integral part of the roof can save considerable money on the collectors but it requires that the individual be a good craftsman and that he learn enough about how to construct such a system that he does a good job. If he does not count his labor, he could economically construct a viable heating system as compared to the higher priced fuels, particularly if the fuel inflation rate is high during the next 10 years. Commercially available solar water heaters may be economical compared to electrically heated water if installation cost is not too high and the 40% federal tax credit is usable.

Additional information on residential solar heating is available in the Energy Extension pamphlet series No. AEES 10 "Residential Solar Heating."