The greatest saving is in the blanketing system and in the strategic use of the warm floor. The solar system provided about half of the energy required.

Present costs of the installation of this solar system indicate a payback of about six years. The blanketing system will pay for itself in less than two years and should be a consideration for every greenhouse producer.

The warm floor concept is valid for crops requiring very little or no hand labor. Crops which require hand operations should be grown on elevated movable benches to reduce labor requirements and increase growing space within the greenhouse.

Rock Storage Solar System Saves Greenhouse Energy

By R. Scaffidi and C. Vinten-Johanson

Several years ago labor was the most costly input to grow greenhouse crops. And, of course, the main interest became automation to replace labor. Now fuel costs have surpassed labor costs and attention has switched to reducing those fuel costs.

This chapter describes a small commercial nursery located in the Washington, D.C., area featuring a solar energy air collection system and a rock storage unit used to both heat and cool. The authors designed and supervised building of the "heat sink" greenhouse.

Objective of the project was to design a simple active heating system to supply a substantial amount of the annual heating load without economic penalties resulting from oversizing the building.

Several modes of operation were incorporated in the system to determine minimum design standards

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for solar greenhouses. With this information one can determine maximum fuel savings for the least amount of money.

Contents of the greenhouse act as a collector (framework, plants, cement floor, etc.) and the energy is collected and transferred from these items to the air. In addition, the air can pass through a second collector made of aluminum cans located inside the greenhouse.

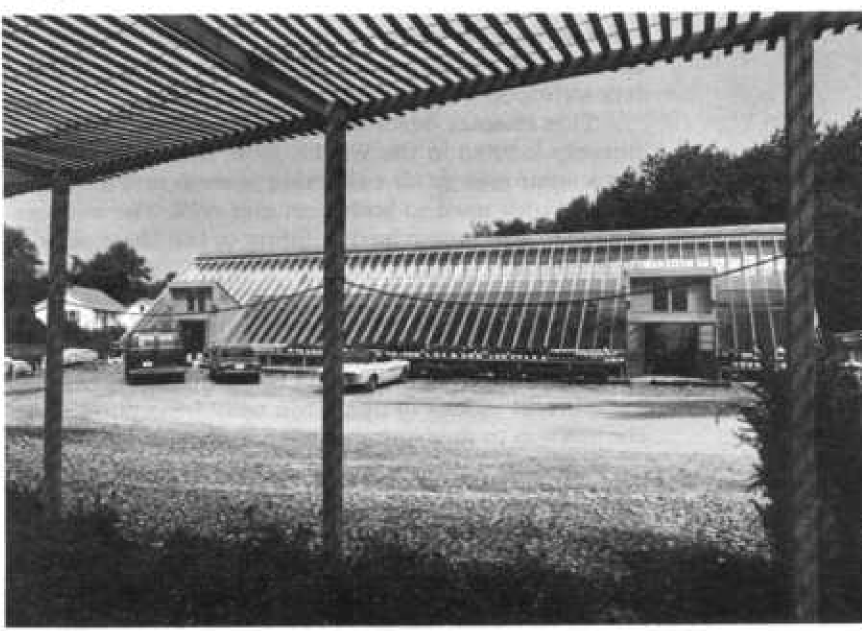
The rock storage, located underground, is split in two units. Either unit can be shut off from the system. Thus a minimum storage size can be determined. Pressure drop through the rock storage in this case was large enough to provide an even air distribution in the rock storage.

Solar Gardens faces south and the entire greenhouse acts as a solar collector. In winter, heated air rises to the greenhouse peak. From there it passes through an aluminum can collector and is pulled down the north wall and into the rock storage.

Air can be drawn from outside or recirculated inside the greenhouse to provide for winter heating and summer cooling.

In winter, air inside the greenhouse is heated and rises to the peak. The air has two choices: To pass through a second collector made of aluminum cans, then continue down the north wall. Or to bypass the second collector and flow down the north wall.

The north wall is constructed of 2 X 2 joists with 6 inches of insulation and a 6-inch air space to provide a duct for the hot air. Air enters an air chamber at the end of the north wall and is pulled by two ¼ horsepower fans into another air chamber located in the center of the floor.



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The two fans create a positive air pressure and forces the hot air through the rock storage and back into the greenhouse. At night the collector is shut off by dampers, and a thermal blanket is drawn across the plexiglass. To maximize heat gain from the rock storage the fans are reversed. Heat is transferred from the rock storage to the greenhouse and cycled back to the rock storage in a closed loop.

Rick Scaffidi, part owner of "Solar Gardens" in Silver Spring, Md., waters plants in his "heat sink" greenhouse.

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In summer, the collector is shut off. During the day, hot air rises to the peak and is exhausted through the ceiling vents. Warm air at the bench level is cycled through the rock storage, cooled, and exhausted back into the greenhouse. Heat captured by the rock storage during the day is exhausted outside the greenhouse at night.

A cooperative Research Agreement with the U.S. Department of Agriculture to test performance of the solar greenhouse commenced during the summer of 1980. The test results will provide information for designing solar greenhouses that are economically competitive with conventional greenhouses.