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✓ A PASSIVE-SOLAR-HEATING PROJECT

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by

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INTRODUCTION

This project was a passive home heating system utilizing solar collectors that are part of the roof structure of a 15' x 30' greenhouse. The design utilized solar air collectors constructed on site that are actually part of the roof of the greenhouse. (See drawing inclosed.) The flow of air is from the storage to the collectors then back to the storage. The storage bin consists of a 5' x 9' concrete insulated bin built into the floor of the greenhouse. The storage mass was gallon plastic jugs (the jugs were saved and recycled from the following places, 1) Osceola County School Food Service, 2) Orlando Hyatt Hotel, 3) Community Hospital.

The plastic jugs did not work properly, so they are being replaced by salt rods. This replacement will be an after the fact project by the owner.

The concrete storage bin was insulated with 2" styrofoam insulation, applied to the 8" concrete wall. The ducts entering and leaving the storage bin have low voltage (12 volt) electric dampers. A cross flow system was used. The heated air circulates from the collectors to storage via ducts in the walls of the lean-to design. The removal of heat from the storage bin was from end to end via the ducts to the central air system for the house. In addition, the greenhouse is connected to the house with a doorway that can be opened to circulate air into the house, a shuttled exhaust fan 1/3H.P. motor has aided in the circulation of air from the storage bin to the collectors and back.

SUMMARY OF DESIGN

To be successful, a solar greenhouse must collect solar energy efficiently; it must also store some heat for use when the sun isn't shining; and it must have a means of retaining heat flow to the outside air. I felt that this design would meet all of the above criteria. The greenhouse design 15' x 30' with approximately 394 sq. ft. of lexan glazing, with metal collection strips. The storage bin did contain approximately 157 gallons of water to store heat for night time use and cloudy days. The thermostatically controlled blower circulated heated air from the collectors to storage. The water absorbed some of the heat from the air, which returns, now cooler to the collectors to be heated again.

This process did not work as planned and a new design will be installed by owner.

CONSTRUCTION DETAILS

The greenhouse also drew upon the storage heat when the inside temperature dropped to 50 degrees, another thermostatically controlled blower was activated. The master thermostat is a Temp-tron micro-computer based thermostat in the house.

Since the actual construction of the greenhouse collector was fairly simple only a quick summary will be given. The site was measured and the footings were dug. Next the footings were constructed (8"x16" and the walls (8"x4') were built. While the concrete walls are being poured 6" anchor bolts were placed in the walls.

The foundation was insulated on the outside as shown in the drawing. Then the backfill of the foundation was completed. Next the floor was poured over a base consisting of 4" of compacted sand, a 6-mil vapor barrier, 6"x6"x number 9 wire mesh and 10" of concrete slab. Return air ducts were placed in the slab area prior to pouring to provide a circulation path from the storage area to the collectors and back.

After the walls cured, 2"x8" pressure treated #2 yellow pine sill plates projected out beyond the concrete to cover the 2" styrofoam insulation.

A ledger strip (2"x6"0 was bolted to the existing house at the point where the greenhouse roof meets the wall.

Next the frame of the greenhouse was constructed. This frame served as the framework for the solar air collectors. After the frames were installed and glazed on the outside the door and roof was completed. The interior glazing and ductwork was then completed.

This solar structure does not look like a regular greenhouse. Instead it is shaped like a shed with a long, steeply sloped front wall. The man behind this design is Dr. Dave McKinnion, a physicist working with the Museum of Northern Arizona and the Atmospheric Sciences Research Center (of the State University of New York at Albany).

" In winter the sun rises and sets fairly far south on the horizon. That's why we have so little light to work with. But, also why clear sidewalls wouldn't give us much extra light or heat". Using this idea a roof framework was designed that would permit light penetration and yet provide solar air collector space. The entire foundation area is also beamed with earth to provide thermo mass to the storage bin. The design of this greenhouse will let in almost all of the useful light and heat, while still providing collector space and greenhouse space. The extra benefit of this design is a fully functioning winter greenhouse, that will be self-sustaining.

SUMMARY

The overall project was successful, however the water jug design did not function as expected. In all future designs this writer would recommend the use of "salt rods" for heat storage. In addition, some type of air filter system should be used to filter the return air to the house. This design would make very cost effective sunspace if done during new house construction. With the added cost of the salt rods and other changes the cost effectiveness of this project is questionable.

"As Built Drawing"

STARKY

PASSIVE AIR SYSTEM Detail

Air Duct
to Central System