Attached Solar Greenhouse
Plans for a solar heated greenhouse attached to your home

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![Diagram of Attached Solar Greenhouse]

**Glass Insulation Detail**

- Glass
- Butyl rubber caulk
- 4" rigid insulation covered with stucco

**South Elevation**

- 1 X 6 covers joint of roof and wall
- Insulated roof
- Sliding glass door into house

**West Elevation**

- Brick on sand floor
- Section A-A

http://mygreenhouseplans.com
Designed and built by New Mexico landscape architect John Mosely for his own Santa Fe home. The solar greenhouse shown above is attached by a sliding glass door to the house not only convenience but also to take advantage of greenhouse heat during the winter. In the summer cooler air in the house is vented through the greenhouse to the outside.

The roof of the 8- by 14-foot glass (Lexan Thermoclear is a good option) and redwood structure is angled for maximum exposure to the summer sun. The upper third of the roof is covered with insulation to provide relief from the overhead summer sun. The 14-foot-wide north-wall, made from pumice block poured with concrete is the heat sink. The outside of the 8-foot-high wall is insulated with 4-inch-thick rigid insulation stuccoes to protect it from the weather. The front-wall and the roof were originally designed to hold only one pane of glass in each opening, but the local code required two.

The code also required that the glass windows be separated at the corners so the block-wall was extended and a work area formed beside the outside entrance. You can adapt this greenhouse to your area eliminating the extension if it is not required locally. Begin the construction by laying out the site and excavating the ground so that the floor of the greenhouse will be level with the house floor. Position slip forms of 1 by 4's for the footing around the inside perimeter and level them.

Form the outside of the footing with rigid insulation braced against the excavated wall. Pour the concrete, when the footing has hardened build the walls with standard sized pumice blocks. Rabbet each vertical stud plus the top and bottom plates and the crosspieces to receive the panes of glass. If you don't have access to a table saw for rabbeting you can install the glass using quarter-round molding or 1 by 1 redwood strips as stops nailed to the studs and rafters.

The next step is to frame piece by piece the west-wall which holds the exterior door. The 2 by 6 door frame goes in first. The next elements to be installed are the top plate, the door header, and the window and vent frames. With the front and side-walls in place it is time to put up the roof. Instead of installing each rafter individually measure and lay out the roof as if it were a wall.

Cut the front end of the rafters so that they are in a vertical line with the front-wall. Rabbet each piece as you did the front-wall. Then nail together the entire roof section. Lift it into place and toenail it to the
top plate of the front-wall, nail on a 1 by 6 to cover the seam. With exterior grade plywood cover the back area where the roof extended above and slightly over the wall, insulate it inside and outside. Install the glass, sealing each piece on both sides with butyl rubber or use polycarbonate panels, instructions for installation provided by manufacturer. Use 1 by 2 strips to hold the glass in place.

Complete the greenhouse by installing a brick and sand floor. You can substitute glass with Lexan twin wall or triple wall polycarbonate as well. The view will not be as clear as glass but it will be more insulating than glass or acrylics for that matter AND shatterproof even at low temperatures.

**Solar Greenhouses vs. Conventional Greenhouses:**

A solar greenhouse differs from conventionally designed and operated greenhouses in that it does not rely on outside sources of energy for winter heating and summer cooling.

A conventional greenhouse is usually glass or polycarbonate and pays no attention to direction of the sun.

The solar greenhouse tries to get as much of the sun's energy as possible by taking advantage of a southern exposure as much as possible. The northern walls are insulated to reduce heat loss at night and on cooler days. Vents promote natural circulation to help keep the interior cool. A storage mass usually in the form of water filled 45 gallon barrels helps reduce the loss of heat especially at night. The solar greenhouse relies on passive solar energy. The advantage of passive solar heat is that it can be built right into a freestanding or attached solar greenhouse. The passive design will use very little mechanical equipment, extra piping or special maintenance, as active systems often do.

**A solar greenhouse must contain the following parts to be considered a complete passive solar heating system:**

- A collector, such as the double layer of greenhouse window glazing (glass, polycarbonate, acrylics, fiberglass or Poly plastic).
- An absorber, usually the darkened surfaces of the walls, floors, and water-filled containers inside the greenhouse,
- A storage mass normally the concrete, brick or water that retains the heat after energy has been absorbed.
- The distribution system, which is the means of getting heat around the greenhouse using fans and natural circulation.
- A control system (or heat regulation unit), such as movable insulated curtain or blanket used to prevent heat loss from the greenhouse at night. Roof overhangs that block the summer sun and thermostats that activate fans are also controls.

**How a Solar Greenhouse Works**

The following principles briefly explain the basics of understanding how a solar greenhouse operates:

The sun shines through the clear areas in short waves. These waves strike objects in the greenhouse and are reflected as long waves. When the long waves cannot escape because of the glazing is a good example of the greenhouse effect.

Large objects in the greenhouse such as masonry walls, rocks, water drums, concrete absorb heat during the day and return heat to the structure at night. The most efficient heat sink is enclosed water in a barrel.

The warm air (80-90F) from the greenhouse goes directly into the adjoining structure or your home. This works best if there are high and low openings. The vents establish a natural air circulation system that benefits the home and the greenhouse. At night the openings can either be left open or closed, at the occupants option. If open, the greenhouse will draw on some home heat and will keep higher temperatures.

The partially shaded and insulated greenhouse roof will keep it warmer in winter and cooler in summer.

How well the greenhouse retains heat is influenced air leaks and drafts. A well constructed greenhouse and has all windows, side walls and joints in the greenhouse insulated and or caulked to prevent heat loss.

Calling a greenhouse solar is somewhat redundant since all greenhouses are solar heated to some extent. The greenhouse itself traps the heat each day and anyone who has been inside one for a few minutes on a sunny day knows how warm the sun can be. A greenhouse acts as a natural solar collector on sunny days but it does not retain the sun's heat at night. Consequently 75 to 80 percent of
the cost of heating a greenhouse by conventional energy sources is expended at night.

To retain the sun's heat you need something the heat can be stored in, a heat sink. This heat sink can consist of barrels of water, rocks, concrete walls or some other thermal mass. At night stored heat radiates throughout the greenhouse. The two types of solar energy systems are referred to as active and passive. The system commonly used in a hobby greenhouse is passive. Here a thermal mass such as rocks or water filled drums captures heat during the day and radiates back at night.

The active system requires electricity or another conventional source of energy to pump heated air into a storage area such as a basement filled with rocks or water drums. More efficient than passive solar heating this type of system is also more expensive and more complex. Both types of solar heating systems work better in areas with a high percentage of sunny days even if the days are cold than they do in areas where overcast days are common.

**Passive System**: The sun's warmth is deposited and held in the thermal-mass heat sink during the day. At night this heat radiates out and keeps the greenhouse warm.

**Active System**: The sun's heat warms the transfer fluid (water or air) in a solar collector, later fluid is pumped to another location and stored for redistribution as heat.

Solar Heat Sinks or Storage mass (thermal mass), are materials used for capturing & storing solar heat usually in the form of water in containers; stacked water filled steel drums; concrete-filled cinder or pumice; brick, stone or adobe wall; masonry floors and walls; concrete slab on top of a bed of rocks; bin or loose pile of rocks or rock wall held in place w/wire-mesh are used in passive solar houses to store heat during the day and emit it into the living apace at night.

Storage mass also is used to regulate heat within the space so that it is not too hot during the day or too cold at night. The large areas of south-facing glazing on a passive solar greenhouse create a large amount of heat loss during the night, many greenhouses use moveable insulation in the form of curtains or panels.