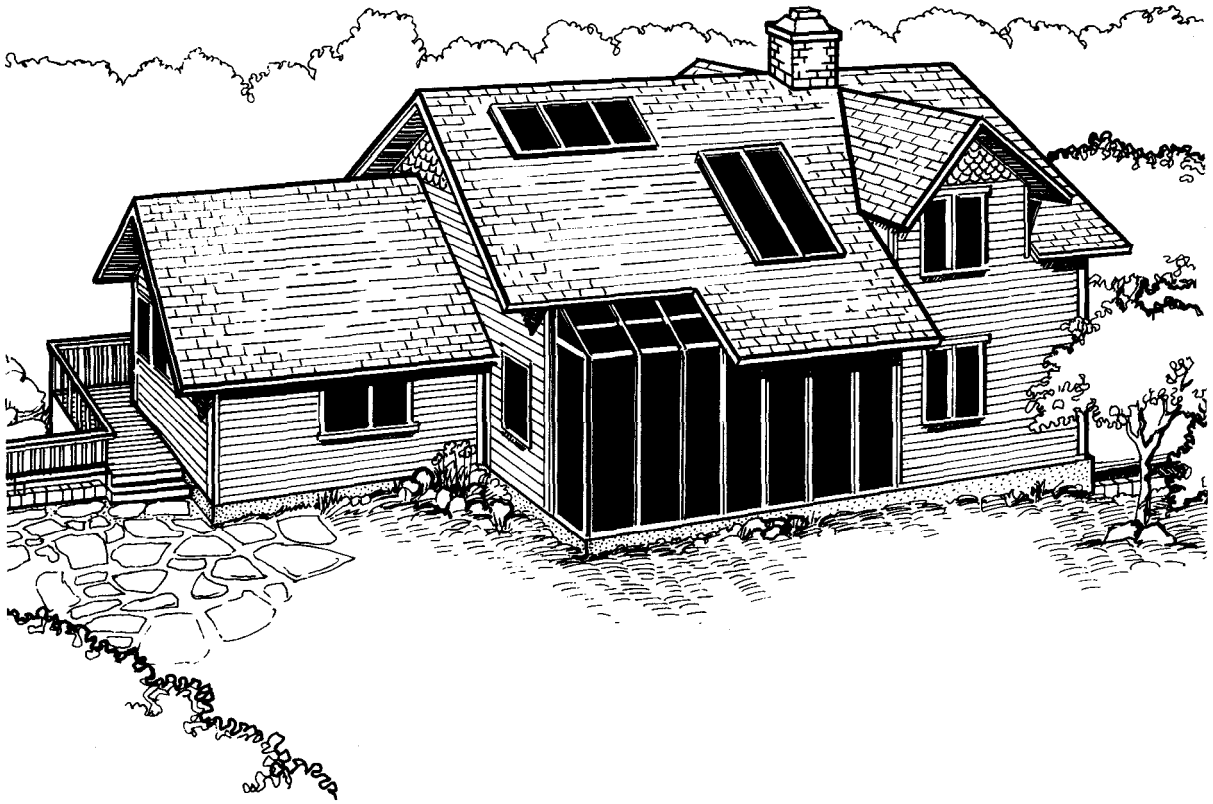
Boulder, CO



Builder: Ashcroft Constructors, Inc., Boulder, CO

Designer: Milburn-Sparn Energy Architects, Inc., Boulder, CO

Solar Designer: Milburn-Sparn Energy Architects Inc.

Price: $125,000

Net Heated Area: 1938 ft²

Heat Load: 107.6 x 10⁶ BTU/yr

Degree Days: 6500

Solar Fraction: 62%

Auxiliary Heat: 3.23 BTU/DD/ft²

Passive Heating System(s): Direct gain, isolated gain

Recognition Factors: Collector(s): South-facing glazing, greenhouse glazing, skylights, 343 ft² **Absorber(s):** Solarium floor, brick walls **Storage:** Solarium floor, brick walls, rock-bed storage—**capacity:** 17,460 BTU/°F **Distribution:** Radiation, natural and forced convection **Controls:** Dampers, fans, moveable insulation

Back-up: Electrically ignited gas furnace (64,000 BTU/H), woodburning stove

Domestic Hot Water: Liquid flat-plate collectors (49 ft²), 82-gallon storage

Passive Cooling Type: Induced ventilation

This contemporary Victorian condominium design is part of a Planned Unit Development that includes 28 passive solar residences. The steep north-sloping site was intentionally chosen to demonstrate the solar potential of a difficult location. The 3-bedroom, split-level unit has a cathedral ceiling living room with a balcony that opens to a greenhouse. Two skylights with louvered shades are located at the ceiling ridge. The building form is compact, with a long east-west axis to maximize solar penetration. Because of the difficult siting, the primary energy-conservation measures specify caulking, vapor barriers, and high R-value insulation in exterior walls to reduce infiltration.

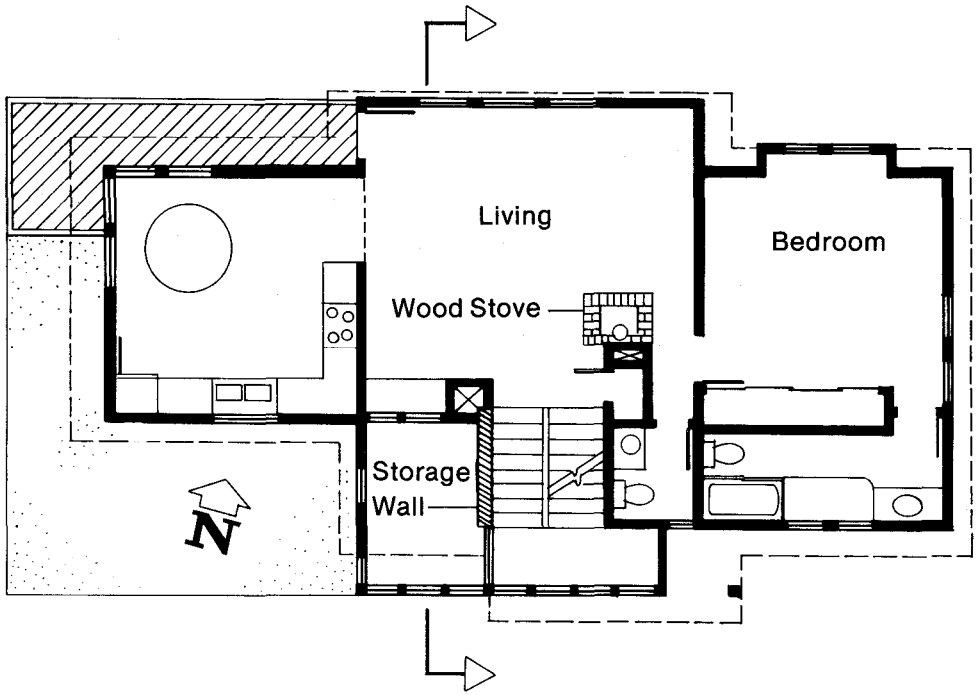
Solar heat is collected primarily through south-facing greenhouse glazing and the skylights at the peak of the cathedral ceiling above the greenhouse. Heat is absorbed and stored in the greenhouse concrete floor and brick mass wall, and later is radiantly distributed into living spaces. In addition, solar heat is stored in a remote rock bin located in the basement beneath the greenhouse. The rock storage bed is connected with the back-up gas-fired furnace and air-handling system. During the heating season, a manually operated damper in the central return duct is left permanently in the open position. In the daytime heat storage mode, the fan in the air-handling system runs continuously, and

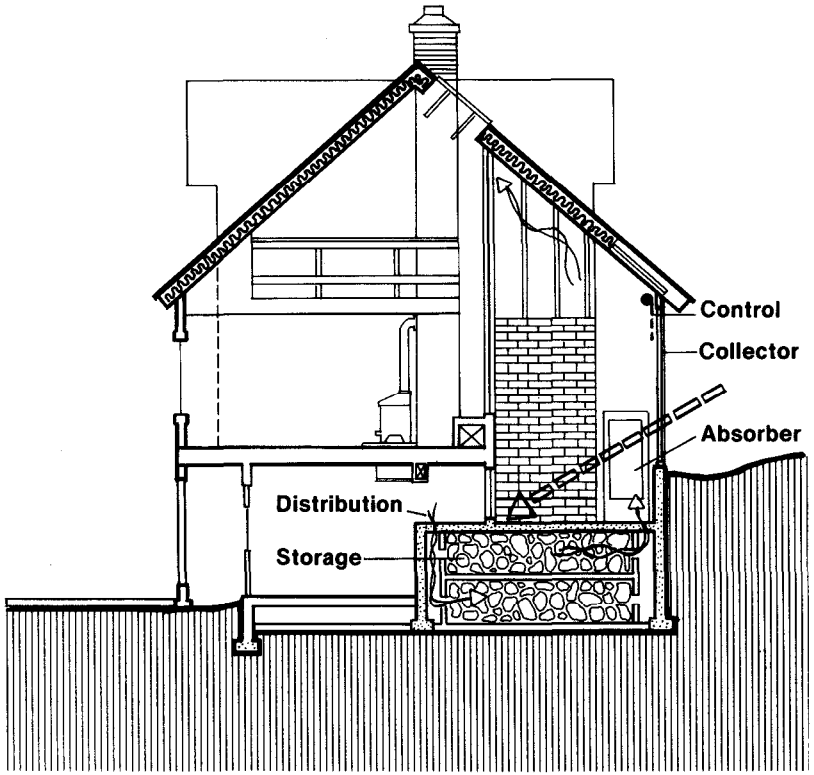
an automatic reversing damper permits solar-heated greenhouse air to be pulled through the rock bed, charging it with heat. Air is then returned to the greenhouse at floor level. At night, when the house thermostat calls for heat, the position of the automatic damper is reversed, which reverses the direction of the air flow through the rock bin. Solar-heated air is then extracted from the bin and **distributed** to the house through supply ducts and floor registers. When solar heat from rock bed storage is insufficient to maintain indoor temperatures at the desired level, the furnace turns on.

During winter nights, heat loss is **controlled** by manually closing the skylids™ on the living side of the skylights, pulling roller-type insulation shades down over windows in primary living spaces, and closing the moveable insulation under the greenhouse roof glazing.

Summer cooling in this sunny climate requires reducing heat gain during the day. This is accomplished by closing the skylight louvers and closing the sunscreen in the greenhouse each day. Permanent southern overhangs provide further shading. Forced ventilation of the house is accomplished by activating the fan and manually closing the summer damper in the return duct which prevents hot air from being circulated from the greenhouse to the rock bed during the cooling season. When a north basement window and the skylights are opened and the basement stairway door is closed, the forced-air system can draw cool air into the rock storage bin and vent hot air through the skylight. The same effect can be created by natural circulation if the fan is shut off, but the circulation of air will be slower.

The design includes an active solar domestic water heating system that is used throughout the year. The system uses two flat-plate collectors, an antifreeze solution as the heat transfer medium, and a fiberglass insulated tank with 82 gallons of storage volume.





This plan is from the book
“Passive Solar Homes – 91 new award-winning, energy-conserving single-family homes”,
The U.S. Department of Housing and Urban Development, **1982**

The solar homes designs in this book were the winners of HUD’s fifth (and final) cycle of demonstration solar homes. The 91 winning home plans in the book were selected from 550 applications from builders.

This was a time of great interest and activity in the passive solar home designs – many of the winning homes show a level of innovation not found in most of today’s passive solar designs.