

Builder: Hornbeek Construction Company, Davis, CA

Designer: Hornbeek Construction Company

Solar Designer: Hornbeek Construction Company

Price: \$90,000

Net Heated Area: 1180 ft²

Heat Load: 40.7 x 10⁶ BTU/yr

Degree Days: 2419

Solar Fraction: 75%

Auxiliary Heat: 3.49 BTU/DD/ft²

Passive Heating System(s): Sun-tempering, direct gain, indirect gain, isolated gain

Recognition Factors: **Collectors(s):** Greenhouse glazing, sliding glass doors, 286 ft² **Absorber(s):** Greenhouse brick floor over concrete slab and sand, steel water tank surface **Storage:** Brick floor, concrete slab floor, water in steel tanks—**capacity:** 8906 BTU/°F **Distribution:** Radiation, natural ventilation **Controls:** Insulated curtain, greenhouse canvas shade, adjustable sunshade, tank insulating curtain, vents

Active Solar Heating: Active space heating back-up from DHW system

Back-up: Hot water is pumped through fan-coil units and baseboards

Domestic Hot Water: Active DHW system

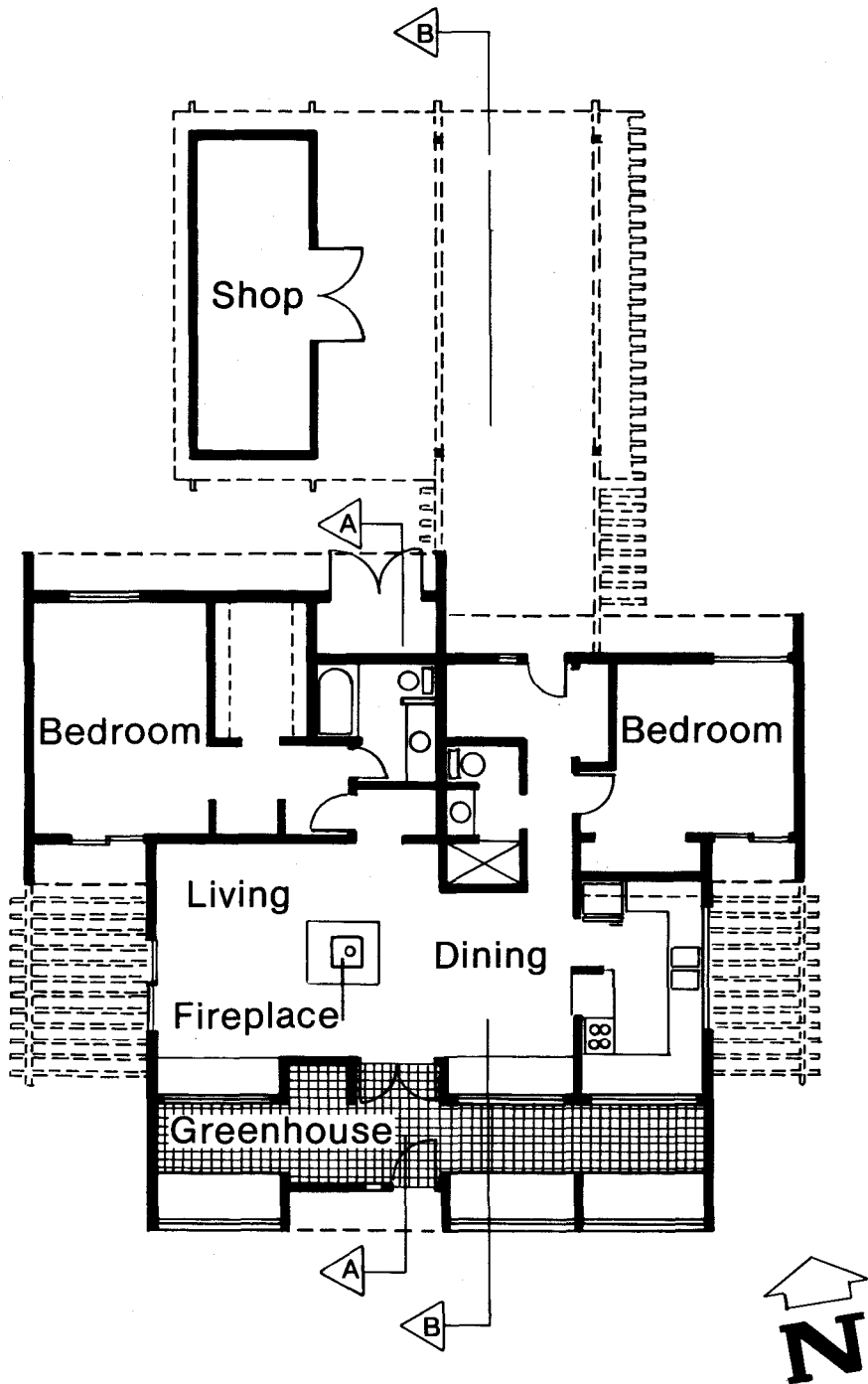
Passive Cooling Type: Night-sky radiation, convection

All houses built in Davis, California, must conform to the city's energy-conservation ordinance. This traditional ranch house has been built almost to the book to meet these requirements.

Its compact form, with a heated area of 1180 square feet, avoids a box-like appearance by the use of protruding side wings for the two bedrooms, a gently sloping roof to deflect the north wind, and a separate carport and shop wing attached by a breezeway.

Windows on the east and west sides have been kept to a minimum; cross-ventilation has been emphasized to take advantage of the Sacramento delta winds; double glazing has been used throughout; and overhangs and trellises are included to protect the house from direct sun. The house is oriented 10 degrees east of true south.

Serving as **collectors** are three standard, double-glazed aluminum greenhouses incorporated into the south side of the house. Fin walls jutting out to the level of



the entrance form "pockets" for the greenhouses. The center foyer opens on either side to the greenhouses.

On the east and west flanks of the house, two bedroom wings extend with sliding glass doors facing south to act as additional passive collectors. Opening onto trellis-covered patios, these allow some winter sun exposure for the bedrooms and excellent cross-ventilation in the summer.

Absorbing and storing solar radiation are brick floors in the greenhouses that are set in sand on 4-inch thick concrete slabs, and three black-painted steel water tanks, 2 feet high, dividing each greenhouse from the living room, dining room, and kitchen. The tanks are built in under functional counter tops with sliding glass windows closing off the greenhouses from the rest of the house.

On winter nights, stored heat is distributed by radiation from the tanks directly to the rooms and an insulating curtain is drawn to prevent back losses from the tanks to the greenhouses. A convective distribution is set up between the greenhouses and the remainder of the living area by opening the sliding glass windows over the three water tanks.

The amount of solar energy admitted to the house can be controlled by the raising or lowering by crank of three outside synthetic canvas (acrylic) blinds which are installed over the glass contours of the greenhouse.

A wood stove, centrally located in the living area, provides back-up heat.

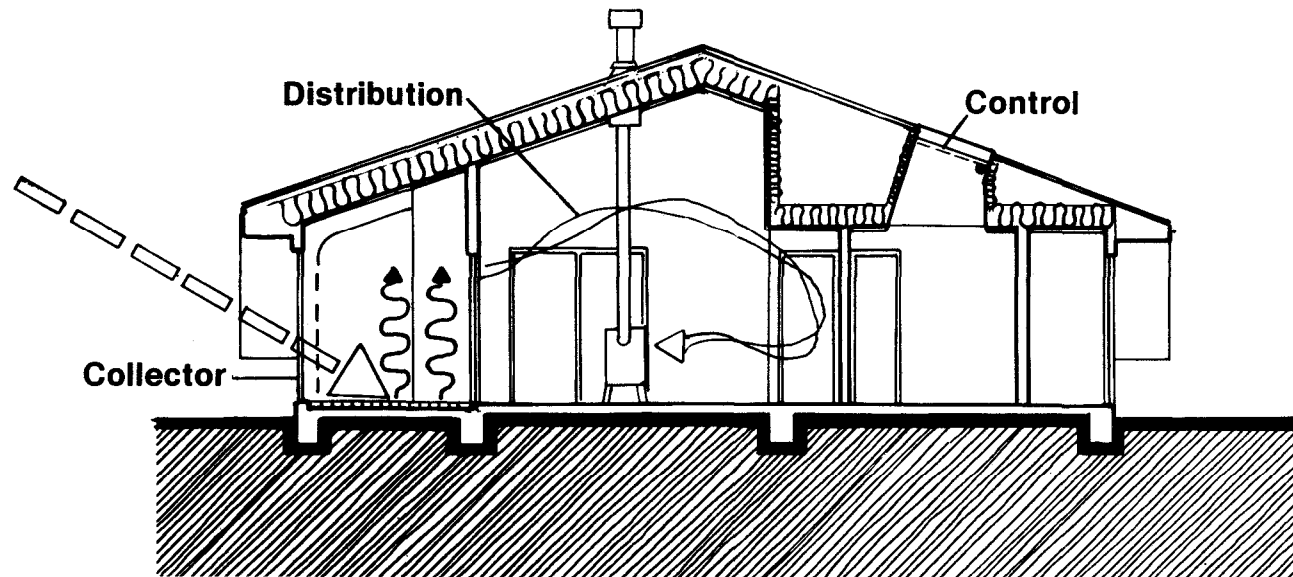
On summer days, the adjustable sunshade is lowered, the tank insulating curtain is pulled down, the skylight shutters are closed, and the hatches to the attic and the vent-louvers to the garden are opened to allow cross-ventilation of the greenhouse. In the cool of the evening, moveable insulation is raised, and all hatches and vents opened to allow natural cooling. In the event that there are no breezes, an exhaust

fan with a manually timed switch ventilates the house. The year-round climate in Davis is mild. Extreme summer heat can be taken care of by one air conditioning unit in the west wall of the living room.

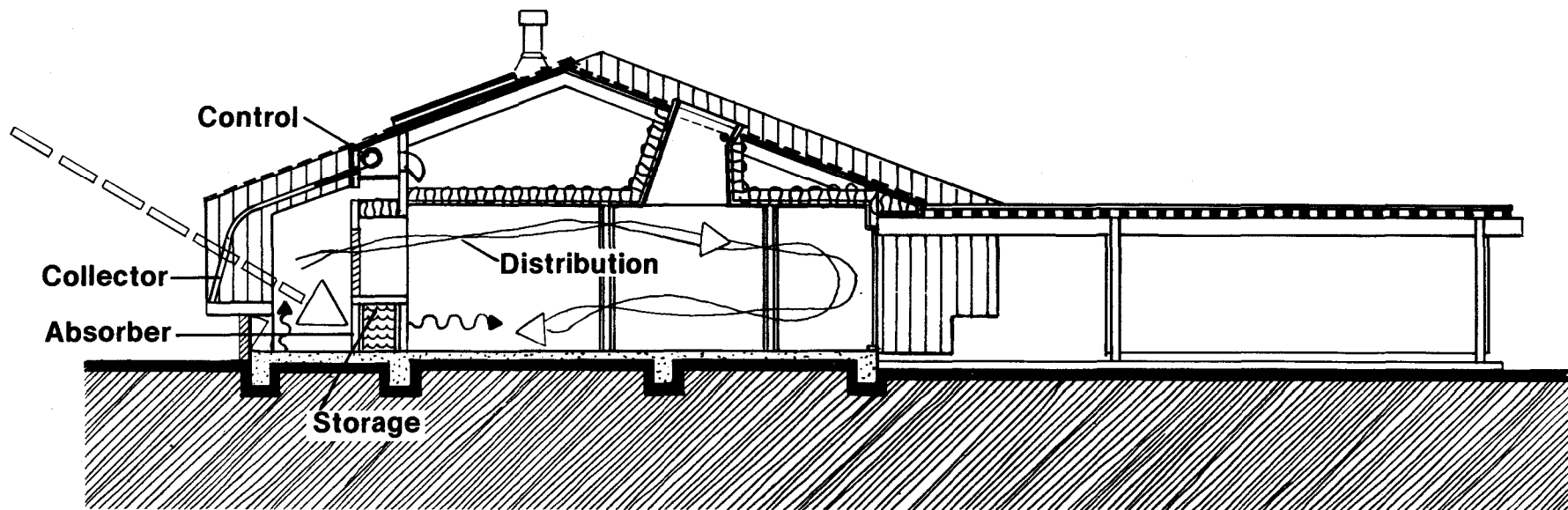
An active solar domestic water heating system also provides an effective space heating back-up in winter. Hot water is pumped through fan-coil units and baseboards using, in the process, relatively little mechanical power.

The house could be considered a model for the energy-efficient requirements of the city of Davis. It has R-19 insulation in the walls and R-30 in the roof, double glazing, insulated and shuttered skylights, and windows and doors that are all caulked and weatherstripped. The R-6 perimeter insulation minimizes slab edge losses. The use of unnecessary glass has been avoided and windows facing east and west kept to a minimum to prevent summer overheating.

A storage room, a carport, and a shop form a separate wing of the house and are connected by a trellis-covered breezeway. This north-facing service area deflects north winds from bedrooms and bathrooms. The repetition of the trellis motif, along the south front and over the east and west south-facing patios, give the house an airy appearance and is another pleasing element of a house well designed in many ways.



A-A



B-B

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.

www.BuildItSolar.com

