AGRICULTURAL
# GUIDE
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energy information

# Solar-heated new technology house

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In 1979, the UMC College of Agriculture began construction of a solar-heated home on a University farm near Columbia. It's called a *New Technology House* because it incorporates the latest technology available for home construction. The major emphasis is on energy conservation and solar heating. The house was completed in January 1980, and was occupied shortly thereafter by a family of four.

To reduce the heating requirement, a compact (24 x 38 foot) two-story house plan was selected. About one half of the lower floor is below ground level. This house is 100 percent usable because the lower level has an all-weather wood foundation with a wood floor. So it's possible to keep the lower floor just as comfortable and livable as the upper floor. The house is insulated with 6-inch fiberglass insulation all around the lower level, 6-inch fiberglass insulation plus ¾-inch expanded polystyrene sheathing on the walls of the upper floor, and 12 inches of insulation in the ceiling. Most of the windows are in the south wall, and the window area is approximately 5 percent of the floor area. The windows selected were triple glazed for better insulation value. The average R value (resistance to heat flow) considering windows, doors, walls, and roof is approximately 29.

Steps were taken to reduce the air infiltration to a minimum. Each of the outside doors, except one, leads to a protected area such as the porch, garage, or greenhouse. The doors have a magnetic seal around the edge to reduce air infiltration. The casement windows have about one-tenth the infiltration of a high quality, double-hung window. To reduce air infiltration even more, electric wiring on the outside wall was placed on the surface rather than cut into the wall.

The house has a 420-square-foot solar collector in the attic. The heated air in the attic is circulated through the house or is forced through a rock bed below the house. This rock bed consists of approximately 30 tons of 2-inch rock for heat storage. The furnace fan pulls heated air out of the rock storage when it's needed to warm the house. If there is not enough heat stored in the rock, a heat pump and electrical resistance heating is available to back up the system. During the summer, the attic is ventilated to prevent heat buildup. At night, the fan in the attic can draw cool outside air into the house to cool the rock bed. During the day, air can be circulated through the rock bed to cool the house.

The waste treatment system for this house is a septic tank with a drainage field. Because the clay subsoil at the site is impermeable, an experimental, mounded drainage field was used. This system spreads the effluent evenly over the base of the mound rather than discharging it into trenches. The objective is to improve effluent intake by spreading it over a larger area.

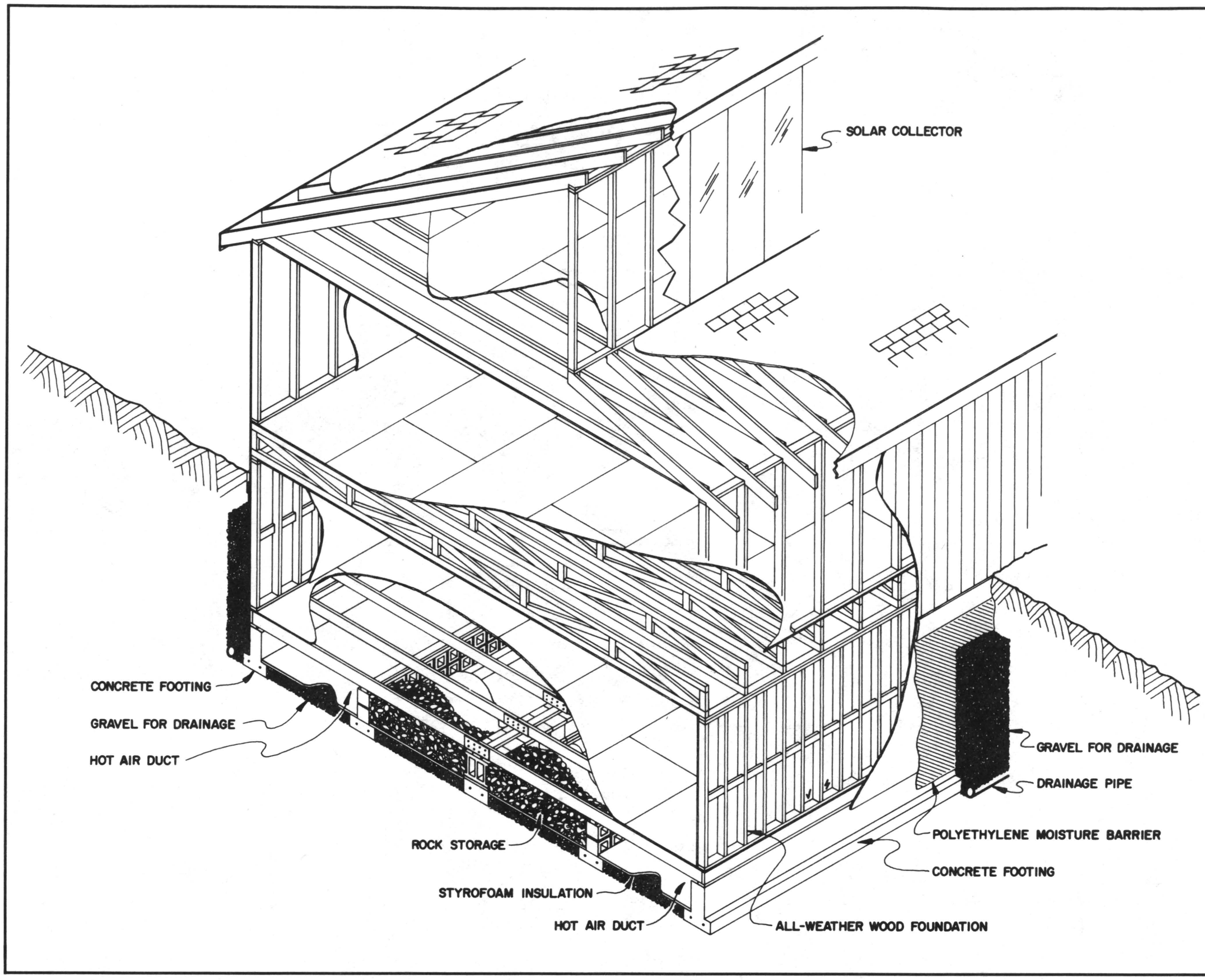
Energy use records have been kept since March 1980. Table 1 shows the energy used for heating and cooling.

The actual cost of energy from Boone Electric Cooperative (based on 1985 rates) ranged from 5.35 to 6.08 cents per KWH, depending upon the amount of energy used. At 6 cents per KWH, the average cost of electrical energy during the entire cooling season was $156 and for the entire heating season the cost was $198.

As a matter of interest, several other appliances were metered during a three-year period. The average *monthly* energy use is shown below.

| **Appliance** | **Average KWH per month** |
|---|---|
| Water heater | 402 |
| Range | 54 |
| Clothes dryer | 139 |
| Refrigerator | 148 |

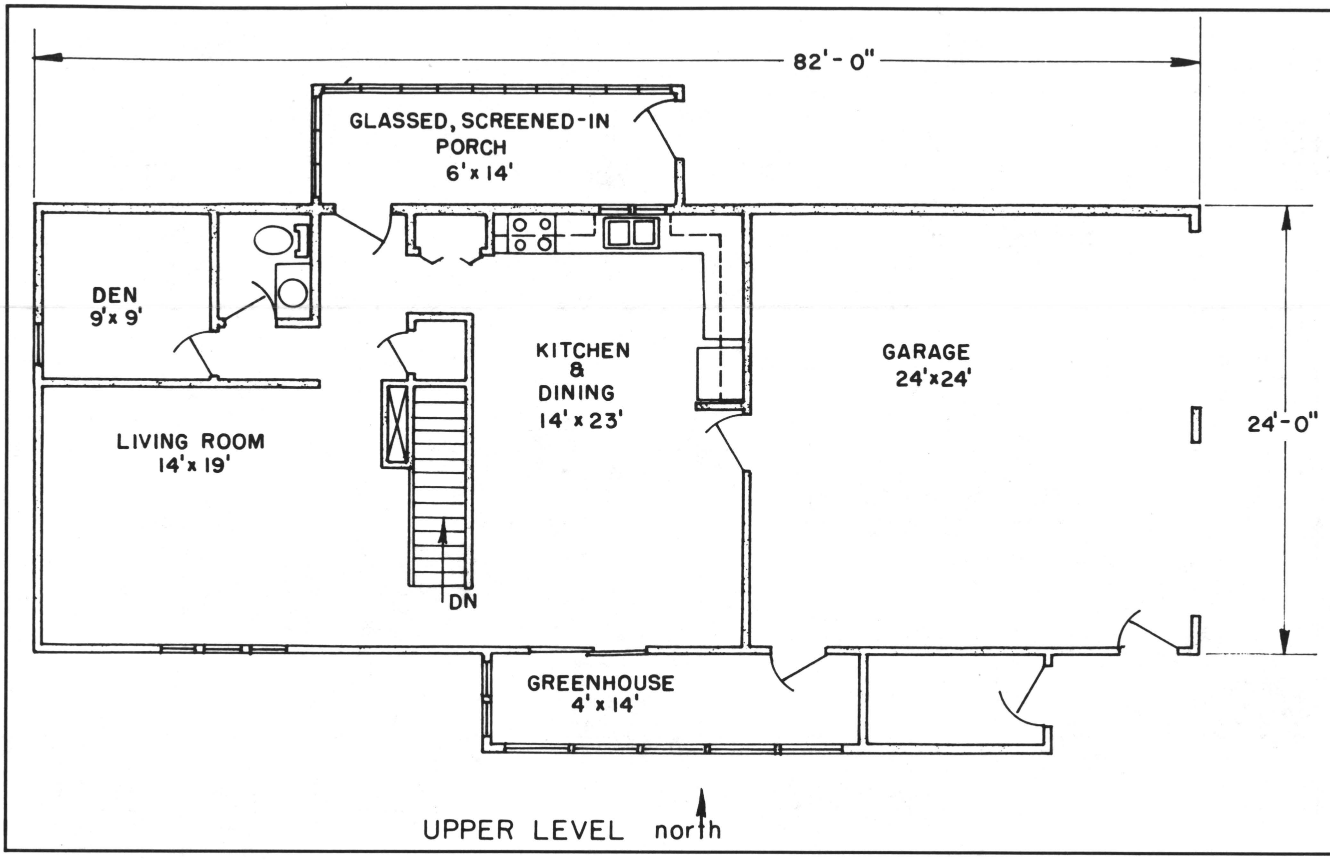
Plans for the New Technology House are available from your local extension center.

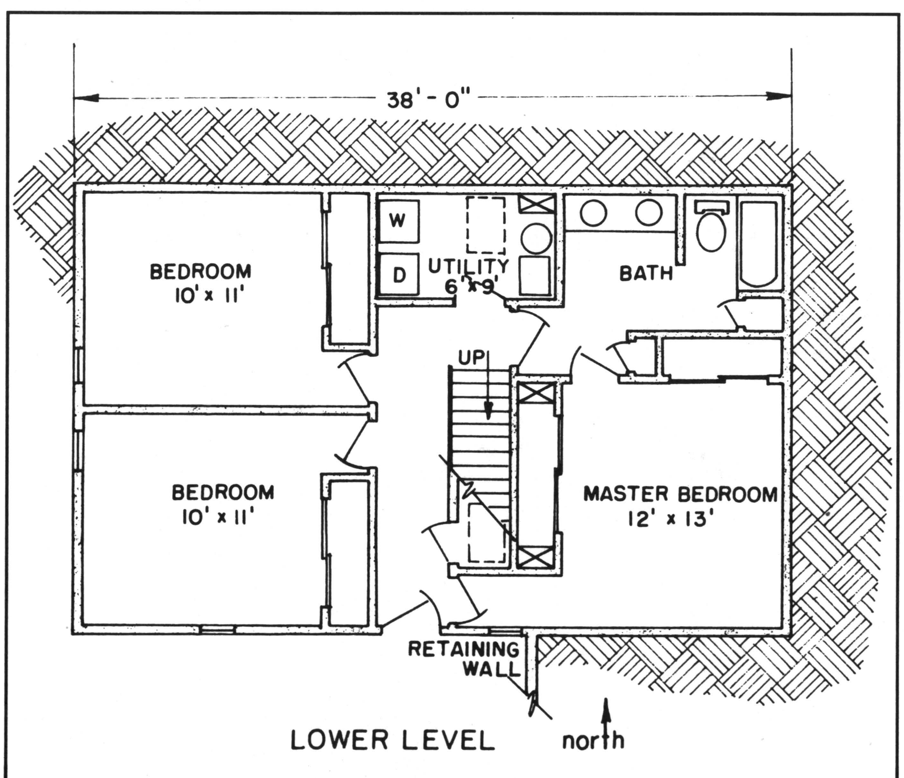



Construction features of the New Technology House.

South view showing solar collector.

# Floor Plan


82'-0"
GLASSED, SCREENED-IN PORCH 6'x14'
DEN 9'x9'
KITCHEN & DINING 14'x23'
GARAGE 24'x24'
24'-0"
LIVING ROOM 14'x19'
DN
GREENHOUSE 4'x14'
UPPER LEVEL north


38'-0"
W
D
UTILITY 6'x9'
BATH
BEDROOM 10'x 11'
UP
BEDROOM 10'x 11'
MASTER BEDROOM 12'x 13'
RETAINING WALL
LOWER LEVEL north

| Table 1. Energy use (kilowatt hours) | Heat pump and fan (summer cooling) | Heat pump, furnace, and fan (winter heating) | Total for 12 months |
|---|---|---|---|
| May—October 1980 | 2651 | | |
| November 1980—April 1981 | | 1779 | 4430 |
| May—October 1981 | 2499 | | |
| November 1981—April 1982 | | 3539 | 6038 |
| May—October 1982 | 2151 | | |
| November 1982—April 1983 | | 3541 | 5692 |
| May—October 1983 | 2860 | | |
| November 1983—April 1984 | | 5057* | 7917 |
| May—October 1984 | 2799 | | |
| November 1984—April 1985 | | 2592 | 5391 |
| 5-Year Average | 2592 | 3301 | 5893 |

*DIFFERENTIAL THERMOSTAT CONTROLLING ATTIC FAN WAS INOPERATIVE. SYSTEM WAS OPERATED MANUALLY OR NOT AT ALL.

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