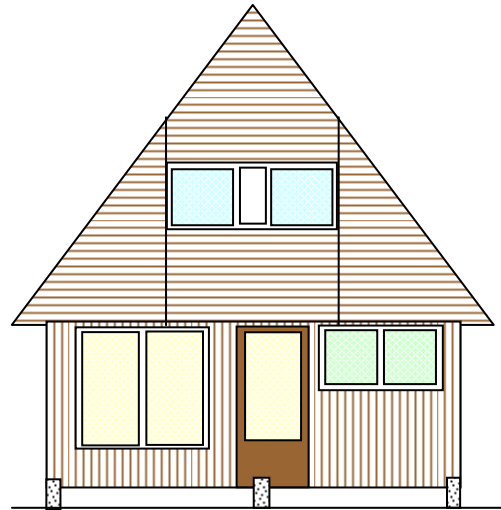


# TEST HOUSE IN NORWAY



During the winter of 1992 – 1993 STEP Warmfloor was tested for performance and energy efficiency in a 1295 ft<sup>2</sup> (120 m<sup>2</sup>) two-story home located in Norway.

The home is located in the outer Oslo Fjord on an island named Tjøme, the latitude is 60° north. It was one of 100 similar homes built in the area in 1975. The temperature on the island varies from 14°F to 32°F (-10°C to 0°C) in the winter. There is some snow, but mostly rain and sleet.

The family consisted of two adults and two teenage children. During the evening the family sleeps with the bedroom windows open and in the morning the house is aired out by opening the windows and doors.

The house is exposed to sunshine from noon to sunset. The windows in the living room are big and have a western exposure. All windows are triple-glazed.

The house was constructed on concrete pillars above the ground. There is no basement and the crawl space has full air circulation.

The floor has R-24 insulation, [°Fft<sup>2</sup>h / Btu], (0.24 W/m<sup>2</sup> °C = 0.206 [Kcal/m<sup>2</sup>h°C]). The insulation consists of 2 layers of 4" (100mm) Rockwool Class B covered by 1" (22mm) chipboard.

The outer walls have R-16 insulation, [°Fft<sup>2</sup>h / Btu], (0.36W/m<sup>2</sup> °C = 0.309 [Kcal / m<sup>2</sup>h°C]). The walls are made of 3/4" (20mm) wood panels, 1/64" (0.5mm) pasteboard, 1/2" (12mm) asphalt cardboard, 4" (100mm) Rockwool insulation, a plastic film and 1/2" (12mm) chipboard.

The roof has R-26 insulation, [°Fft<sup>2</sup>h / Btu], (0.22 W/m<sup>2</sup> °C = 0.189 Kcal/m<sup>2</sup>h°C]). The materials used for the roof are wood shingles, 8" (200mm) Rockwool insulation, a plastic film and 1/2" (12mm) chipboard covered with PVC.

Before the renovation the main heating source consisted of electric baseboard heaters and a wood-burning stove. The old vinyl flooring was removed and STEP Warmfloor heating elements were installed.

The elements were glued down to the particleboard and covered with a plastic membrane. The new pine plank floors were placed crosswise over the elements, glued together and nailed to the subfloor.

The system runs on 24 Volts and the total power installed was 4,137 Watts. The material was installed on both the first and second floors to provide total heating for the home. Separate energy meters were placed to measure the daily energy consumption of STEP Warmfloor.

## Results

The heating system was turned on from November 25<sup>th</sup>, 1992 to April 20<sup>th</sup>, 1993. During this time the average daily temperature was 35°F (1.5°C) and the indoor temperature was maintained at 68°C (20°C).

Regulators were used to lower the installed power from 3.2 W/ft<sup>2</sup> (34.5 W/m<sup>2</sup>) to an average of 1.67 W/ft<sup>2</sup> (18 W/m<sup>2</sup>).

During the 5 winter months the total energy consumption for the STEP Warmfloor heating system was 7,635 kWh. This gives an energy consumption of 5.9 kWh/ft<sup>2</sup> (64 kWh/m<sup>2</sup>). In comparison typical home heating systems consume between 13 – 15 kWh/ft<sup>2</sup> (140 – 160 kWh/m<sup>2</sup>).

Based on these results STEP Warmfloor saves 55 – 60 percent energy over conventional heating systems, such as electric baseboard and forced air.

