

The Benefits of Radiant Ceiling Panels

by Bruce Sullivan



A study by the National Association of Home Builders (NAHB) Research Center has found that heating a home with ceiling-mounted radiant panels can use 33% less energy than a heat pump, and 52% less energy than electric baseboards. The research project, completed in May 1994, was cosponsored by the U.S. Department of Energy, and SSHC Inc., maker of the Enerjoy panels used in the tests. Tests were conducted in a Maryland house equipped with radiant panels and a two-zone forced-air heat pump. Two employees of the NAHB Research Center lived in the house and used the two systems at specified times during the heating season. Data for electric baseboards came from a previous test in the same

house. While it's hard to generalize from the results of one test, this study shows that in a moderate climate radiant panels are an affordable option.

Comfort and Savings

Thermal comfort depends on more than air temperature: The temperature of surrounding surfaces also comes into play. For instance, you can feel chilled sitting near a cold window even if the surrounding air is warm. A better indicator of comfort is the "operative temperature" — the average of air temperature and the temperature of surrounding surfaces.

With radiant panels, heat radiates to objects and people in the room, eventually migrating to room air. Radiant heaters also maintain comfort at

a lower temperature than other heating systems: The Enerjoy panels operate at 150°F to 170°F, and mount to the ceiling surface, not behind or inside the wallboard (see Figure 1). The panels reach operating temperature in only three to five minutes, so people can adjust the thermostat up and down in the same way they would turn lights on and off.

Benefits

Compared with forced-air systems, the benefits of radiant panels are clear:

- **No duct losses.** Heat loss from ducts, even insulated ones, reduces efficiency in forced-air systems. Radiant panels eliminate duct losses.
- **No wasted fuel.** A furnace blower burns a lot of fuel that never gets delivered as heat; radi-

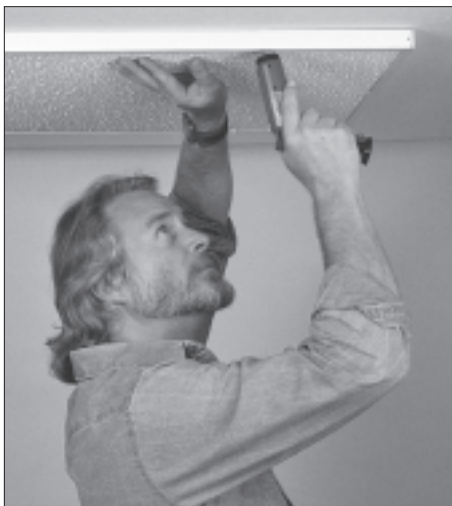


Figure 1. The surface-mounted, low-mass radiant panels used in the NAHB study are lightweight and operate on 120-volt or 240-volt circuits.

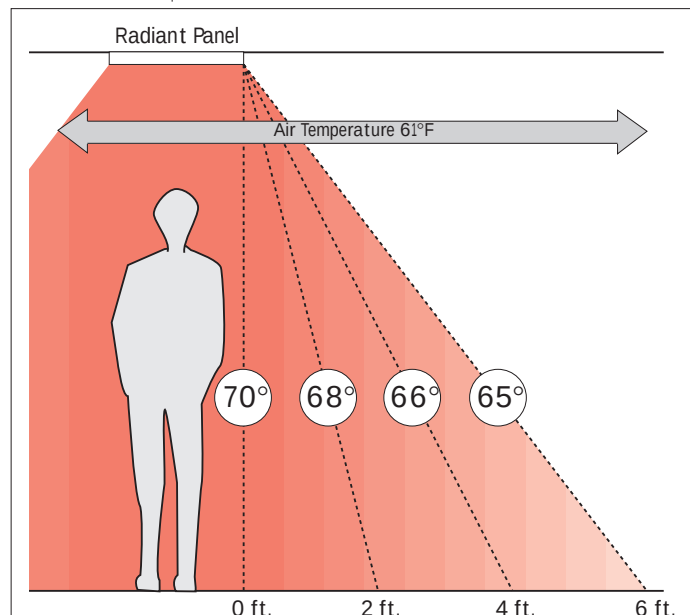


Figure 2. Operative temperature (the average of air temperature and the temperature of surrounding surfaces) is highest directly below the radiant panel, but declines gradually over distance. Air temperature remains constant.

ant panels are much more efficient.

- **Easy zoning.** Like most electric heaters, it is relatively easy to zone with radiant panels. The panel's quick recovery feature makes zoning more efficient, because many people don't mind turning back the thermostat if they know the heating system will recover quickly.
- **Unobtrusiveness.** Unlike a forced-air system, radiant panels operate quietly and without air movement.
- **Stable humidity.** Radiant panels don't dry out the air the way a forced-air system can. Occupants of the test house had fewer sinus problems than with a forced-air system.
- **Low installation cost.** The Enerjoy radiant panels used in the test had an installed cost of between \$1.25 and \$1.50 per square foot of conditioned space (\$2,500 to \$3,000 for a 2,000-square-foot house). That's considerably less than a forced-air system.

Comparing Comfort

Thermal comfort is subjective, so it was no surprise that the two occupants of NAHB's test house responded differently to the radiant heaters. Heat is highest directly beneath a radiant panel, and the operative temperature drops about 5°F over the first six feet (Figure 2). While this may be viewed as a disadvantage by people who expect even temperatures throughout the house, each occupant of the test house was able to find a comfortable spot in the same room.

The most serious complaint had to do with a panel cycling off while someone was seated directly beneath it. Even though the air temperature did not change, the operative temperature directly below the panel dropped 4°F in 20 minutes. Occupants not located directly beneath the panels, however, reported no discomfort. While this problem can be reduced with careful panel placement, the panels in this test were installed in an existing house where ceiling fans, sprinkler heads and other obstructions prevented several panels from being properly placed.

No Cooling

The main limitation of radiant heat is that it can't be used to cool the house because it has no duct system. Installing a separate central air conditioner undermines the advantage of not having to install ducts with the radiant panels. One alternative is a ductless air conditioner, called a "mini-split," that cools a small area. Like the typical split-system air conditioner, a mini-split has an indoor unit and an outdoor unit, but it blows cool air directly into the room instead of through ducts. Mini-splits range in capacity from 1/4 ton to 4 tons, with the larger units designed for commercial buildings. ■

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Sources For Radiant Panels

Marley Electric Heating
470 Beauty Spot Rd. East
Bennetsville, SC 29512
803/479-4006
Aztec Panels

Solid State Heating Division
SSHC Inc.
P.O. Box 769
Old Saybrook, CT 06475
203/388-3848
Enerjoy Panels