The Energy Report

Energy Case Study: Ceiling Radiant Heat

An Evaluation of Thermal Comfort and
Energy Consumption for the Energy Radiant Heating System

Radiant heating systems such as the ceiling surface-mounted Energy system can offer the potential for significant energy savings by warming objects and occupants and only indirectly heating the air. With fast-acting, radiant panels and thermostat control in each room, heat is supplied to the home in a manner similar to lighting.

A review of the radiant heating literature revealed little relevant, empirical evidence for energy savings and thermal comfort associated with ceiling, surface-mounted, radiant heating systems such as the Energy system. Testing the energy and thermal comfort performance in an occupied home could serve to expand the base of information on which discussions of various heating strategies are based.

To this end, an Energy radiant heating system, an air-to-air heat pump system, and a monitoring data acquisition system were installed in an occupied research home. Information on thermal comfort and energy consumption for alternating operation of the two heating systems was collected for approximately one-half of a heating season. Also, data on energy consumption from a zoned electric baseboard heating system previously installed in the same house was available for comparison.

In this study, for the same operating and outdoor conditions, the installed capacity of the Energy system was 2.5 times less than the electric baseboard and two times less than that of the heat pump system. Generally comparable levels of thermal comfort were provided by the radiant and heat pump systems. And the capacity of the installed Energy system was sufficient to meet outdoor design conditions. As a result, the significantly reduced installed capacity of the Energy radiant system should be of particular interest to utilities whose capacities are stressed or whose territories are experiencing rapid growth and development.

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Energy consumption savings of 33 percent were estimated for a typical record year in the Washington DC area for the Energy radiant system in comparison to the air-to-air heat pump system and an estimated 52 percent savings in comparison to the electric baseboard system.
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The energy consumption data indicated that the Energy radiant heating system

would out perform both the heat pump and the electric baseboard systems regardless of climate. Because a portion of the energy savings with the Energy system was related to room by room setback and the specific number and routines of the research home occupants, savings for other households may be different than those obtained in this study. The magnitude of the savings obtained from the working couple occupying the research home suggests that energy savings would be obtainable in a great portion of U.S. households.

The occupants of the test home preferred the radiant heating system to the forced-air system. They cited greater flexibility and lack of sinus irritation with the radiant system.

The energy savings demonstrated in this study indicate that fast-acting radiant systems such as the Energy system have a role to play in increasing the energy efficiency of U.S. housing. It is our hope and belief that the results of this study will broaden the understanding of the home heating options available to the U.S. homeowners.

This study was conducted by the NAHB Research Center, Inc. jointly for the U.S. Department of Energy (DOE) and SSHC, Inc., Solid State Heating Division of Old Saybrook, Connecticut.

Project No. 4159 May 31, 1994

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