

## ECONOMICS OF ENERJOY™ SOLID STATE HEATING COMPARED WITH CONVECTIVE AND OTHER RADIANT SYSTEMS

### COMFORT QUEST SPURS RADIANT TECHNOLOGY

Radiant heating is not new; however, there is a renewed respect for radiant comfort and cost advantages both as primary and supplemental heating. Now, for the first time, ASHRAE Standard 55-92 Thermal Environmental Conditions for Human Occupancy evaluation is possible using the Building Comfort Analysis Program, ASHRAE Research Project 657 Simplified Method to factor Mean Radiant Temperature (MRT) into Building and HVAC System Design. Architects, engineers and builders increasingly design for internal and external radiant, day lighting, and passive solar benefit in residential, commercial and institutional buildings.

### HOW ENERJOY RADIANT HEAT WORKS

Enerjoy radiance produces a feeling of sunshine-like warmth within minutes of activation. Solid State Radiant Energy reflects off of surfaces such as glass while warming and storing heat in objects and building mass. Heat is reradiated from these objects, gradually raising the air temperature. Full PEOPLEHEATER® operating temperature is achieved in four minutes, providing occupant warmth much like the experience of when a cloud moves past the sun. The feeling of comfort at a six to eight degree Fahrenheit lower ambient temperature produces considerable cost savings. Quick response enables occupants to Treat Your Heat Like Your Lights®, saving money with room by room, day and night temperature setback, by turning the thermostat up when the room is entered and down when the room is vacated.

### WHY CONVECTION HEAT COSTS MORE

Any heating system which primarily uses the air as the heat transfer medium is a convective heating system. Air is a gas which expands and becomes lighter

when heated and rises to the ceiling, warming the wall and ceiling in the process, gradually losing heat and falling to the floor to repeat the cycle.

Normally, the convection heating duct outlets or baseboards are positioned in or on the outside perimeter walls of the room to be heated with return cold air ducts on the opposite interior wall. Cold air is warmed by the baseboard or sucked out of a given area and replaced by ducted warm air. Exterior wall or floor placement increases heat transfer to the floor and wall which is exposed to severe temperatures only 6" to 8" away. Another efficiency heat loss characteristic of hot water and forced air systems is thermal distribution loss through ducts or pipes used to convey heat to the area to be warmed. ASHRAE Standard 152P addresses the delivery heat losses encountered by heating systems in getting heat from origination to place or point of use in a building.

In addition, the heater or boiler must initially be warmed causing additional significant heat loss and energy waste. Historically, gas system combustion efficiency averaged 65% to 80%. A minimum rating of 72% is now required by law. Higher 90% combustion efficiency is offset by an increase in power consumption and heat loss created by plumbing, ducting, flues and mechanical or convection building pressurization differential not reflected in Annual Fuel Use Efficiency (AFUE). System performance now requires costly maintenance not formally characteristic of gas furnaces.

The response time for convective systems is relatively slow as all of the air within the heated space must be warmed to restore comfort. Of course, the entire furnace capacity operates regardless of how small the heating area requirement may be as a result AFUE is not an accurate indicator of installed furnace performance.

**STUDIES CONFIRM 20% TO 50% LOWER COST**

Heat pumps, in addition to normal convective penalties, are drafty and exhibit "cold blow": the heated air they produce is only 85°-95°F, therefore, as much as three times more air must be circulated to satisfy the heat load. Efficiency declines markedly as the temperature drops below 35°F. In fact, the Advance Housing Technology Program ENERJOY Case Study sponsored by the U.S. Department of Energy and the National Association of Home Builders Research Center found an annual savings of 33% over the heatpump in the occupied Adaptable Fire Safe Demonstration House.

Maintenance can be a major annual cost factor. The argument that you have both heating and air conditioning is not compelling as heat pump lifecycle cost is 15% higher than stand-alone central air conditioners. Air conditioning designed specifically for cooling in combination with ENERJOY uses, interior wall, simplified, less costly ducting, and multiple units for zoning resulting in increased comfort, reliability, and energy savings.

Baseboard electric heat may be zoned but slow response makes daytime short term setback impractical. Installed wattage is normally 20% to 30% higher than radiant systems. In fact, the ACCA (Air Conditioning Contractors of America) Manual J calculations resulted in 54% more installed baseboard than Radiant ENERJOY wattage for the case study house. The NAHB Case Study found 52% higher annual operating cost in Maryland heating record year than ENERJOY. Safety should also be considered as flammable objects (drapes, furniture, etc....) can not be placed on or close to baseboard electric heaters.

In an all electric equivalent comfort study conducted by the Pierce Foundation at Yale University, the Enerjoy panel system used 89% of the power per unit of floor area as the forced air system. Baseboard used 109% and the carpet heating system used 116%.

Enerjoy Solid State Heating is considerably less expensive to install than oil or gas systems, especially when the cost of hook-ups, storage tanks, flues, extra space, and special code construction requirements are included. And with the tight, low air infiltration construction prescribed by the Model Energy Code, ASHRAE Standards 90.1 and 90.2, careful attention must be paid to kitchen, bath, and central exhaust ventilation systems to avoid unhealthy carbon monoxide furnace, water heater, and/or fireplace back drafting. Importantly, Enerjoy Heatmodules® require no maintenance and eliminate heat loss created by plumbing, ducting, flues and mechanical building pressurization.

#### **ENERJOY COSTS LESS TO INSTALL AND OPERATE THAN OTHER RADIANT SYSTEMS**

Oil and gas hydronic radiant floor systems are about twice as expensive to install. The piping or tubing may be inaccessible and restrict floor use. Thermal

inertia (LAG) is significant, which may result in solar overheating and make setback recovery impractical.

Concealed ceiling radiant heat involves placing the heating element or panel in or above gypsum board and has several disadvantages. Installation is generally complex and insulation is required above the heating elements for interior floors to direct heat to the area to be heated.

Concealed heating is not readily accessible for replacement or repair, restricts future use of 60% to 90% of the ceiling space, should not be used in super insulated houses (R-50 to R-70 ceiling insulation) and requires 20% to 30% more installed wattage than Enerjoy.

The UL/CSA Standard Revision from 60°C to 50°C maximum ceiling temperature will require companies offering these products to relist their products, a long and costly process. In addition, the reduced heating watt density will require a 10% to 20% increase in required ceiling area to meet heat loss.

Operating costs of concealed systems, while generally below convective systems, is penalized by a very slow recovery time of 30-90 minutes which reduces the opportunity for temperature setback savings as the entire mass of the ceiling must first be heated.

#### **ENERJOY SOLID STATE HEATING DESIGNED FOR VERSAILTY AND ECONOMY**

Light weight, quick response Enerjoy Heatmodules are available in standard sizes, custom sizes and all popular voltages.

ENERJOY IS THE HEATING SYSTEM OF THE FUTURE: uses alternating or direct current, has the lowest required AMP draw of any electric heating system, minimizes off cycle temperature swing by storage of radiant heat in the building mass, and never requires maintenance (due to its lifetime longevity). ENERJOY may be installed to take advantage of photovoltaic, wind or any economic alternate energy source. Enerjoy is ideal for electric utility demand side management. ENERJOY Solid State Heating is truly the only lifestyle heating system which allows users to Treat Your Heat Like Your Lights®, enjoy and pay only for desired comfort when, where and as needed. ENERJOY makes your house a true comfort system.

An interesting way to view conventional heating is to consider how much more lighting power would be needed if a room were lighted by placing all lighting along the outside walls at floor level under drapes and/or behind furniture. ENERJOY RADIANT PEOPLEHEATERS are centrally placed up on the ceiling where direct source to object radiant energy warms occupants first, while gradually heating the room. **Comfort you must feel to believe!**