

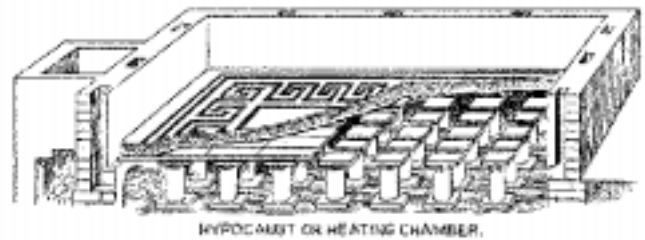
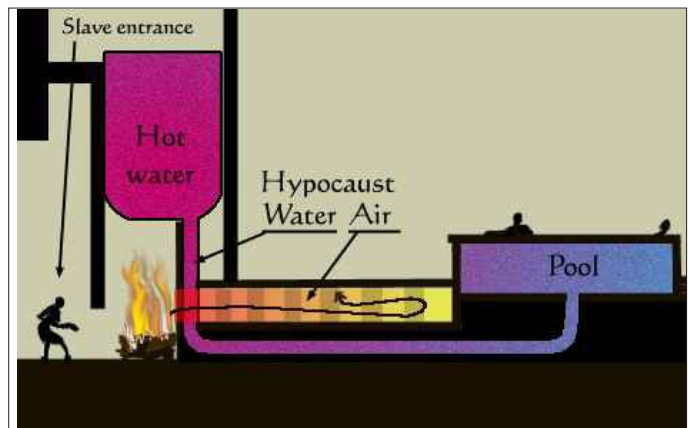
Panel Heating Radiates Comfort

The benefits of radiant panel heating have been known for thousands of years. The Romans used “hypocausts” to heat large public baths, gymnasiums and other magnificent buildings by forcing warm air under the floors. The same principle was used in Asia as late as the 19th century. Several famous Korean Royal Palaces are equipped with such systems. In our century, radiant floors were installed during the 1950’s in Europe and the US. Utilizing steel and copper pipes buried in the concrete slab, most worked fairly well. However, the life span for metal pipes buried in concrete proved to be fairly short. Many systems had to be abandoned after only 15-20 years, often sooner. The problems were mainly due to thermal expansion and contraction of the pipes. Since the concrete rigidly held them, the thermal movement was hindered and this caused stress and fatigue resulting in brittle cracks. But system failures also included corrosion of the pipes and shifting of the slab itself.

In the late 1960’s and early 1970’s radiant floors were reborn in Europe, using plastic pipes. Continuous lengths of flexible plastic pipes promised to solve the problems previously encountered with copper and steel pipes. But the low and medium density Polyethylene and Polypropylene used at that time, proved to have life span problems as well. They became brittle when subjected to higher temperatures, bending, and chemicals that induced stress cracking.

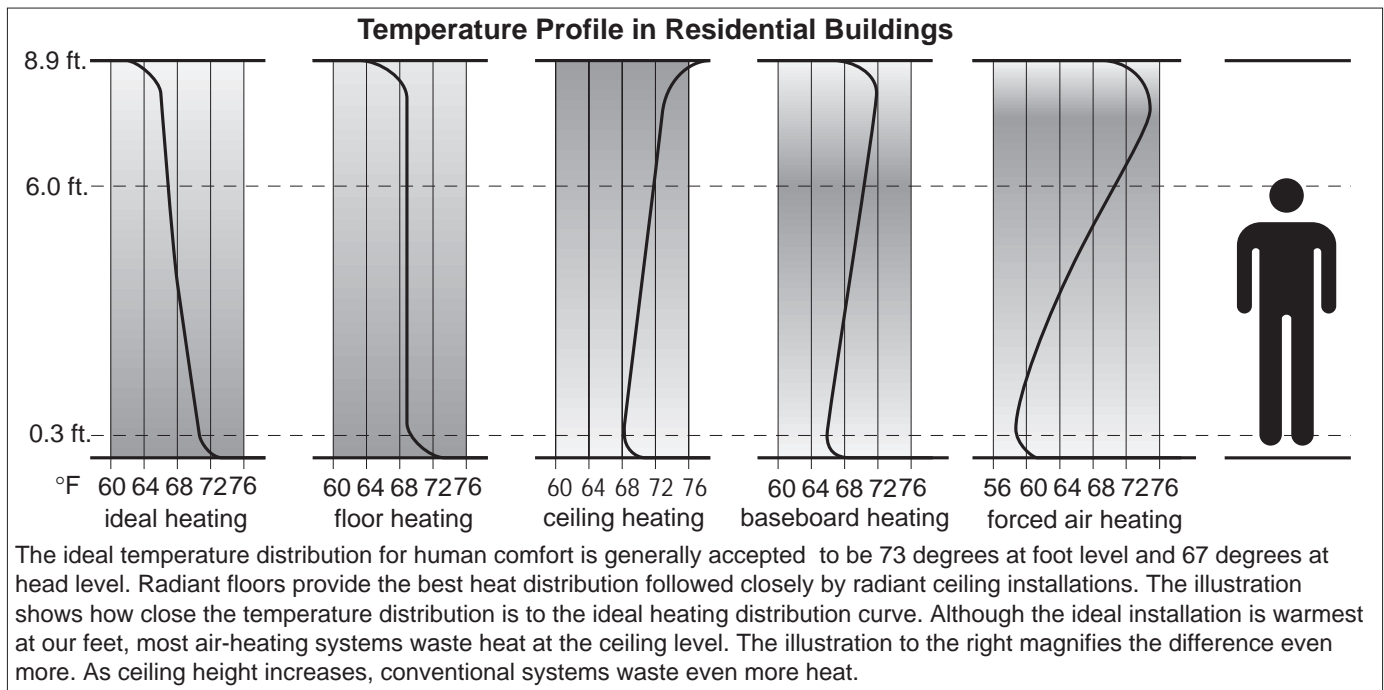
It was the introduction of Crosslinked Polyethylene (PEX) in the early to mid-1970’s that created an ongoing radiant floor boom in Europe. This flexible material has high temperature/pressure ratings, outstanding stress-cracking resistance and proven durability. Today, two out of three new construction projects in continental Europe utilize radiant panel heating. Approximately 70% of these projects are installed with PEX tubing. But, even more impressive, the Korean hypocaust tradition has led to PEX tubing radiant panel heating being used in virtually every new building project in that country.

As American consumers learn more about the comforts of radiant panel heating systems, and contractors learn more about design and ease of installation, these systems are capturing an increasing share of the U.S. heating market. In central Europe, radiant panel heating systems are now installed in nearly 3/4 of all new residential homes and over half of the commercial market. Due in large part to the enhanced comfort and the proven energy savings of radiant panel heating systems, sales in the US are currently growing by more than 25% annually. But radiant panel heating systems also provide important health and safety benefits, and we will look closer at it’s features.



The Roman Baths often had an underground heating system, called a Hypocaust, which heated the men’s and women’s hot bathrooms. Floors in the heated rooms were held up by short pillars floors. Smoke and hot air passed under the floors and up the walls of the heated room. The furnace often also heated a water tank connected to the pool. This meant that the water, the flooring and the walls were all kept warm. Even some private larger houses had the Hypocaust system.

Panel Heating Radiates Comfort (continued)



The #1 Reason for Selecting Radiant Floors: Comfort! Given its many advantages, having warm feet without needing thick carpets is a daily sensation with radiant panel heating. Feet are actually the thermostats of the human body. Cold feet make you feel cold; warm the feet and you are comfortable. But the comfort does not stop here:

Radiant Panel Heating is Quiet. Blowers suddenly starting up can be annoying and controlling heat by reducing air register openings may lead to hissing and whistling noises. Air channels, although large in size, convey this noise when too much air is rushed through. Because water is much denser and can transport so much more heat (3,200 times more per volume), it can run slowly through noise-absorbing plastic tubing. And you can't hear the small circulator pumps, not even inside the utility room.

It is invisible. Because tubing is installed behind floors or ceiling panels, radiant heat requires no unsightly wall or floor openings. A new world of opportunities is opened to the interior designer and design conscious homebuilder. You are completely free to decorate as you wish, since you need not take into consideration the locations of heat registers, baseboard, radiators, etc. The heat distribution is there but it is invisible. This also makes it virtually vandal proof.

No drafts and less dust. There are no drafts with radiant heat because air heated by floor or ceiling panels moves slowly. Contrast this with forcing the huge amount of warmed air (with dust) required into a room just to take the chill out of the air.

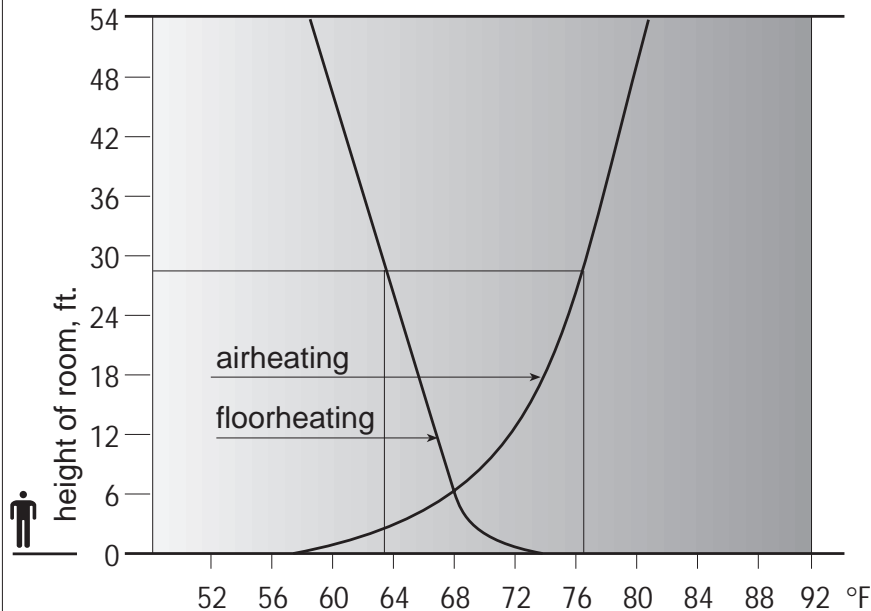
Make a comfortable basement. The cellars of old times were cold and damp, often only used for storage and utilities. With radiant heat, warm floors keep rooms dry, and basement floors are as comfortable as those on any other level. What was previously a cellar has become a prime living area thanks to radiant heat.

The floor is a drier.... Warm floors don't stay wet. Bathroom spills dry up. A damp towel left on the floor does not start to smell. Wet shoes dry faster. Garage floors are quickly free from snow, ice, and water.

....but does not dry up the air. During the cold winter the outside air contains very little moisture. Forced air heaters need considerable amounts of makeup air to partly replace the indoor air. The result is a very low humidity in forced air-heated buildings, which leads to uncomfortable static electric discharges, dry skin, general discomfort, and dying flowers. Panel heating does not consume indoor air, so normal humidity can be maintained during the winter.

Panel Heating Radiates Comfort (continued)

Temperature Profiles for Radiant and Air Heating in Industrial Applications



The above chart assumes that a room thermostat on the level 6 ft. is set on 68°F to control the temperature on that level (this is where the two lines intersect). In reality, the room temperature would be selected considerably lower for radiant floors and higher for air heating to reach the same comfort level; 3 – 6°F. This provides additional energy saving in addition to above calculation.

Our experience, when comparing commercial/industrial buildings heating costs, is that the average energy saving is in the magnitude of 40 to 45% with radiant floors over air heating.

Using the graph, let's assume that an industrial building has a ceiling height of 28 ft. A horizontal line is entered on that level in the graph. This line intersects with the "floorheating line" at approximately 63°F, and with the "airheating line" at approximately 77°F. These temperatures are the approximate air temperatures at the ceiling level for radiant heating resp. forced air heating at this ceiling height.

The average outdoor temperature during the heating season may be, for example, 40°F at the selected building location. That means that the temperature difference between the inside of the ceiling and the average outside air is $(63 - 40 =) 23^\circ\text{F}$ for the floor heating, and $(77 - 40 =) 37^\circ\text{F}$ for the air heating. The difference in heat loss through the ceiling is directly proportional to this difference and proves the radiant heat waste only $(23/37 =) 62\%$ of the heat lost this way for an air heating system.

Floor Heating Provides Huge Energy Savings

In buildings with radiant panel heating, thermostat settings are typically 3 to 6°F lower for three reasons:

1. Temperature distribution all over the room is close to ideal. Therefore, normal thermostat settings can be decreased.
2. About half the heat is provided as radiant heat, which most thermostats do not read correctly. They mainly read air temperature; the portion of heat generated by convection or movement of warmed air.
3. Because the feet are the thermostats of the body, when a radiant panel directly warms your feet, you feel comfortable at a much lower room temperature.

Panel heating systems require comparatively low water temperatures, so a winter water temperature of less than 110°F is enough for many buildings and floor constructions. This allows for the utilization of alternate warm water sources. Panel heating provides excellent efficiency with heat pumps and solar collectors. In addition, warm wastewater from industrial processes, cogeneration plants, large freezers or chillers, etc., can be utilized for heating. With low water temperatures, heat losses from mains and system components are minimized. Also, modern radiant floor systems allow you to zone

each room, or group of rooms, individually so you can heat them individually to exactly the degree you want.

Heat recovery Imagine that maintenance of a jumbo jet airplane is complete and the hangar doors are open for 5 minutes to let the giant out. Virtually all warm air inside the building is lost. With a radiant floor system, 50% of the heat will be recovered instantly after the doors are closed! Because half of the total heat is provided by radiation (which travels at the speed of light), and the large thermal mass of concrete floors virtually eliminates temperature fluctuations. A great deal of energy can be saved in buildings with high ceilings such as schools, churches, shopping centers, gymnasiums and industrial buildings when the air above the people inside is not overheated. The typical energy savings for a good radiant floor system is 15 - 30% for residential projects and even more for commercial and industrial installations.

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Don't Forget Radiant Health & Safety Benefits

Warm Feet Cold feet may not be proven to worsen flu symptoms - "but everyone says so".

Allergies Many persons have allergic reactions to dust-mites and other creatures living inside textile fibers like those in carpeting. With radiant panel heating carpeting is not desirable. Tile, vinyl, and wood become attractive and healthy flooring alternatives.

The Clean Air Act In commercial installations, dust, germs, viruses and molds entering rooms through dirty air channels is a concern and cleanliness of air distribution channels has to be tested with annual cleaning of ducts. Residential air channels need cleaning, too.... Radiant panel systems provide an obvious advantage because they do not blow germs, dust, pollen, or particles around. And there is no visible heating system to clean.

Carbon monoxide When a furnace malfunctions, poison gases can be circulated by the forced air system and distributed throughout the building. Although radiant panel heating systems do not use furnaces, it's recommended that everyone install smoke and CO detectors, anyhow.

Molds. Most types of molds need moisture to grow and any condition contributing to long term moisture retention (flooding, leaks, condensation, etc.) is a great environment for mold growth. Radiant panels can help in curing that "sick house syndrome", because heated floors dry quickly and dry wood does not rot or promote mold buildups.

The Versatility and Reliability of Radiant is Unsurpassed.

For most projects, a radiant panel heating system provides the ideal solution. Radiant panels can be fitted into virtually all floor constructions and can be installed in walls and ceilings as well. Whatever the application - a comfortable home, a nice business atmosphere, a healthy day-care environment, a maintenance garage with dry floors, a illness free hog barn, a snow-free emergency entry, invisible and tamper-proof penitentiary heating, a hangar that doesn't waste heat, a warm floor in a chilly kennel, or winter football on live turf - all can be built utilizing a radiant panel system. Can any other heating system accomplish this?

Easy to use, PEX Tubing is the material of choice for Radiant Panel Systems. With nearly 30 years of field experience and laboratory testing, manufacturers now offer 25-year warranties. Plastic tubing doesn't rot or corrode and metal components are typically high-quality brass making radiant panel systems extremely reliable. No wonder that radiant panel heating, already the most popular way of heating Europe and Asia, is rapidly growing in North America.