

**Thermal Comfort in the Home**

What makes you feel warm? What makes you feel cool? If you're like most North Americans, when you think of these things in the context of your home, you'll think of that little box on the wall: the thermostat. We've been trained by years of forced-air heating systems and baseboard heaters to believe that air *temperature* equates to *feeling comfortable*. But that's not necessarily true.

"Think about being outdoors on a cold sunny day," says Goran Ostojic of Cobalt Engineering. "It's 10 degrees Celsius, yet you can sit in a nice sunny spot protected from the wind and enjoy your coffee. Now imagine a cloud blocks the sun. Suddenly you become cold because the air temperature is actually only 10 degrees. It was the *radiant energy from the sun* that was keeping you warm."

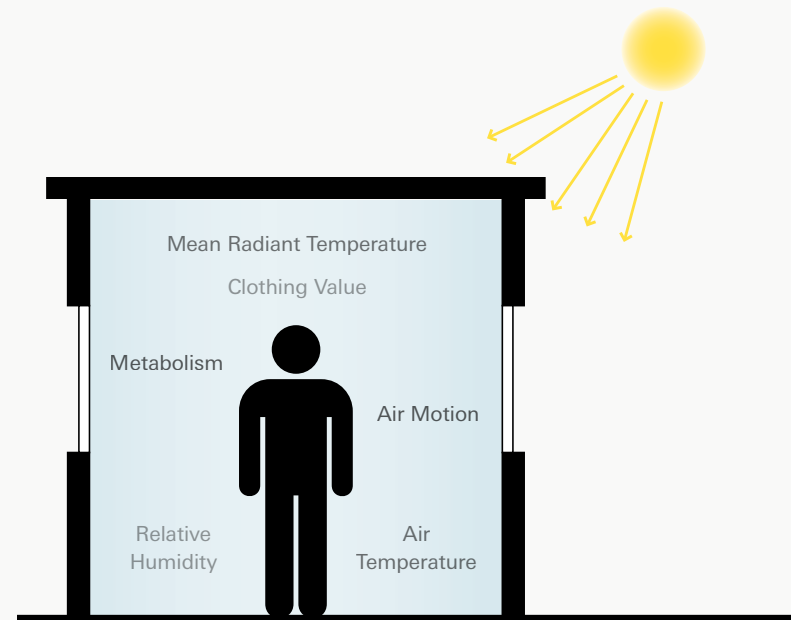
Feeling comfortable indoors comes from a variety of elements (see diagram) – many of which, such as humidity and air movement (drafts) are addressed

in building design. Air temperature does play a role – but we've given it too much focus in the way we design our homes.

"Air is a very bad heat transfer mechanism – it's actually an excellent insulator," says Peter MacLellan of Olympic International (see page 17). "That's why forced air systems use so much more energy – they're designed to maintain a particular air temperature. With radiant heat, we can have people be comfortable without concentrating on changing the temperature of the air. And it turns out to be much more efficient because you don't have to pump all that air around all the time.

"So with a radiant system you have no thermostat giving an air temperature readout. It doesn't have a direct correlation to comfort."

# Radiation is how energy reaches us from the sun



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## HOW RADIANT HEAT WORKS

Snowflakes falling in the air while you sit comfortably under an outdoor restaurant radiator. Shivering uncomfortably next to the cold glass of an office window despite a normal air temperature. Feeling relief near a cool concrete wall on a hot sunny day.

All these are examples of radiant energy transferring heat from one body to another.

"Heat transfers in three modes only: convection [fluid movement that carries heat, such as forced air heating], conduction [heat transferring without movement, such as a mug growing warm from holding coffee], and radiation," says Goran Ostojic of Cobalt. "Radiation is how energy reaches us from the sun. It crosses a vast distance of universe with no air and warms

the earth. A radiant exchange occurs between two objects or elements with mass that have different temperatures. The air is completely insignificant."

So radiant heating and cooling systems *act directly on your body* as you absorb or release heat energy to the other objects around you. Understanding the power of radiant energy – particularly what comes from the sun – is the first step to recognizing the importance of integrated, passive design in creating comfortable, energy-efficient places to live.

The psychrometric chart is a graph of the physical properties of moist air at a constant pressure (often equated to an elevation relative to sea level); it is a useful tool for engineers concerned with thermal comfort and passive design. The chart graphically expresses how various properties (dry bulb temperature, wet bulb temperature, dew point and relative humidity) relate to each other.

