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Time for an Air Change

May 26, 2010 - Green Buildings

If you haven't been living under a rock for the past three or four years, you will have realized by now that the world has reached a fork in the road. The two very significant issues of economic meltdown and global warming are two problems that must be confronted and resolved immediately. How can we as designers help move our industry to do our part to mitigate these two challenges?

This article is about one of the many issues we have control over in the daily course of events when designing buildings - heating and cooling.

These systems in the buildings we design consume the lion's share of energy and electricity. Re-designing these building strategies can have a very large impact on global warming and the financial success of a building.

The first energy reduction strategies should always be passive: building shape, orientation, windows, insulation and mass of walls and roof. The air tightness of the envelope is an essential passive energy controller. New building conceptual design is an iterative exercise, integrating passive and active building systems, combining the passive with active systems such as people, lighting and air conditioning systems and observing different results from different strategies.

We need to get over the 100 year old concept of air conditioning: blowing air over a chilled water coil and a hot water coil in an air handler and distributing air throughout the building to ventilate heat and humidify in the winter, and cool and dehumidify in the summer. Currently air conditioning uses 16% of all electricity consumed in the United States and on a hot summer day, it is responsible for 43% of US peak electrical load keeping 200 power plants busy. This system is by no means economical. It simply cannot provide both ideal comfort conditions and minimize energy and maintenance. We need a new plan.

Let's consider the way we do things now. Currently 99.9% of commercial and institutional buildings contain a very expensive, difficult to maintain (if ever), uncomfortable and inefficient heating and cooling system that is by and large based on using air as the thermal transfer and storage system. Why is this the case? The answer lies in many places; however it is primarily based in politics, education, the structure of the US design process and plain old fear of change. This trend must be reversed. There is no reason why we can't, as design consultants, suggest a low cost, low maintenance, very comfortable and high performing system for the heating and cooling of the buildings we design new, and the retro-fitting of the existing built fabric.

The basic facts of water vs. air are interesting to note:

- * One cubic foot of water can store or transfer the same amount of heat as more than 3000 cubic feet of air.
- * A one inch pipe is the equivalent of a twelve inch diameter duct.
- * Pumps use about 20% of the energy fans need to distribute the same amount of thermal energy over a given building area.

* Pipes cost roughly 25% of the cost of ductwork installation.

* Human thermal comfort is largely affected by mean radiant temperature rather than by the air temperature or movement.

Marcus Springer member of USGBC MA

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