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Heat Sinks in Architecture

*Executive Summary: The Field of Architecture is becoming increasingly conscious of passive design features that utilizes the laws of thermodynamics and fluids to save energy and become more sustainable.*

In the field of Architecture sustainability is a key component of smart design. Not only is sustainability cost effective in the long run, it is just plain common sense. Sustainably designed buildings use the laws of physics to their advantage with features like rainwater collectors and thick concrete walls used to act like a heat sink. An offshoot of the sustainable movement is the zero carbon (or low carbon) footprint movement. By using this way of design, a building is made to take full advantage of its assets. Low carbon buildings store the heat of the summer and use it to heat in the winter.

Renewable heat is a key part of adapting buildings to their climates to construct a low carbon producing building. Renewable heat is defined as the generation (or capture) of heat from sustainable sources. The exemplar of this is the sun. The sun is the source of heat and all natural light for the earth. The sun provides the earth with enough energy in one hour that if collected it could provide for all the energy needs of the world. The only problematic concept of this, is how to go about collecting this much energy.

The sun bombards structures with its energy heating up the structure and the air around it. The traditional method of dealing with this excess heat is using large quantities of electricity to transfer the heat to just outside of the structure. This cools the structure while heating up the environment around it. This system is in nearly 100 Million (1,000,000) homes in the United States of America alone and, as I am sure you have figured out, is called air conditioning.

Additionally, in the winter, homes that were once pumping out heat like there is no tomorrow begin burning fossil fuels such as heating oil or natural gas. This not only costs a lot of money over time but has a very large impact on the environment. Why would any sane person just throw out energy in the form of heat? It is just plain wasteful!

A less conventional means of both heating and cooling homes is called ground source energy. Ground source energy is a way of naturally heating and cooling a build environment (Building). In the summer, surfaces like rooftops, asphalt surfaces, and just buildings in general create useable heat that could be utilized in the winter. Until recent years, there was no practical way of storing heat for long periods of time. Now heat can be stored in glorified heat sinks called thermal banks.

A thermal bank is a heat sink that uses the ground to store heat. It pumps heat in to the ground in the summer and pulls heat out in the winter, and can even store cold in the winter to cool homes in the summer. The system utilizes the common heat pump to transfer heat. There are numerous applications of this new and exciting combination of technologies.

In the United Kingdom a large section (and in Hiroshima, Japan a testing area) of road collects heat stores it and uses it to melt snow and ice quickly and efficiently. All over the world, use of the ground to store heat for large and small buildings is quickly becoming the sustainable heating option of choice.

In addition to in ground heat storage, there are numerous other home heat sinks available. Let’s start with the most basic, walls. There is new (small) trend in architecture to design buildings with large concrete walls with insulation on the outside this lets the walls become thermally stabilizing feature of a home. Often accompanied by thick concrete floors, it can reduce heating costs by up to 98%. Homes have been made that require almost no heating and cooling in a climate similar ours using this technique.

Was able to attain this impressive and crazy feat by using Thermal Mass. Thermal mass is a barrier that takes a long time to heat up and to cool down effectively stabling the temperature of a structure. Traditional thermal mass homes in hot climates were made out of stone or adobe and just made to withstand the cycle of hot days and cool night however, with modern engineering and insulation, this age old technique is now relevant in more seasonal climates. Thermal mass can also be attained with water. It is used is numerous large public buildings as well as many small residential homes. For example, in a residential home, 280 sealed bottles of water heat up in sunlight and keep that energy, slowly dispersing it throughout the day

Additionally, the storage of hot air is a great architectural heat sink. A house Colorado takes full advantage of this. This environmentally conscious house was built with the kwnoledge that heating and cooling is responsible for around 50% of the average household’s energy consumption. This house took advantage of a widely known principal, the greenhouse effect. The house was built with a greenhouse (not for plants) that has a tall sloped roof so that the hot air produced collects in the top. From there, a series of ducts with fans flow from the greenhouse into the rest of the home carrying warmth. The best part about this design is that the heat can be pumped back in to the green house space to cool the house.

Innovations are taking place throughout the field of architecture for the better. By using these innovations that are made possible because of our understanding of thermodynamics and fluids, we are able to do our part to save the planet. It is just proper planning to design buildings to contribute to a solution, not a problem. The understanding of heat sinks in architecture has been a major innovation that has not only made buildings more energy efficient, but made humans have a smaller carbon footprint.

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