Thermal energy storage: essential for solar cooling

THERMAL ENERGY STORAGE INCREASES THE EFFICIENCY AND ECONOMY OF SOLAR COOLING

Solar thermal cooling

In a solar cooling installation, a solar thermal collector system drives a thermally driven chiller, such as an adsorption chiller. A very elegant aspect of solar cooling is the close match of supply and demand: cooling is mostly needed during times of high solar irradiation.

The main function of storage in a solar cooling installation is peak shaving. In times of low cooling demand, the storage is charged; in times of peak demand, the chiller and storage are turned on simultaneously, providing the required peak cooling power.

Storage is a valuable addition to conventional compression coolers as well. Having a diurnal storage makes it possible to run the cooler at night, at low electricity prices, sharply decreasing the operating costs of the cooling system. In addition, this decreases the electricity demand during peak hours, decreasing the load on the grid and the chance of blackouts.

SOURCE: SOLAHART/ESTIF

Thermal storage technology

Thermal energy can be stored using different technologies. With sensible heat storage, heat is stored by increasing the temperature of a medium. Common examples include hot water boilers, solar combi systems, ground heat exchangers, and aquifer storage.

Up to three times more energy can be stored with latent heat storage, where heat is stored in a phase change, e.g. by melting paraffin or organic salts. Because latent heat storage is very effective over a small temperature range, it is an excellent material to stabilise an indoor climate, for example.

Thermochemical storage has the highest energy density. By storing heat in a chemical reaction, reversibly changing the storage material structure, up to 10 times more energy can be stored compared to a hot water tank of the same volume. In addition, thermochemical storage has virtually no heat losses, making it very suitable for seasonal storage.

Why storage?

Efficiency

Thermal (cold) storage can increase the performance of thermally driven chillers as well as conventional compression chillers. The increased efficiency leads to lower electricity consumption, and hence lower emissions and lower operating costs.

Peak shaving

Because a thermal storage can be used to shave load peaks, smaller and cheaper chillers can be used. The system becomes more reliable and economically more attractive. Even with conventional compression chillers, thermal storages can be economically interesting: especially in Asia, where electricity prices vary strongly between day and night, a shift of production to nighttime will provide economical benefits.

SOURCE: CRISTOPIA

Did you know..?

…cold storage can reduce electricity demand during peak hours, decreasing the risk of blackouts?

…cold storage can reduce the size and the operating costs of a cooling system?

…up to ten times more energy can be stored in a given volume using advanced storage materials?

SOURCE: GELDERLANDER

SOURCE: SORTECH

The solar cooling market

With 64 million units sold, the world residential air conditioning market grew by 10% in 2006, and continues to expand steadily. The main reasons for this expansion are the rapid growth of the Chinese market and the recent heat waves in Europe, doubling the AC demand.

The Chinese market reached over 20 million units in 2006, becoming the world's largest single market. The market did not grow more rapidly than in 2004–5, most likely due to the rapid economic growth, the worsening situation of electric power supply, and the recent government policy reinforcing control on the real estate boom.

The USA and Japanese markets have remained stable at 16 million and 8 million units sold, respectively.

Because solar cooling is still a young technology on the market, the residential cooling market is currently still completely dominated by "on-demand" compression coolers.

However, with the expected increase of blackouts in the electricity grids , combined with a rising electricity price, the market for solar cooling systems, and as such for advanced cold storage systems, is expected to grow rapidly over the next few years.

Find out more

For more information on thermal energy storage, visit the PREHEAT website at *www.preheat.org*.

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