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How the new IEC charge limit for hydrocarbons will shake up commercial refrigeration.



Viking Cold Solution's thermal storage cells at Dreisbach distribution center in Richmond, Calif.

Thermal Batteries Cut Cold-Storage Energy Costs

Viking Cold Solution's thermal-storage cells take over from refrigeration systems during peak demand hours

— by Devin Yoshimoto and Michael Garry

“The result were really wonderful.”

— Jason Dreisbach, Dreisbach Enterprises

One way to reduce the energy consumption of a refrigeration system is to use it at night when energy costs are low and lower ambient temperatures yield maximum mechanical and condensing efficiency.

But what about during the day? For energy-intensive industrial refrigeration plants, Viking Cold Solutions has a solution.

The Houston, Texas-based company has developed a thermal storage system (TES) that employs phase-change material, intelligent controls and cloud-based monitoring; the frozen material absorbs heat during costly peak-demand hours, partially melting, and allows the vapor-compression system to remain idle. During low-cost night hours, the refrigeration system takes over and refreezes the phase-change material.

Viking's phase-change material, a mix of water and salt formulated for each temperature target, is packaged in “passive

cells” — in effect, thermal batteries — and installed on elevated racks in the refrigerated space. It's managed by a control system installed on top of a facility's existing refrigeration control system. The material absorbs up to 85% of heat infiltration, which helps to stabilize temperatures in the facility, said Viking.

Though it has been marketing the thermal energy storage system for only about two-and-a-half years, Viking has already installed it at 33 locations in the U.S., mostly cold storage facilities, and in the walk-in freezer a few at supermarkets, including a Whole Foods Market outlet, said Collin Coker, Viking's vice president of sales and marketing. Coker spoke about the system in June at the Global Cold Chain Expo in Chicago, where Viking exhibited.

Also in June, Viking announced that it had successfully completed the

installation of eight thermal energy storage systems as a part of a utility-backed demand management program in Massachusetts. The systems store and facilitate the management of about 1.3 MW of energy at several cold storage facilities, including the Greater Boston Food Bank.

Some of Viking's installation have been at plants using ammonia refrigeration, though not at any using transcritical CO₂, still relatively new to the industrial refrigeration industry.

But Coker observed that the Viking system would help support the efficiency of a CO₂ system running in higher ambient temperatures in transcritical mode.

“We are an exceptional pair with that technology in markets that have more transcritical days,” he said.

CASE STUDY IN CALIFORNIA

A measurement-and-verification case study on the thermal energy storage system describes an installation at a refrigerated distribution center in Richmond, Calif., run by Dreisbach Enterprises, a logistics company.

The Viking system was installed as a retrofit in the facility's 93,000-ft² (8,640 m²) freezer with a centralized ammonia refrigeration system. The facility also has medium-temperature storage, dry storage and office space.

The system kicks in as ambient temperatures increase during peak hours of the day and the heat rejection of the condenser is less efficient. The control algorithms reduce the run time of the refrigeration system, and allow fully charged, frozen thermal energy storage modules “to absorb the heat infiltration and maintain temperature stability inside the freezer,” said the study.

This reduced the energy consumption of the freezer by 35%, according to the study; peak period energy consumption was cut by 43% while peak demand (for low-and medium temperature loads) fell 29% for 13 hours per day. Temperature stability improved by 50%.

“The result were really wonderful,” said Jason Dreisbach, owner of Dreisbach Enterprises, in a video on Viking's website.

Viking's latest project is to install its thermal energy storage system with solar power generation at a food bank, further reducing energy costs. ■ DY & MG

THERMAL ENERGY STORAGE AROUND THE WORLD

Viking Cold Solution's thermal energy storage system is one of a growing number of thermal storage applications being used with natural refrigeration systems.

For example, in Japan, Yamato Co. Ltd. has developed a brine-ice thermal storage system that works with CO₂ condensing units. In Australia, Glaciem Cooling Technologies has devised a 100-kW thermal energy storage/CO₂ refrigeration system.

These systems are seeing significant adoption by end users around the world. Lawson, Japan's largest convenience store chain, is testing Yamato's system, while Glaciem Cooling Technologies' system was installed in April 2018 at The Bend Motorsport Park, a \$160-million motor racing circuit in South Australia.

In the U.S., Rebound Technologies has developed an on-demand ice storage system, IcePoint, that subcools liquid ammonia systems for food processing and cold storage operations.

IcePoint has been tested by Lineage Logistics, a U.S. cold-storage operator, at a facility in Oxnard, Calif., and will be installed at a Lineage plant in Unadilla, Ga., this fall. (See “Lineage Logistics to Deploy On-Demand Subcooler at Ammonia Plant,” *Accelerate Magazine*, June 2019.)