



CHILLY forecast

Supermarkets are revamping their refrigeration systems with eco-friendly refrigerants and more efficient configurations and components.

BY KIM ANN ZIMMERMANN

As supermarkets look to lessen their impact on the environment—and save some cold hard cash in the process—they are turning a critical eye to their refrigeration systems. Grocers are moving toward natural options such as CO₂ to replace ozone-depleting hydrochlorofluorocarbon (HCFC) refrigerants that are being phased out. They are also revamping the architecture of their refrigeration systems to reduce leaks and boost efficiency along with updating critical components such as compressors and valves.

The push to reduce HCFCs was accelerated when early this year the U.S. Environmental Protection Agency (EPA) published

a proposed ruling to adjust and further reduce HCFC allowances during the 2012-2014 timeframe. The reductions being proposed range from 11% to 47% per year over that period. The goal is to eventually eliminate R-22 and other HCFCs from being produced, imported and used in the U.S.

“Our customers started looking at natural refrigerants when the Green-Chill efforts started a few years ago,” says Rajan Rajendran, vice president, engineering services and sustainability for Sidney, Ohio-based Emerson Climate Technologies, referring to the U.S. Environmental Protection Agen-

cy’s partnership with food retailers to reduce refrigerant emissions and decrease their impact on the ozone layer and climate change. “It really got supermarkets





thinking 'green' when it came to installing and updating their refrigeration systems.”

He says that CO₂ used in supermarkets can be used as a refrigerant in a cascade system where the CO₂ is used in the low-temperature system, coupled with a medium-temperature system, that could be using a typical HCFC refrigerant such as R404A or R407A. When used as a medium temperature refrigerant,

CO₂ operates in what is called a transcritical system. Often, CO₂ is also used a coolant, making the air in the refrigerated cases cold and rejecting the heat to another refrigerant such as an HCFC. “CO₂ is good in some locations but it is not the answer everywhere,” Rajendran says, as the refrigerant has limitations in warmer climates.

“It is really a market in flux right now and

we’re seeing experimentation with a lot of different types of refrigerants, especially on the natural side,” says Travis Lumpkin, director of sustainability and senior product leader, refrigeration systems for Bridgeton, Mo.-based Hussmann. “The phasing out of R-22 is sparking a desire to find refrigerants with lower global warming potential.”

Henry Pellerin, director of marketing pro-



grams for Conyers, Ga.-based Hill Phoenix, says the company is seeing interest in HCFC-free stores.

Hill Phoenix is part of Dover Corp., a global industrial manufacturer that recently acquired Denmark-based Advansor A/S, which specializes in the design and manufacture of HCFC-free, CO₂ transcritical refrigeration and heat pump systems for supermarkets. “We see [transcritical CO₂ systems] as an important step forward,” Pellerin says. “Using CO₂ as the primary refrigerant saves the cost and maintenance involved in a cascade system.”

Unconventional refrigerants such as ammonia and propane are also generating buzz, industry observers say. “We just finished working with Supervalu on a store that uses a cascade system with ammonia,” says Bryan Beitler, vice president/chief engineer for Source Refrigeration, an Anaheim, Calif.-based refrigeration contractor. “While there are some safety aspects to be considered with ammonia, it is a small amount of ammonia being used.”

He says that training is key to keeping up with the new refrigeration technologies. “The industry is facing training and servicing challenges as these new technologies come along. We’re making a huge effort to be able to understand the systems and be able to work safely and get it right.”

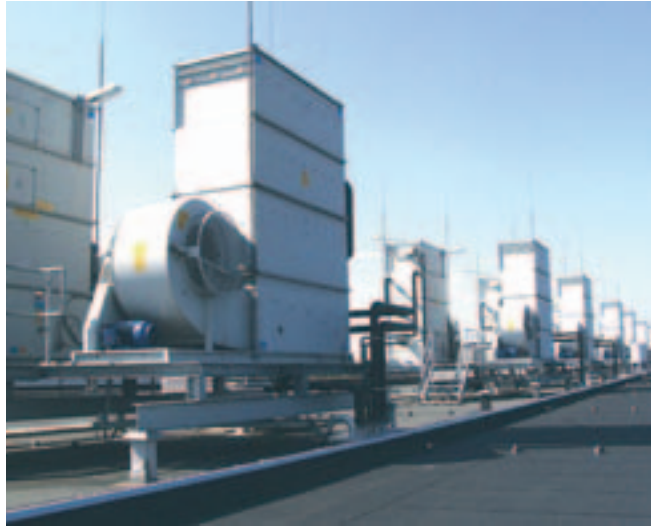
Lund Food Holdings is among the retailers moving toward sustainable refrigerants and architectures for its refrigeration systems. “Zero Zone was honored to work with Lund Food Holdings on their new Lunds store in downtown Minneapolis,” says Carl J. Petersen, marketing and advertising manager for Zero Zone, Inc., a refrigeration equipment manufacturer based in North Prairie, Wis. “From an energy efficiency and sustainability perspective we were especially pleased to provide a well-matched equipment package, consisting of a Zero Zone ColdLoop Secondary System for medium temp, DX Parallel Refrigeration System for low temp, Crystal Merchandiser reach-ins and Evolution low-temp door cases for their 20,000-square-foot store. We were pleased to again collaborate with Market Mechanical, the contractor/installer, which handled the install efficiently and helped make the start-up smooth and painless. We are happy to hear that the store has been warmly welcomed by shoppers and that sales are brisk.”

Wally Lindeman, facilities maintenance manager for Edina, Minn.-based Lund Food Holdings, says the system has been working well since the store opened in late spring in the former home of a car

dealership. “There are a number of benefits to the refrigeration architecture in this store, which opened on June 14,” he says. “We are able to reduce refrigeration charge and reduce the potential for refrigeration leaks because we don’t have as much piping running throughout the store. While these types of refrigeration systems have been available for a while, it is a first for us and we are pleased so far.”

Lunds is in the process of applying for Leadership in Energy and Environmental Design certification for the store. “The refrigeration system, which uses eco-friendly glycol to chill the products, is certainly helping in our overall effort to build sustainable stores,” Lindeman says.

In addition to reducing the refrigerant charge and the potential for leaks, Lindeman says there were some unexpected benefits to



the new refrigeration system. “We believe that the product integrity is better because of the consistency of the refrigeration system, which is a benefit to our customers who



get product that has been kept at the proper temperature and there is also potentially less shrink for us.”

GREEN SPROUTS

Sprouts Farmers Market is another retailer that has been aggressive in its use of natural refrigerants, says Jerry Stutler, vice president of construction and engineering for the Phoenix-based retailer.

In April 2011, a Sprouts store in Thousand Oaks, Calif. was outfitted with a Second Nature Cascade CO₂ System from Hill Phoenix. The system consists of a low temperature CO₂ cascade compressor system

combined with a medium temperature CO₂ secondary coolant system.

“We have a year under our belt and the system has virtually operated flawlessly,” says Stutler, adding that the retailer is looking to install similar configurations in other stores going forward. “The main goal at Thousand Oaks was to reduce the risk of leaking harmful HCFCs into the atmosphere. Secondly we wanted to reduce the cost of our initial refrigeration charge. Finally, we wanted to reduce our potential exposure to costly catastrophic leaks in our systems.”

He says that the retailer has one platinum, three gold, and seven silver GreenChill-certified stores, and more are expected. “Before we got involved with GreenChill, we were averaging about 2,000 pounds of refrigerant in our systems,” he says. “Then we reduced that by about 60% to 65% with our stores that are GreenChill Gold certified. This new CO₂ design yields an even more significant reduction in HCFCs.” He adds that the CO₂ cascade system brings the total refrigeration charge down to about 200 pounds.

According to Stutler, not only is CO₂ better for the environment, it is better for the bottom line. “CO₂ is about \$1 per pound compared to \$15 a pound for R407F, which is the typical refrigerant we use and is among the greenest available,” he says.

New refrigerants also have an impact on refrigeration components, including compressors, valves, fittings and heat exchangers.

“Fundamentally, there is a progression



away from HCFCs, which is being spurred by concerns that HCFCs are eventually going to be outlawed,” says Clay Rohrer, business manager U.S.-Electronics BU, Climate & Industrial Controls Group-Sporlan Division, for Cleveland-based Parker Hannifin Corp. “This has an impact on every control system, valve, filtration system and component. We are designing our components to optimize the various natural refrigerants

and configurations being explored.”

He says the company has built an extensive lab with a number of refrigeration scenarios to test its various components. “Our idea is that some of these refrigerants and architectures are so new that in some cases there are not many out in the field and if we don’t have them we can’t test them.”

Condensers are also keeping pace with demand for more efficient refrigeration systems

that experience fewer leaks and require less maintenance. Baltimore Aircoil Co.’s TrilliumSeries Condenser uses a patented Dry-Coil Adiabatic Design that provides up to 18% peak energy reduction, uses up to 60% less refrigerant charge and lowers operating costs with a smaller refrigeration system, according to officials for the Jessup, Md.-based company. The On-Demand Adiabatic Pre-Cooler uses water only on the hottest days to maintain condens-

ing temperatures.

“This is really the best of both worlds,” says Ajit Kailasam, manager of refrigeration engineering sales. “It only uses water on the hottest days and the water is dumped out of equipment at end of day.” Keeping water away from the coil also reduces maintenance, he says.

The product’s direct drive EC motors match the fan speed to load, company officials explain. “While this feature has energy benefits, it also lessens the sound emitted from the motor,” says Kavita Vallabhaneni, Baltimore Aircoil Co.’s product marketing manager.

Kailasam says that the condenser’s micro-channel coils require one-fifth of refrigerant charge and are 100% recyclable. “We see an increased interest in GreenChill certification, and this is one more step to get them there,” he says.

Hill Phoenix’s Pellerin says he is also seeing a move toward smaller condenser coils to conserve refrigerant. “The smaller the coil the less refrigerant required,” he says.

While retailers are investigating alternative refrigerants with lower impact on the environment, Emerson’s Rajendran says grocers are also looking at more efficient configurations for their refrigeration systems. “They are moving away from the traditional rack systems with high refrigerant charges and leaks,” he says.

Some supermarkets are exploring secondary loop refrigeration systems that employ a central refrigeration equipment in a mechanical room. Refrigeration is provided to display cases by a secondary fluid pumped between the cases and the chiller system. The secondary fluid could be glycol or CO₂, Rajendran explains.

“A typical secondary loop refrigeration system can reduce a store’s total refrigerant charge from about 3,000 pounds to about 500 pounds and reduce the leak rate from 15% to about 2% to 3% when compared to a traditional rack system,” he says. “About 20% to 30% of supermarket refrigeration systems are

secondary loop systems and within the past few months we’ve seen increased interest in these systems across the board.”

Distributed systems—another type of refrigeration system architecture—put the mechanical load closer to the cases, reducing the refrigerant charge and allowing for shorter lines so that there is less potential for leaks, Rajendran says. “You might have one system to cover five or 20 cases.”

Observers expect the industry to continue to tweak refrigeration systems as new refrigerants and configurations gain momentum. “We’ll continue to see a lot of experimentation as retailers look to different formats and refrigeration systems that meet their needs of efficiency and sustainability,” says Hussmann’s Lumpkin. “There are some people working with ammonia, for example. The components such as valves and compressors have to be updated to keep up with the new refrigerants and configurations. It will definitely be interesting in the next few years.” □