

JULY-AUGUST 2016

ACCELERATE

ADVANCING HVAC&R

M E R I C A

State of the Industry

p.14

CO₂ VISIONARY

Person of the Year :

Marc-André
Lesmerises

Carnot Refrigeration

Award Winners:

Sobeys, Red Bull,
Campbell Soup and
True Manufacturing

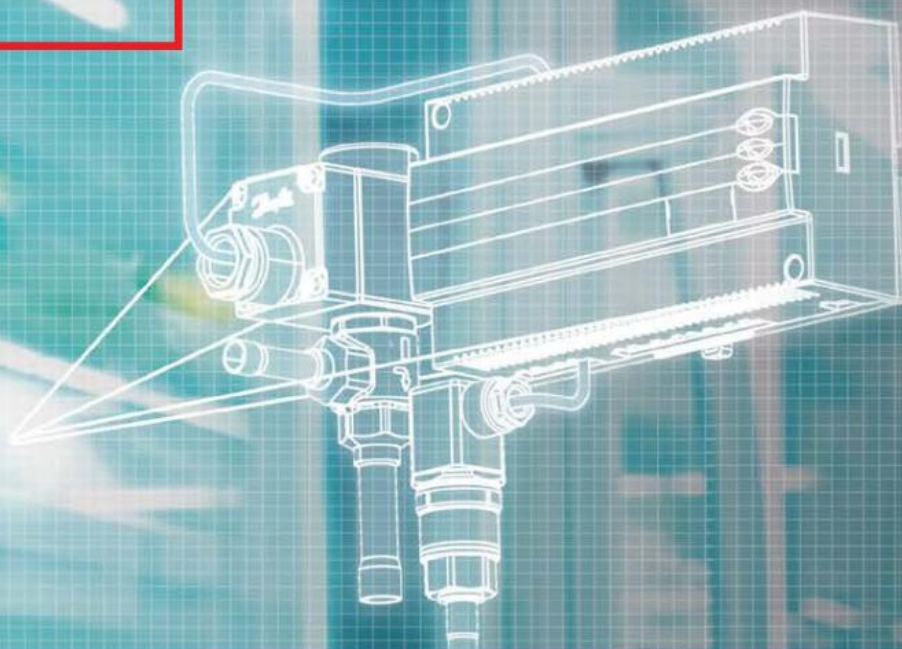
p.18

Carrefour's
Warm-Weather
CO₂ System

p.40

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Editor's note by Michael Garry

THE INDUSTRY GROWS UP

In Chicago this year, the Cubs are trying to do something they haven't done since 1908 – win the World Series.

In June, Chicago was also the locale for this year's ATMOsphere America conference, where participants discussed progress towards another gargantuan goal – moving the HVAC&R industry towards natural refrigerants.

It was the fifth ATMOsphere America, and each year, the number of attendees grows (over 340 this year), and the advances become more palpable: more end users, more implementations of natural refrigerants, more new technology. Of course, many of the same obstacles were cited – cost, high ambients for CO₂, lack of trained technicians – but more solutions to these obstacles were presented. As global and national regulatory forces continue to put pressure on HCFCs and HFCs, natural refrigerants are becoming an increasingly sought-after alternative.

A sense of the natural refrigerant industry's progress could be gleaned from the state-of-the-Industry session on the first day of ATMOsphere America, in which major OEMs reported on their individual experiences ([page 14](#)).

Dustan Atkinson of Hillphoenix, a major manufacturer of transcritical CO₂ systems, described this equipment as a “future-proof technology” that is garnering a “pretty significant share of the market.” Reflecting on the growth of low-charge ammonia, Joe Sanchez of Bitzer reported a 60% rise in the company's ammonia compressor unit sales in each of the past three years.

And Marek Zgliczynski of Embraco said that hydrocarbon (mostly propane) compressors would represent 20% of the company's U.S. sales, up from 11% in 2013.

At ATMOsphere America's end user sessions, the diversity of natural refrigerant applications was striking. Food retailers talked about, not only transcritical CO₂, but propane (a fast-growing option) and ammonia/CO₂ cascade systems ([page 26](#)). Cold storage and food processing operators discussed low-charge DX ammonia, low-charge packaged ammonia and transcritical CO₂ ([page 32](#)). The utilities and incentives session pointed to growing opportunities for energy rebates for energy-efficient natural refrigerant technology ([page 50](#)).

The natural refrigerant industry has matured enough that shecco, organizer of ATMOsphere America and publisher of this magazine, decided to recognize the person and companies who have done the most to elevate the North American market for these refrigerants, with our first annual Accelerate America Awards presentation at the conference ([page 18](#)).

With all of this activity, it's true that the North American natural refrigerants industry is still experiencing growing pains, and is still far behind developments in Europe and Japan.

But I think it's still appropriate to recognize the strides that have been made in a few short years. So, congratulations to the Accelerate America Award winners – and congratulations to the natural refrigerants industry! **MG**

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ACCELERATE

ADVANCING HVAC&R NATURALLY

AMERICA



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About Accelerate America

Brought to you by shecco America Inc., the worldwide experts in natural refrigerant news, *Accelerate America* is the first monthly news magazine written for and about the most progressive business leaders working with natural refrigerant solutions in all HVAC&R sectors.

<http://accelerate-na.com>

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The Industry Grows Up

Editor's note by Michael Garry

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The More, the Merrier

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The Best & the Brightest

In the first annual Accelerate America Awards program, Sobeys, Red Bull, Campbell Soup, True Manufacturing and Marc-André Lesmerises of Carnot Refrigeration have been recognized for advancing the uptake of natural refrigerants

Industrial's New Pathways

End users at Atmosphere America discuss alternatives to traditional ammonia systems, including transcritical CO₂, low-charge ammonia DX, and low-charge packaged ammonia

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'I'll Have CO₂ and Ammonia with That'

McDonald's franchisee Caspers reinvents its distribution business with a new warehouse cooled by an ammonia/CO₂ and low-charge ammonia DX system

Carrefour Proves CO₂'s Mettle

The French retail giant shows in Spain that enhanced CO₂ transcritical systems can operate on average more than 45% more efficiently than HFC installations in warm climates – and now it's bringing the technology to Brazil.

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Skating on Green Ice

Patine Leisure taps Mayekawa's NewTon NH₃/CO₂ system and solar panels to turn its Japanese ice rinks into models of efficiency

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As the world awaits a global approach to HFCs, Canada has developed its own plan while Mexico looks for funding to support its phase-down objectives

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Embraco Steps Up Hydrocarbon Focus

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Publisher Marc Chasserot
marc.chasserot@shecco.com
[@marcchasserot](#)

Editor Michael Garry
michael.garry@shecco.com
[@mgarrywriter](#)

Reporter Mark Hamstra
mark.hamstra@shecco.com

Contributing Writers Pilar Aleu
Jan Dusek
Nina Masson
Charlotte McLaughlin
Elke Milner
James Ranson
Klara Skacanova
Justina Tamasiunaite
Andrew Williams

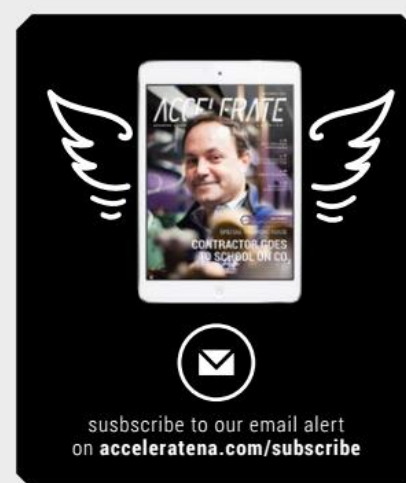
Events Coordinators Silvia Scaldaferri
Anastasia Papagiannopoulou

Advertising Manager Franziska Menten

Art director Mehdi Bouhjar

Graphic Designers Charlotte Georis
Anna Salhoffer

Photographer Ben Beech



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1

August 1-3, Washington, DC
2016 GCCA Assembly of Committees
<http://www.gcca.org/2016-gcca-assembly-committees/>

2

August 9-11, Providence, RI
Energy Exchange 2016
<http://www.2016energyexchange.com/>

3

August 10-12, New Orleans, LA
Global Sustainability Summit
<http://www.fmi.org/sustainability2016/overview>
 twitter: #FMIGMASummit @FMI_ORG

4

August 10-12, Salt Lake City, UT
ASHRAE and IBPSA-USA SimBuild 2016: Building Performance Modeling Conference
<http://ashraem.confex.com/ashraem/ibpsa16/cfp.cgi>

5

August 17-18, Secaucus, NJ
Build Expo New Jersey 2016
<http://buildexpousa.com/>
 twitter: @BuildExpoUSA

6

August 19-21, Miami, FL
Eco-Green & Solar Expo
<http://www.blegsolar.com/>

7

August 21-26, Pacific Grove, CA
2016 ACEEE Summer Study on Energy Efficiency in Buildings
<http://aceee.org/conferences/2016/ssb>

8

August 24-26, Calgary, AB
HRAI's 48th Annual General Meeting & Conference
<http://www.hrai.ca/agm/>

9

August 28-30, Los Angeles, CA
The 2016 Western Foodservice & Hospitality Expo
<http://www.westernfoodexpo.com/72/western-home.htm>

10

August 31-September 1, Oklahoma City, OK
2016 Oklahoma Restaurant Convention & Expo
<http://mms.okrestaurants.com/Calendar/moreinfo.php?eventid=36139>
 twitter: #ORAShow2016



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|--|---|
| <p>1 September 7-9, Austin, TX
CONSTRUCT 2016
https://constructshow.com/</p> | <p>7 September 20-22, Philadelphia, PA
Comfortech 2016
http://www.comfortechshow.com/ct16/Public/Enter.aspx
twitter: @comfortechshow</p> |
| <p>2 September 11-14, New Orleans, LA
FMI's Energy & Store Development Conference
http://www.fmi.org/forms/meeting/Microsite/ESD2016.0
twitter: @FMI_ORG #FMIEnergySD</p> | <p>8 September 21-22, Santa Clara, CA
Northern California Facilities Expo 2016
http://www.fenc.facilitiesexpo.com/
twitter: @Facilities_Expo</p> |
| <p>3 September 12-15, Las Vegas, NV
Solar Power International
http://www.solarpowerinternational.com/
twitter: #SolarPVExpo #SPIcon @SPIconvention</p> | <p>9 September 21-22, San Jose, CA
Bay Area Build Expo 2016
http://buildexpousa.com
twitter: @BuildExpoUSA</p> |
| <p>4 September 13-15, Charlotte, NC
21st Century Building Expo & Conference
http://21buildingexpo.com/
twitter: #21CBEC @21CBEC</p> | <p>10 September 21-23, Washington, DC
39th World Energy Engineering Congress
http://www.energycongress.com/</p> |
| <p>5 September 14-15, Indianapolis, IN
The New Consumer Conference, a Supermarket News Event
http://www.snconsumerconference.com/sn16/Public/Enter
twitter: #TheNewConsumer @Snnewconsumer</p> | <p>11 September 27-29, Orlando, FL
2016 Florida Restaurant & Lodging Show
http://www.flrestaurantandlodgingshow.com/</p> |
| <p>6 September 20-22, Monterrey, Mexico
AHR Expo Mexico
http://www.ahrexpomexico.com/
twitter: @ahrexpomexico</p> | |



- 1** October 3-5, Charlotte, NC
Critical Facilities Summit 2016
<http://www.criticalfacilitiessummit.com/>
twitter: #CFS16 @CFSummit
- 2** October 4, Online at 2pm EDT
GreenChill Webinar: Using the Internet of Things to Manage Refrigerants
<http://epawebconferencing.acms.com/internetofthings/>
twitter: @EPAGreenchill
- 3** October 4-7, Las Vegas, NV
RETA Annual Conference
<http://reta.com/>
- 4** October 4-8, Madison, WI
2016 World Dairy Expo
<http://worlddairyexpo.com/>
twitter: @WDExpo
- 5** October 5-7, Los Angeles, CA
2016 Greenbuild International Conference & Expo
<https://greenbuildexpo.com/>
twitter: #Greenbuild16 @Greenbuild
- 6** October 8 – 11, Las Vegas, NV
IBIE 2016
<http://www.ibie2016.com/>
twitter: #IBIELive #IBIE2016 @BakingExpo
- 7** October 11-12, Washington, DC
Beverage Business Expo
<http://eventegg.com/bb-expo/>
- 8** October 11-12, Long Beach, CA
Cargo Logistics America 2016 (CLA)
<http://cargologisticsamerica.com/>
twitter: #cargo2016 @CargoLogistics
- 9** October 16-19, Phoenix, AZ
2016 SMACNA Annual Convention
<https://www.smacna.org/events-education/events/calendar-of-events/event-details/2016/10/16/default-calendar/2016-smacna-annual-convention>
twitter: #SMACNA16 @SMACNA
- 10** October 18, Online at 2pm EDT
GreenChill Webinar: Ongoing Efforts to Evaluate Alternative Refrigerants
<http://epawebconferencing.acms.com/evaluatingrefrigerants/>
twitter: @EPAGreenchill
- 11** October 17-23, San Antonio, TX
CONNECT 2016 - Plumbing-Heating-Cooling Contractors
<http://www.phccweb.org/EducationEvents/content.cfm?ItemNumber=6714>
- 12** October 18-21, Atlanta, GA
NACS Show
<http://www.nacsonline.com/NACSShow/Pages/default.aspx>
twitter: #NACSShow. @NACSONline
- 13** October 22-25, Washington, DC
2016 NFRA Convention
<https://nfraconvention.org/>
- 14** October 26-28, Mexico City
The GREEN Exhibition and Congress 2016
<http://thegreenexpo.com.mx/en/>
twitter: #economiacircular #experienciagreen #thegreenexpo2016 @thegreenexpomx

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SHORT TAKES

— By Klara Skacanova, Michael Garry and Andrew Williams

PROGRESS MADE ON HFC PHASE DOWN



Montreal Protocol, in Vienna

Close to 200 countries at the Montreal Protocol meetings held in Vienna July 15-23 made significant progress toward a global phase down of HFCs.

While more time is needed to overcome remaining differences between countries, the international community is confident that a definitive agreement will be reached at the next meeting in Kigali, Rwanda in October.

"Amending the Montreal Protocol to phase down HFCs is one of the single most important unitary steps that we could possibly take at this moment to stave off the worst impacts of climate change and to protect the future for people in every single corner of the globe," said U.S. Secretary of State John Kerry in Vienna on July 22.

In the first days of the meeting, countries were able to make progress on challenges such as funding, exemptions and links to the existing phase out of HCFCs. As the gathering progressed, the parties discussed consumption freeze dates and reduction schedules for both developing and developed countries, and possible baseline years against which these targets will be set. **KS**

COCA-COLA ACCEPTS HCS IN SMALL COOLERS

After establishing that carbon dioxide would be its standard refrigerant for new beverage coolers, vending machines and fountain equipment, the Coca-Cola Company "will open the door" to hydrocarbon refrigerants for smaller cooler equipment, said Antoine Azar, the company's global program director.

Azar, who made the announcement at the ATMOsphere America conference in June in Chicago, defined smaller equipment as units that are 300 liters in volume or smaller, which accounts for about 10% of its equipment. "Everything above 300 liters must still be CO₂," he said. Below 300 you can go with either CO₂ or hydrocarbons [either propane or isobutane]. The decision would be made at the local level by the company's bottlers. Coke will no longer allow R134a to be used in smaller units.

The reason for the move, said Azar, is the difficulty of using CO₂ compressors in small equipment. "We have a lot of 150-300 liter certified equipment with CO₂; the problem is 10%-12% higher cost," he explained. "Below 150, the problem is compressor availability, finding a size that fits."

Azar left open the possibility that Coke would at some point allow hydrocarbons to be used in larger units. **MG**



Antoine Azar, Coca-Cola

HC RESEARCH TO FOCUS INITIALLY ON A2LS

A 5.2 million research program focused on risks associated with flammable refrigerants, backed largely by the U.S. Department of Energy, the Air Conditioning, Heating and Refrigeration Institute (AHRI), and the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), will initially focus on mildly flammable (A2L) refrigerants, according to an AHRI spokeswoman.

"The first phase of the first project focuses on A2L refrigerants, but it will expand to include A3 [in the fall]," said Monica Cardenas, senior director, communications, at AHRI. "This is a long-term program and will include several projects that will research both A2L and A3 refrigerants."

A3 refrigerants are flammable gases that include hydrocarbons like propane that are being widely adopted in the U.S. in light-commercial equipment. A2Ls include R444A, R451A and R1234ze. Some industry observers have suggested that the research would exclude A3 refrigerants altogether. **AW**



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Nature Inside



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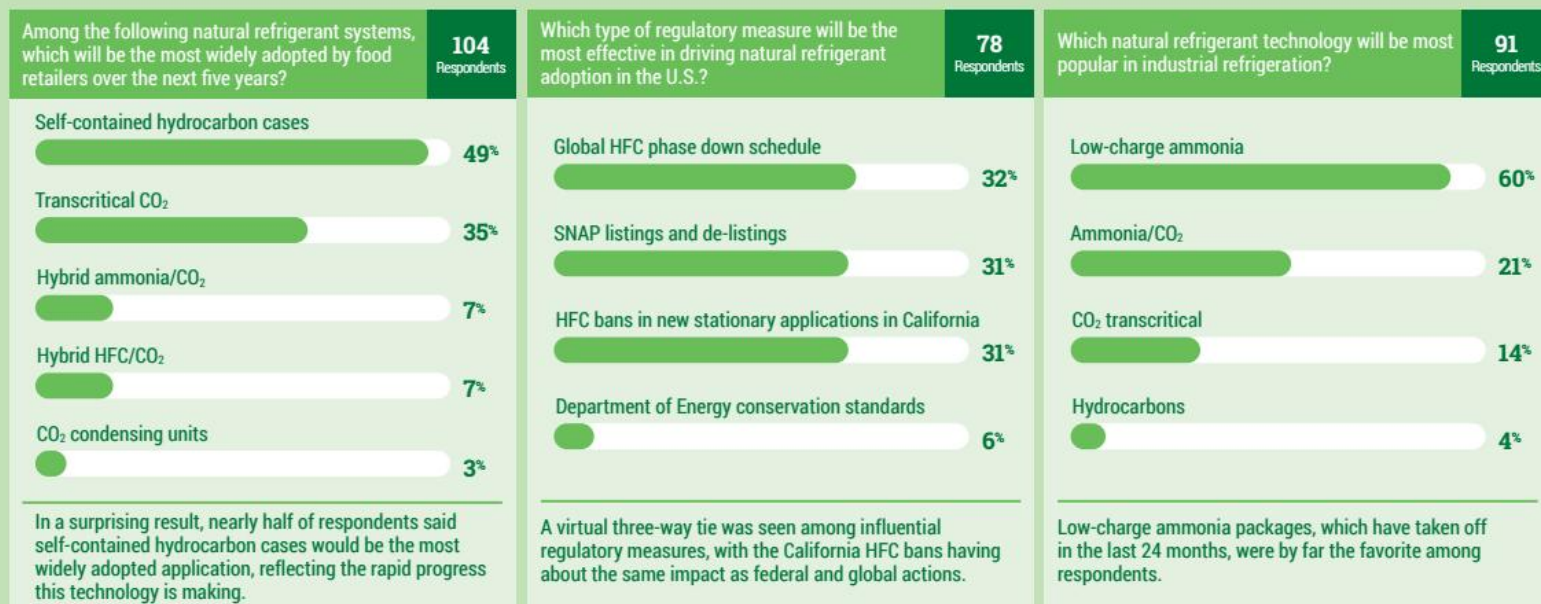
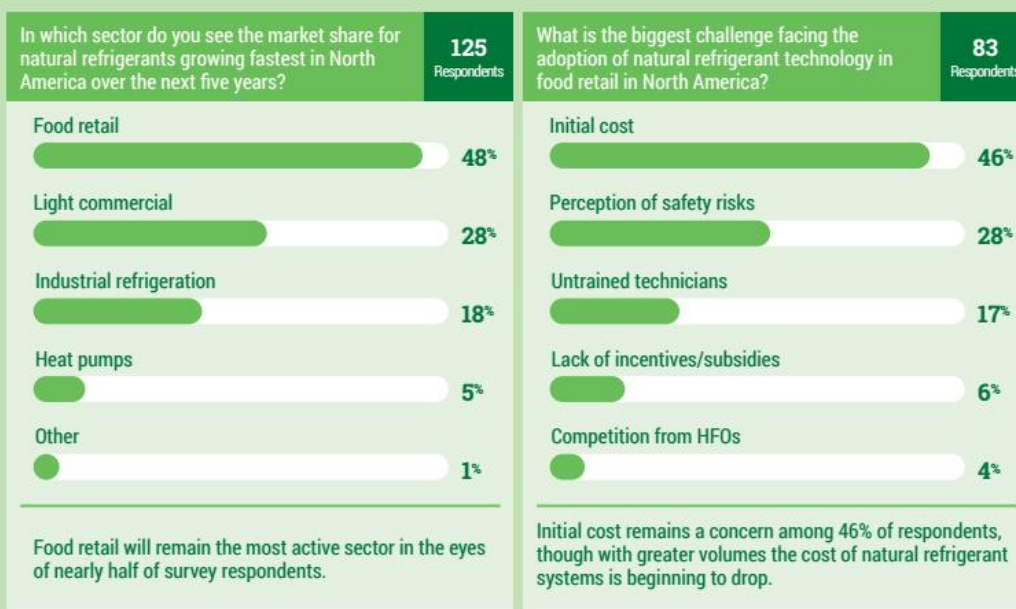
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WEIGHING IN

At the ATMOsphere America 2016 conference in Chicago last month, the more than 340 attendees from all walks of the HVAC&R industry had a chance to express their opinion on a variety of major issues impacting the adoption of natural refrigerants in North America. Here's a sampling of what they said.



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From left: Randy Powell, Dustan Atkinson, Michael Lehtinen, Joe Sanchez, Marc-André Lesmerises, James Knudsen and Marek Zgliczynski

STATE OF THE INDUSTRY: MARKED GAINS FOR NATREFS

At ATMOsphere America, industry vendors report significant strides for CO₂ transcritical, low-charge ammonia and hydrocarbon applications, though cost and other challenges persist

— By Charlotte McLaughlin and Michael Garry

Original equipment and component manufacturers of natural refrigerant equipment – the companies that have made the biggest investment in this technology and are on the front lines of marketing it to end users – are well positioned to assess the state of the industry in North America.

And several of the leading global players did just that at ATMOsphere America in June. Their conclusion: the market for CO₂, ammonia and hydrocarbon HVAC&R applications continues to progress steadily, and shows considerable potential for expansion, while the industry still grapples with core challenges.

CO₂ GAINING MARKET SHARE

Dustan Atkinson, manager of product strategy at Hillphoenix, expressed confidence in the prospects for CO₂ transcritical refrigeration in the U.S. “We think that CO₂ is going to gather a pretty significant share of the market for commercial, industrial and light commercial – it is a truly future-proof solution, and it’s easy to install,” Atkinson said.

“Transcritical booster systems are no longer just being trialed – this is becoming mainstream, and it is very viable moving forward,” he added. According to Atkinson, there are more than 200 installations of transcritical systems in North America, 150 supplied by Hillphoenix.

continued on p.16 →



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→ He cited several “measurable savings” for transcritical technology, including refrigerant charge, installation, case performance and energy, as well as “intangible benefits” such as HFC retrofit cost avoidance, relief from leak and recordkeeping requirements, better quality products and evidence of social responsibility. But persistent challenges include capital costs, technician availability, energy evaluation, understanding the ROI and impact on total cost of ownership, and refrigerant management.

At the same time, he sees equipment costs dropping over time, greater availability of incentives and rebates, the growth of training programs like Hillphoenix’s own learning center, and investment in new technologies like parallel compression and ejectors that improve efficiencies “even in extremely warm climates.”

Marc-André Lesmerises, CEO and co-founder of Carnot Refrigeration, sees potential for CO₂ applications “everywhere.” In addition to putting CO₂ transcritical systems into 65 supermarkets in Canada and the U.S., (including 15 retrofits), Carnot has installed them in data centers (18 projects), ice rinks (nine), and warehouses, and even has a CO₂ chiller for wineries.

James Knudsen, North American food retail segment leader for Danfoss, cited shecco data in estimating that by the end of 2016, there would be 350 transcritical systems installed in North America (an 84% increase from 2015), and 6,000 deployed in Europe (a rise of 15%). He cited government regulations as a key driver of growth. “OEMs are adapting designs to meet new refrigerant and efficiency requirements,” he said.

New legislative developments are creating new opportunities for collaboration between companies, reported Randy Powell, vice president, SPX Cooling Technologies, a provider of heat-rejection equipment, including a new adiabatic cooling system for CO₂ gas cooling/condensing in supermarket applications.

VARIED NH₃/CO₂ APPLICATIONS

Ammonia is also experiencing a period of growth in the United States. Carnot has seen great success with ammonia/CO₂ systems for industrial refrigeration, and its latest project is a large-scale, 1,500TR installation in a food production and distribution center

“We think that CO₂ is going to gather a pretty significant share of the market.”

Michael Lehtinen, director of marketing for Heatcraft Worldwide Refrigeration, demonstrated how its new ultra low-charge ammonia/CO₂ system is delivering impressive energy savings at a Piggly Wiggly store ([see story, page 26](#)). Heatcraft has plans for more transcritical CO₂ installations in supermarkets as well as cold storage facilities. “The end-game refrigerant is going to be less than 150 GWP,” he said.

The main challenges confronting ammonia/CO₂ systems include technician skill level, national and local regulatory codes and the availability of components, Lehtinen said. He recommended that the industry “expand and promote industry training to improve the CO₂ and ammonia knowledge base.”

Joe Sanchez, engineering manager for Bitzer U.S., reported that his company recorded a 60% increase in the number of ammonia compressors sold in North America in each of the last three years. Bitzer offers a wide range of compressors for low-charge ammonia systems, and will be introducing a 250TR “industrial-size” ammonia compressor this year.

He also reported more than a 50% rise in CO₂ compressor unit sales in each of the last two years in North America. This year, Bitzer will unveil a six-cylinder, 50HP compressor for CO₂ transcritical, designed for commercial and industrial applications ([see story, page 54](#)).

Sanchez continues to see the boundaries between commercial and industrial refrigeration sectors dissipating, with low-charge ammonia finding more applications in commercial facilities and CO₂ transcritical being adopted in industrial plants.

Meanwhile, propane may also be on the brink of large-scale U.S. expansion. Marek Zgliczynski, product manager for Embraco, said he expects the efficiency of hydrocarbon systems, which exceeds that of old and new refrigerants, to trigger a wider rollout; he predicts that 20% of Embraco’s U.S. sales in 2016 will be in hydrocarbon units, mainly propane.

However, barriers to increased uptake of hydrocarbons in the U.S. remain, including the low charge limit, “psychological” concerns about flammability, and a lack of trained technicians. “We work to mitigate those barriers because we believe hydrocarbons are the future,” he said. **CM & MG**

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Accelerate America Awards

THE BEST & THE BRIGHTEST

In the first annual Accelerate America Awards program, Sobeys, Red Bull, Campbell Soup, True Manufacturing and Marc-André Lesmerises of Carnot Refrigeration have been recognized for advancing the uptake of natural refrigerants

By Michael Garry & Charlotte McLaughlin

When *Accelerate America* was launched in November 2014, Marc Chasserot, its publisher and CEO of parent company shecco, wrote this: "Natural refrigerant-based technologies are disrupting the HVAC&R industry in North America. Behind this wave of innovation are people with brilliant and creative ideas who are designing and using functioning technologies in brand new ways to meet exciting new business opportunities. These are the people, ideas and technologies we want to cover in *Accelerate America*."

The concept of the Accelerate America Awards is to take this mission a step further, calling out the companies and people who have done the most to bring down barriers and move natural refrigerant technology forward in North America.

So we have established three sector awards – food retail, foodservice and industrial – specifically for end users. We are also recognizing the company responsible for the most important innovation of the year, and the person of the year, who has individually had the greatest impact.

In selecting the winners on the sector side we looked at metrics like number of installations of natural refrigerant systems, reduction in energy

and greenhouse gas emissions, commitment to future installations, and industry leadership. For the innovation award we considered companies that developed a particular technology having a significant impact on the market. And for person of the year we sought someone who has forged new pathways for natural refrigerants – someone without whom the natural refrigerants business in North America would be much less developed than it is.

The winners – Marc-André Lesmerises (Person of the Year), Sobeys (Food Retail), Red Bull (Foodservice), Campbell Soup (Industrial), and True Manufacturing (Innovation of the Year) – received their awards at a special morning ceremony at ATMOSphere America in Chicago in June.

On the following pages you will find profiles of the winners explaining why they were selected.



ACCELERATE
AMERICA
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Accelerate America Awards

Person of the Year Marc-André Lesmerises Carnot Refrigeration



Marc-André Lesmerises

Putting CO₂ Transcritical on the Map

In 2005, when Marc-André Lesmerises worked for Sobeys, Canada's second-largest supermarket chain, he noticed that the company was struggling to resolve its refrigerant issues.

"They were facing the change from R22 to R507 or R404A, but they were afraid to go with HFCs because of the high GWP of the gas," he said. "I saw an opportunity to build a package for them."

That package would turn out to be a CO₂ transcritical refrigeration system, never before used by a supermarket in North America. Lesmerises learned about the technology in Europe, where it was rapidly being adopted by supermarkets. In 2008, at age 31, he decided to become a manufacturer of natural refrigerant systems after launching Carnot Refrigeration in Trois-Rivières, Quebec with two partners. Sobeys was his first customer.

Today, Sobeys has 82 stores that use transcritical CO₂ systems, making it by far the food retail leader of this technology in North America. Carnot has supplied more than 50 of those systems, and has transcritical installations at other supermarkets in Canada and the U.S. Carnot installed the very first CO₂ transcritical store in the U.S., at a Hannaford supermarket in Turner, Maine, in 2013.

Lesmerises also makes CO₂ systems – as well as ammonia/CO₂ and ammonia/glycol systems – for food storage and processing plants. His first project for Sobeys was an innovative ammonia/glycol refrigeration system at a Sobeys dairy distribution center that won two awards from ASHRAE. His CO₂ chillers are used in wineries as well.

But Lesmerises did not stop there, pursuing other sectors like ice rinks, where he has installed transcritical systems at eight locations, and data centers, where his CO₂ units are running in 18 facilities. All told, he has deployed more than 100 transcritical CO₂ systems across sectors in North America, including about 30 retrofits. In doing so he has helped transform the commercial and industrial refrigeration industry on this continent, driving the market for CO₂ transcritical, which is now served by several OEMs and growing steadily. ([See story page 14](#)).

For these accomplishments, Marc-André Lesmerises is the recipient of the 2016 Accelerate America Person-of-the-Year Award.

A complete subject

Lesmerises discovered his passion for mechanical engineering and refrigeration working for the HVAC&R contractor AubinPélissier one summer while a student at Quebec University. "I saw that refrigeration is a complete subject with electronics, thermodynamics, welding, and material science," he said. "I really enjoyed that summer." He soon showed a talent for the field, winning an environmental award from the Canadian government for his design for a heat pump in his final year of studies.

Lesmerises continued working for AubinPélissier after graduating in 2003, and followed that with the stint at Sobeys. It was during his time at AubinPélissier that he traveled the world to learn about alternative refrigeration technologies, including ammonia, propane and CO₂ systems.

In 2008, he joined with two investors from AubinPélissier to launch Carnot Refrigeration, taking the name from the Carnot Cycle, a tenet of thermodynamics well-known to mechanical engineers. (He became the sole owner last year.)

Having gained experience designing ammonia systems, Lesmerises initially thought of developing a unit using ammonia, or possibly propane, for Sobeys' stores. But after working with CO₂ in Carnot's research

lab, "I started to see the benefits of CO₂ over other refrigerants" for supermarket applications, he said. He designed his transcritical units to offer heat reclaim and hot-gas defrost, elements that were not provided in European models but were popular in traditional Canadian systems.

Lesmerises prides himself on the simplicity of his systems. "It's much more difficult to simplify a system than to add components," said, adding, "the only component that never fails is the one that is not installed." His lean transcritical systems are very efficient, though he has started incorporating parallel compression and ejectors to improve efficiencies in warm climates.

His CO₂ transcritical technology has come down considerably in price from when Carnot started, and is now comparable to traditional systems, he said, adding that the systems are on average at least 10% more efficient than HFC units.

Lesmerises loves the challenge of running his own business. Carnot, which employs 20 engineers, as well as 40-50 production people, five or six technicians five administrators and a 24/7 help desk, can turn out as many as 15 transcritical racks per week.

But he's also driven by an environmental mission to supply the world with climate-friendly refrigeration systems. "As an engineer, I don't want to work in something that is not doing something for the next generation," said Lesmerises, the father of two daughters, ages four and six.

Lesmerises remains optimistic about the future for natural refrigerants. "We will not get everyone but we will get a lot of people in the near future," he said. "As an engineer, it makes sense to me. When you understand and live with the system, you see its benefits. You have something that is really hard to beat." **MG**

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Accelerate America Awards

Best in Sector Food Retail: Sobeys's

CO₂ Leader in North America

 In 2008, Sobeys, Canada's second largest supermarket chain with around 1,800 stores, was at a crossroads regarding its refrigeration technology.

Like the rest of the global food retail industry, the company had been phasing out its ozone-depleting CFC refrigerants since the 1990s, and was now engaged in the phase out of CFCs' cousins, the HCFCs. The replacement gas was HFCs, reasonably safe for the ozone but potent greenhouse gases. Could another phase out be in Sobeys future?

"Sobeys asked itself a simple question: 'Would we want to pass through another phase down with no vision of what will be the next refrigerant?' and the response was NO," said Yves Hugron, director of buildings, systems and the environment for Sobeys Quebec.

The cost would just not have been worth it in the long run if the company would need to replace their systems all over again, he added.

It was clear to Sobeys that to avoid a future phase down it would need a refrigerant that would not pollute the atmosphere.

Sobeys' first step, said Hugron, was to invite refrigerant suppliers, rack manufacturers, installers and technicians to join a forum with Sobeys' buyers and address three questions: "Who has a

crystal ball to know what refrigerant will not be phased out in future? What refrigeration system will stay in operation as long as the old R12 systems? And who wants to take the leap to search for a future-proof solution?"

All of the refrigerant suppliers declined the invitation while just 10 manufacturers and installers accepted. In the end, only two manufacturers, Carnot Refrigeration and CSC Inc., proposed a solution with natural refrigerants – transcritical CO₂. Sobeys had found its answer. ([See "Set for Life," Accelerate America, February 2015.](#))

Today, Sobeys has 82 transcritical CO₂ stores – far more than any other North American retailer -- and plans to add nine more by the end of the year; most are in the province of Quebec and many are in franchised stores. Every year, 15-20 additional stores are equipped with CO₂ transcritical, including new stores and retrofits.

Sobeys' transcritical systems have lowered energy costs by 8% to 10% compared to HFC systems, and first costs of the transcritical systems are the same or lower than traditional system costs.

For its commitment to becoming the dominant leader in transcritical CO₂ store installations, Sobeys is the recipient of the 2016 Accelerate America Best-in-Sector/Food Retail Award.

Communicating with customers

Hugron has had a long career as an engineer, previously working as a project designer in hospital construction before moving to Sobeys in 2000.

As director of buildings, systems and the environment for Sobeys Quebec, Hugron's role is to establish the best standards for all parts of store construction, including mechanical and electrical equipment and building materials.

For Hugron, transcritical CO₂ refrigeration is part of Sobeys overall environmental strategy, along with LED lighting and recycling efforts, which the company tries to communicate with customers.

Sobeys is also using other natural refrigerants as part of its commitment to the climate, such as ammonia in NH₃/CO₂ cascade systems in refrigerated warehouses.

He would like to test self-contained cases with propane, but "the building code in Quebec province doesn't permit propane in buildings for fire safety." 

Accelerate America Awards

Best in Sector Foodservice: Red Bull

Bringing Isobutane Coolers to the U.S.

Founded in 1987, Red Bull has sold some 60 billion cans of its energy drink to date in 169 countries, helped by aggressive marketing through events and sports-team ownership. At the retail level, that calls for a lot of refrigeration, including about one million coolers globally.

To rein in its environmental impact, in 2008 Red Bull, based in Austria, decided to deploy ECO-Cooler beverage merchandisers that use hydrocarbons as the refrigerant instead of HFCs. In 2011, the company joined Refrigerants, Naturally!, the European group dedicated to promoting the advantages of natural refrigerants in foodservice applications. As of 2015, Red Bull had deployed more than 500,000 ECO-Coolers globally.

In contrast to its European experience, Red Bull faced an uphill battle switching from HFC's to hydrocarbons in the U.S. That's because the Environmental Protection Agency initially approved Red Bull's hydrocarbon of choice, isobutane (R600a), for domestic, not commercial, stand-alone refrigeration in 2011 through its Significant New Alternatives Policy (SNAP) program.

"Red Bull uses small-cabinet coolers and R600a refrigerant works better in these coolers," said Richard Reeves, Red Bull's director of fleet/purchasing/safety & compliance. So the company worked with

the EPA to approve the use of R600a in stand-alone cooler cabinets. In July 2013, EPA granted that approval.

Red Bull's next task was to buy coolers that were made for the U.S. market. "The U.S. requires different power ratings; therefore, key mechanical components had to be converted to meet U.S. standards," said Reeves. Red Bull's Austria-based purchasing team has led the effort to bring ECO-Coolers to the U.S., with support from Red Bull North America's sustainability team.

To date, Red Bull has deployed over 200,000 isobutane ECO-Coolers in the U.S. marketplace. Reeves predicted that this number would double within two years. The units use 45% less energy than standard coolers.

For its commitment to using hydrocarbon coolers, and spearheading the acceptance of isobutane in the U.S. market, Red Bull is the recipient of the 2016 Accelerate America Best-in-Sector/Foodservice Award.

Servicing summit

Finding adequate servicing for isobutane coolers was initially a problem in the U.S. "Hydrocarbon coolers require different tools and capabilities to service than R134a coolers," said Reeves. "Most of this is related to the flammability of the R290 and R600a refrigerants." A massive training program was required.

Red Bull met this challenge by establishing a hydrocarbon cooler servicing summit and inviting manufacturers and service companies to attend. "This was very successful," said Reeves. "Currently there are no challenges for Red Bull in repairing and servicing hydrocarbon coolers."

Reeves attributed initial safety concerns in the U.S. regarding the use of hydrocarbons to lack of information about hydrocarbon technology. "But once we really started going into it, it was not an issue," Reeves said.

The hydrocarbon coolers have been widely accepted in the U.S., said Reeves. "The retailers realize that there are no negatives to using these coolers. They plug into the same outlets, hold the same volume of product, and with LED lighting the coolers and products placed inside look better."

"Some retailers are requesting hydrocarbon coolers as they understand the benefits of saving energy and the environment," he added. **CM**

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Accelerate America Awards

Best in Sector Industrial: Campbell Soup

Pioneer of Low-Charge Ammonia

For many decades, industrial refrigeration facilities mostly used many thousands of pounds of ammonia to cool and freeze food products in storage and processing applications. It worked well, but ammonia is a pungent and potentially toxic refrigerant, and requires major safety precautions, which may fail on occasion.

In the late 1980s and early 1990s, Bob Czarnecki, head of refrigeration engineering for Campbell Soup, started designing systems that dramatically reduced the amount of ammonia used in plants undergoing a renovation. ([See "Campbell's Low-Charge Recipe," Accelerate America, April 2016.](#))

For cooling areas that required temperatures above 18°F to 20°F, he would employ glycol as the secondary cooling medium, keeping ammonia in the engine room. "Every time we had the chance, we'd take the ammonia evaporators and heat exchangers out of the plant floor," he said. Initially, these new ammonia/glycol systems were field erected, but over time they morphed into packaged skids that consolidated the equipment and cut down on pipes and valves.

For freezers, glycol didn't work as well, so Czarnecki continued using ammonia in the refrigeration area, but much less of it. "We went to a top-feed, bottom-return coil, which drained by gravity," he said. "We didn't allow a lot of liquid in the [evaporator] coils."

Today, most of Campbell's thermal plants use less than 10,000 pounds of ammonia. In addition, Campbell has been converting its Pepperidge Farm bakeries, which have employed R22 and HFCs rather than ammonia, to low-charge ammonia packages. At one of these bakeries, in Richmond, Utah, the ammonia units have been found to be more energy efficient than R22 systems while using only 0.9 lbs./TR.

The immediate benefit of going to a low-charge network was much improved safety. "Our plants were supportive of it," said Czarnecki. "It was mainly a safety issue." Today, with greater governmental pressure on facilities with more than 10,000 pound of ammonia, low-charge systems also provide regulatory relief. And they offer an environmentally friendly and regulation-proof alternative to facilities using R22 or HFCs.

For pioneering the development of low-charge ammonia systems, Campbell Soup is the recipient of the 2016 Accelerate America Best-in-Sector/Industrial Award.

Work on standards

After 38 years at Campbell Soup, Czarnecki retired last year, but he continues to serve the industry with distinction as the long-time chairman of IIAR's standards committee. The person now overseeing Campbell's refrigeration systems is Bing Cheng, principal utilities engineer, who also manages HVAC and other projects. Like Czarnecki, Cheng serves on IIAR's standards committee, focusing on CO₂ and insurance issues.

Under Cheng's direction, Campbell continues to convert Pepperidge Farm bakeries from R22 and HFC to low-charge ammonia packages. Its current conversion project is taking place at a facility in Lakeland, Fla., which will employ Campbell's first NH₃/CO₂ system for a small, 5TR freezer, which previously used R404A.

Getting out of R22 and HFCs aligns with Campbell's membership in the Consumer Goods Forum, the global consortium of retailers and brands that has pledged to reduce use of these gases.

As chairman of the IIAR standards committee, Czarnecki played a major role in the recent revision of IIAR-2, the organization's widely used safety standard. One of the new provisions addresses low-charge ammonia systems, offering them a little more leniency given their smaller quantities of ammonia. He believes this change will support the continued growth of low-charge systems. "I'd like to do more." **MG**

Accelerate America Awards

Innovation of the Year: True Manufacturing

Moving Foodservice to Propane

Some companies – some people – do a better job of reading the handwriting on the wall than others. True Manufacturing is one of those companies.

For a long time, the foodservice marketplace knew that the Department of Energy was ramping up its energy efficiency requirements in 2017 for foodservice equipment and that the Environmental Protection Agency was delisting the major HFC refrigerants used in that equipment starting in 2019.

But it was True that made the first big move to transition its stand-alone merchandising and refrigeration equipment to a natural refrigerant – propane – that would solve both of those regulatory issues, in many cases dropping HFC models from its inventory. And now many other equipment companies are following suit, as became evident in May at the National Restaurant Association (NRA) Show in Chicago. [\(See “Converting to Propane,” *Accelerate America*, June 2016.\)](#)

True began marketing self-contained propane systems in the U.S. in 2013 and made its commitment to the technology clear at the NAFEM show last year. But the NRA Show was True’s breakout event. There, the company’s owner, Steve Trulaske, received the EPA’s 2016 Energy Star Emerging Technology Award in the residential/commercial refrigeration category for 42 of its propane units – by far

the largest number of pieces of equipment one company has ever had recognized by the EPA’s Energy Star program.

The metal-plated wooden award cited True’s “environmental leadership through the design and manufacturing of innovative technology.”

To qualify for the award, the 42 models had to be at least 5% more efficient than their predecessor units. The EPA specified that the energy comparison had to isolate the efficiency gains due only to the low-GWP refrigerant system – not to ancillary components like lighting and insulation.

All told, True offers 150 propane models today, and its customers range from grocery chains, convenience stores and discounters to dollar stores, restaurant chains and beverage brands.

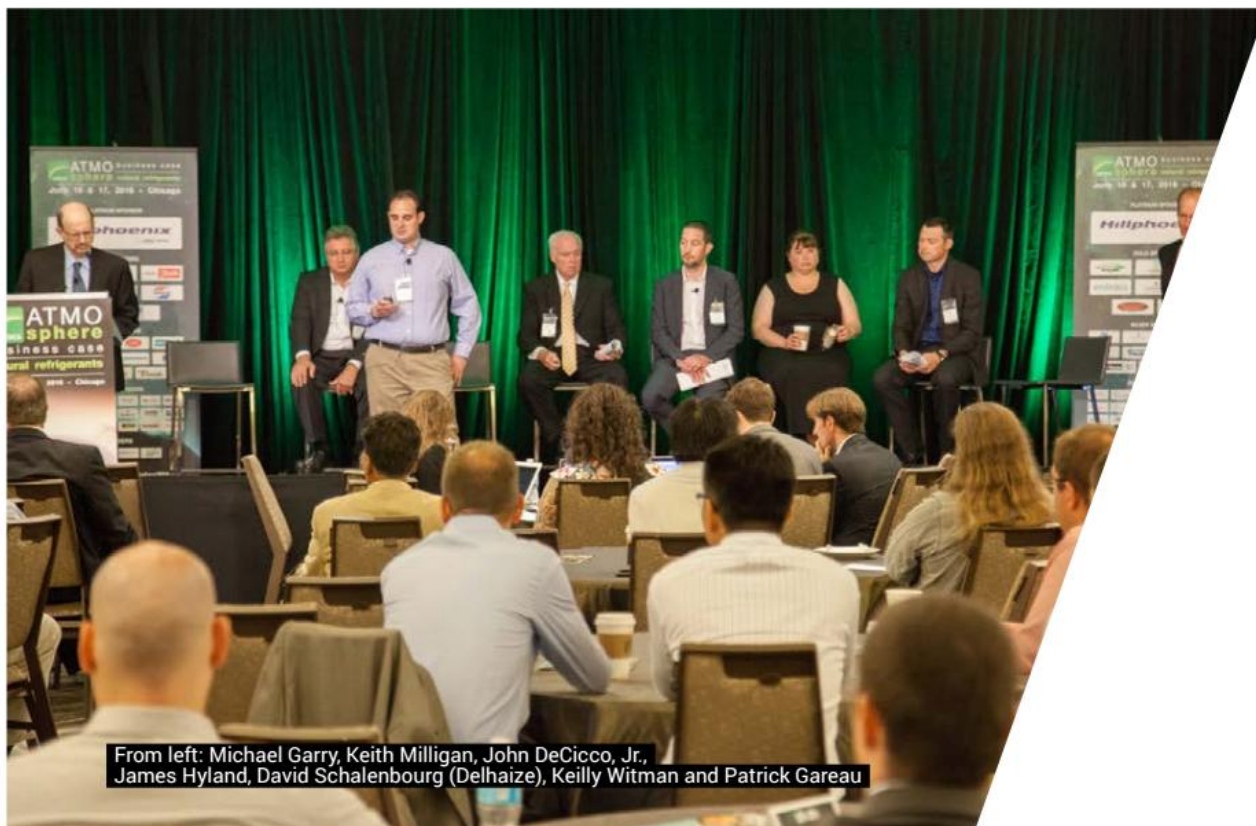
For shifting the standard for foodservice refrigeration equipment to energy-efficient propane units, True Manufacturing is the recipient of the 2016 Accelerate America Innovation-of-the-Year Award.

Hydrocarbons over CO₂

True has in the past built refrigeration units that use CO₂ as the refrigerant, but then committed to hydrocarbons as its standard. “We have a clear understanding of the difference between CO₂’s capabilities and hydrocarbon’s, and we distinctly believe in hydrocarbons for our applications,” Trulaske told *Accelerate America* at the NRA Show.

True considered using isobutane, another hydrocarbon, but decided against it because its lower capacity would not be suitable for freezer units. “We found we could do a whole model mix – refrigerators and freezers – with propane,” said Todd Washburn of True at the NRA Show.

Concerns about the flammability of propane, while prevalent a few years ago, have abated, said Washburn. “Once we educate them on the UL certification and the low charge sizes, it becomes a non-issue.” **0 MG**



From left: Michael Garry, Keith Milligan, John DeCicco, Jr., James Hyland, David Schalenbourg (Delhaize), Keilly Witman and Patrick Gareau

THE MORE, THE MERRIER

The diversity of natural refrigerant options in commercial refrigeration – from hydrocarbons and ammonia/CO₂ to transcritical CO₂ – was in evidence in at ATMOsphere America's food retail panel

– By Andrew Williams and Michael Garry

In North America, food retailers that have invested in natural refrigerants have tended to go with CO₂ transcritical systems, but now they are looking seriously at alternatives like hydrocarbons and even ammonia.

That diversity of solutions was reflected in the Food Retail Panel at ATMOsphere America, held in Chicago in June. The panel included representatives from Sobey's, Roundy's, Piggly Wiggly, Delhaize and DeCicco & Sons, as well as an industry consultant who spoke about Target.

THE PIG TESTS AMMONIA

One of the more compelling natural refrigeration installations is that of a Piggly Wiggly store in Columbus, Ga., one of 19 operated by JTM Corp., a family-run Piggly Wiggly franchise operation based in nearby Phenix City, Ala. (There are more than 600 Piggly Wiggly franchised stores in 17 states.)

The Columbus Piggly Wiggly, which opened last September, employs an ammonia/CO₂ cascade system provided by Kysor/Warren (a division of Heatcraft) and made locally in Columbus. The store, one of only four NH₃/CO₂ supermarket installations in the U.S., received platinum certification from the Environmental Protection Agency's GreenChill program.

The NH_3/CO_2 system contains only 53 lbs. of ammonia, located on the roof so that customers are not exposed to it in the event of a leak. "Even if the whole 53 pounds leaks, which is not very likely, it just goes up into the atmosphere," said Keith Milligan, financial controller for JTM Corp., which is owned by the Milligan family. Technicians working on the system would be alerted to any leak by ammonia's odor, he added.

At first, JTM considered a variety of refrigerant options for improving efficiency and environmental performance at its new store. But with the cost of new low-GWP synthetic alternatives "skyrocketing" and the Environmental Protection Agency continuing to blacklist more high-GWP refrigerants under the SNAP program, JTM opted for natural refrigerants instead, Milligan explained. The company was "fed up with changing our refrigerants to the latest and greatest synthetic refrigerant every few years. We felt [CO_2 transcritical] would be the end game."

The Piggly Wiggly store's NH_3/CO_2 system, which includes an evaporative condenser, offers a slew of benefits, including energy savings, heat reclaim, a reduced environmental impact, low-cost refrigerants, improved product shelf life and the absence of regulatory concerns (even for ammonia, due the low charge), noted Milligan.

JTM has added other efficiency elements to the store, including LED lights, skylights, case doors and a high-efficiency HVAC system. Based on energy consumption data accumulated from October 2015 through April 2016, the store as a whole used 28.5% less energy than a traditional HFC store, a savings of \$33,170,



Keith Milligan, Piggly Wiggly



he said. "You need to sell a lot of groceries to make that much money," Milligan said

But there have been several challenges associated with the new store, including the 50% to 70% higher initial cost of the NH_3/CO_2 system, and the lack of incentives to compensate for the higher cost. In addition, Milligan cited the shortage of trained service technicians and the training needs of the installation contractor.

Even with the first-cost premium, Milligan expects the total cost of ownership of the system to be 15% to 20% less than a conventional system. JTM remains committed to using natural refrigerants "in every new store we build," said Milligan, and hopes to work with Heatcraft on store retrofits next year.

TARGET'S PROPANE POLICY

Over the past year, hydrocarbons have emerged as a natural refrigerant of great interest to food retailers, especially for self-contained cases.

For example, Minneapolis-based Target Corp. has sent out notifications to its suppliers of self-contained refrigeration equipment indicating that its policy is to use only propane as the refrigerant in self-contained units.

"Target asked its suppliers, 'Where do you stand on that? Do you need help?'" said refrigeration consultant Keilly Witman, owner of Boise, Idaho-based KW Refrigerant Management Strategy, who participated in the food retail panel. "The suppliers said that's already where we're going, so it's no problem at all."

Witman and Paul Anderson, director of engineering for Target, gave a joint presentation in September 2015 at the Food Marketing Institute's Energy & Store Development Conference, where they discussed propane-based refrigerated cases and Anderson said Target was testing that equipment at smaller

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→ Target outlets. (See, "[Hydrocarbons: The Refrigerant of the Future for Supermarkets?](#)" *Accelerate America*, October 2015.)

The following month, at a White House-hosted meeting, Anderson announced that all of Target's new stand-alone coolers in its stores with a compressor capacity below 2,200 BTU/Hr. would be HFC-free starting in January 2016.

In her ATMOsphere America presentation, Witman also said that Target has talked to contractors that might be working on the propane equipment about the chain's expectations. "Target said, 'Here's where we're going; we need you to be able to handle that,'" she noted. "That gave contractors the signal that they needed to provide any training necessary for their service technicians, which enabled Target to be very comfortable about moving forward."

In addition to using propane cases on a spot basis in stores, Target has a few stores opening in the next six to eight months that will use only propane self-contained systems, added Witman.

Witman also disclosed that a major U.S. food retailer, which asked not to be named for publication, is testing a propane/CO₂ cascade system, the first in North America.

NORTH AMERICAN TRANSCRITICAL LEADERS

European retailers have had great success with CO₂ transcritical refrigeration, with over 5,500 stores installing the technology to date. CO₂ transcritical is now making inroads in the North American food retail sector as well.

In Canada, Sobeys has established itself as the "leader in CO₂ [transcritical] refrigeration in North America," said Patrick Gareau, refrigeration specialist for Sobeys.

The supermarket chain currently has 82 supermarkets using CO₂ transcritical systems throughout Canada with nine more on the way, (this includes 22 retrofit stores). Since Sobeys' first transcritical installation in 2009, the systems "have evolved and are now mature," he said. Its four transcritical suppliers include Carnot Refrigeration, Systemes LMP, Hillphoenix and Zero-C. Sobeys is also testing CO₂ in air conditioning.

Gareau said CO₂ transcritical systems had allowed Sobeys to reduce energy consumption by 8%-10% compared to stores fitted with HFC-based technology. He also described the systems as low maintenance, with CO₂ being much less expensive than HFCs.

“Transcritical is worth it; it really is worth it.”



James Hyland, vice president of corporate communications & public affairs for Milwaukee-based Roundy's (which merged with Kroger last December), explained how Hillphoenix's Advansor CO₂ transcritical CO₂ booster system has reduced the chain's environmental footprint and efficiently covered both medium-temperature and low-temperature loads. Its transcritical program is the most aggressive for a supermarket retailer in the U.S., and second to Sobeys in North America.

Roundy's, which operates 154 stores under four banners in Wisconsin and Illinois, launched its transcritical program at new supermarkets with an installation at a Pick 'n Save store in Menomonee Falls, Wis., in January 2014. (See "[Roundy's Money-Saving CO₂ System](#)," *Accelerate America*, November 2014.) The transcritical system, which was found to consume 20% less energy than Roundy's prototype system during the first six months of operation, has "performed flawlessly" since its installation, said Hyland. On an annual basis, the transcritical system saves \$13,000 in annual energy costs over a comparable HFC system, he said, adding that based on the EPA's greenhouse gas equivalence calculator, the system delivers an annual reduction of 33.6 metric tons of greenhouse gas, the equivalent of not burning 36,000 pounds of coal.

"Transcritical is worth it; it really is worth it," he said.

The success at the Menomonee Falls store led the company to install a second transcritical system at a Mariano's store in Orland Park, Ill., in January 2016, a third at a Metro Market store in Shorewood, Wis., in February, and two more at Mariano's stores in Westmont, Ill., and Naperville, Ill., in March and May, respectively.

In August and September, Roundy's is opening a transcritical store each month in Chicago. Next year, the chain plans to open five Mariano's with transcritical systems in the Chicago area. As a member of the EPA's GreenChill partnership, Roundy's has "pledged to install transcritical CO₂ refrigeration system at all new stores and remodels where the refrigeration system is being replaced," said Hyland.

Hyland pointed out that CO₂ has a high heat of rejection, "making it ideal for heat reclamation applications and efficient hot-gas defrosting." He acknowledged that many CO₂ systems require steel piping throughout and "carry a higher risk of pressure-related system breakdowns." However, he added that the Advansor system eliminates those concerns by "perfecting the use of pressure-reducing valves so that everything inside of the store operates under lower pressure, as it would with an HFC-based system."

INDEPENDENT TAKES ON TRANSCRITICAL

DeCicco & Sons, a six-store food retailer based in Pelham, N.Y., is one of the few independent grocers in the U.S. to install a transcritical CO₂ system, which it did last December at a new 18,000-square-foot store in Larchmont, N.Y. ([See "DeCicco's Bold Move," Accelerate America, October 2015](#), and ["So Far, So Good" Accelerate America, May 2016](#).) DeCicco is in the process of retrofitting its Pelham, N.Y., store with a transcritical system.

DeCicco & Sons enhanced the Larchmont store's transcritical system to improve its overall efficiency, adding a variable-speed drive on one medium-temperature and one low-temperature compressor, and installing an adiabatic condenser to help cool the CO₂ gas when the temperature exceeds 88°F, noted John DeCicco, Jr., president of the company. The store also has a 100kW solar system on the roof, especially useful in the summer.

“There’s a big improvement in product quality.”



John DeCicco, Jr., DeCicco & Sons

The store also makes use of on average 700,000 BTUs of heat reclaimed daily from the transcritical system for hot water and other applications. Additional energy-saving features include night curtains and a high-efficiency HVAC unit.

The system has given DeCicco much tighter temperature control than a comparable R404A system – two degrees vs. six degrees for meat cases, and five degrees vs. 20 degrees for frozen cases. "There's a big improvement in product quality," he said.

DeCicco is able to save a lot of energy at night when the store is closed by running the system at 18% to 20% of capacity. Overall, the Larchmont store is saving a little more than 30% in energy, though this does not yet count the summer months.

DeCicco's transcritical system was the first of its kind for service contractor AAA Refrigeration, which trained 100 technicians on it – something that "made me feel really good," he said. **AW & MG**



From left: John Scherer, Michael Garry, Gerard von Dohlen, David Bornemeier and Luc Decubber

INDUSTRIAL'S NEW PATHWAYS

End users at Atmosphere America discuss alternatives to traditional ammonia systems, including transcritical CO₂, low-charge ammonia DX, and low-charge packaged ammonia

– By Charlotte McLaughlin and Michael Garry

Ammonia in large quantities has been the dominant refrigerant in industrial refrigeration for many decades, but now it is finding use in an array of low-charge applications.

And another natural refrigerant – CO₂ – is starting to make headway, in combination with ammonia in cascade systems (where ammonia is the primary refrigerant), but also by itself in transcritical systems.

Low-charge ammonia systems as well as transcritical CO₂ were the subject of end-user presentations during the Industrial End User Panel discussion at ATMOsphere America in Chicago in June.

CO₂ FOR CRANBERRIES

Cranberry processors in Canada are turning to CO₂ transcritical systems to freeze cranberries in the critical month after the harvest from mid-September to the end of October. One example is Canneberges Bécancour, a Quebec-based cranberry producer that installed a CO₂ transcritical refrigeration from Carnot Refrigeration.

Canneberges Bécancour produces 15 million pounds of cranberries from 450 acres of cranberry bogs on its 1,000-acre property, with 80% of the harvest exported to the U.S., said Luc Decubber, owner of Canneberges Bécancour. The company also processes cranberries for other growers in his facility, which has a 25-million-pound capacity.



From left: von Dohlen, Bornemeier, Decubber, Scherer and Harry Paul

To be transformed into juices, dried fruit and other ingredients, the cranberries must be frozen. The CO₂ transcritical system freezes them slowly, from 55°F to 0°F, in a three-room, 50,000-square-foot freezer. "The ice crystals have to be as big as possible," said Decubber.

The transcritical system features 39 compressors in three racks, with three gas coolers on the roof. It has 21 evaporators (six per freezer room and three in the loading dock). The freezing capacity is 400TR.

"The system is simple to use, relatively inexpensive to install, and regulatory compliance is simpler than for other products," Decubber said. "And it is very efficient in cold weather, when the most capacity is needed for the cranberries." For the rest of the year, only one of the three racks is used.

The CO₂ system also met Canneberges Bécancour's environmental standards by being non-toxic and minimizing its carbon footprint.

Decubber said he considered using an ammonia refrigeration system but decided against it. "A small leak of ammonia would make the berries turn brown, which is unacceptable," he said.

LOW-CHARGE FOR EGGS

Industrial refrigeration innovators are developing a variety of systems to cut the charge of ammonia, enabling end users to reduce their regulatory obligations while providing a safer environment for employees, customers and products.

Colmac Coil's DX ammonia evaporators represent one low-charge scenario employing a traditional machine room with evaporators in the cooling/freezing areas. Colmac's evaporators are being employed at a number of cold storage and processing plants, including Shepherd's Processed Eggs, Spanish Fork, Utah, which processes about one million eggs per day for fresh, hard boiled and pasteurized liquid egg products.

Shepherd's Eggs installed its low-charge ammonia system at a new 10,000-square-foot facility, in contrast to its other facilities, which run condensing units using HCFC and HFC refrigerants, explained Harry Paul, sales and marketing manager for Air Treatment Corp., who helped design the system, in his ATMOSphere America presentation.

When he initially suggested a low-charge ammonia system, Shepherd's Eggs executives were concerned about worker safety and regulations, said Paul. "But as we got into the whys and wherefores, they decided that as conscientious egg farmers, they would be far better off with a system that was very natural."

The Shepherd's Eggs plant consists of a freezer room with two blast freezers at -15°F (-25°F saturation suction) and two large egg cooler rooms at 38°F. The refrigeration system includes two Vilter screw compressors, one serving the DX freezer (30TR) and one serving a glycol chiller (120TR). The chiller cools glycol, which is delivered to the egg cooler rooms. The system also employs a plate-and-frame condenser for the freezer and evaporator in the chiller. Ammonia gas used in hot-gas defrost in the freezer comes back as condensate to a surge drum that channels it back to the chiller.

The total ammonia charge is only 400 pounds or 3 lbs./TR, compared to what would have been a pumped ammonia charge of 5,000 pounds. The first cost of the system was \$125,000 less than a pumped ammonia system, and \$180,000 less than an R507 system, with lower operating and maintenance costs.

Paul explained that the system achieved its low charge in four ways: an enhanced surface in the DX evaporator coils, Danfoss feed valves that monitor and meter the ammonia at a slow rate; the plate-and-frame heat exchangers; and a tank distributor that delivers the ammonia to the DX evaporator in small quantities, like an intravenous feeding tube connected to a hospital patient. "Only a little refrigerant is needed, just a shot glass' worth," he said.

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AMMONIA AMBITIONS THWARTED

Gerard von Dohlen, president of Newark Refrigerated Warehouse, Newark, N.J., had planned to convert his warehouse from R22 to low-charge ammonia.

Working with industry officials, he developed a plan with the state of New Jersey to avoid the state requirement to have engineers on premise 24/7 if ammonia refrigeration is used (a cost of \$700,000/year); the state would waive that requirement if the ammonia charge were 5,200 lbs. or less; the system complied with the IIAR-2 safety standard; and the facility hired one full-time engineer certified by RETA. (See ["Ammonia Returns to the Garden State," Accelerate America, June 2015.](#))

Von Dohlen was set to meet those requirements when New Jersey's Department of Labor decided to abandon the plan and stay with the existing system. "So now I'm in a quandary," he said. "I'd like to change R22 to ammonia, but I'll have to do something else."

For now, he intends to use R32 as a primary refrigerant with CO₂ brine in one building, and with calcium chloride brine (also used as a liquid desiccant) in two others. But he leaves open the possibility of using ammonia and asking for an exemption from the Department of Labor.



→ PACKAGED AMMONIA OPTIONS

Other end users are reducing their ammonia charge by employing low-charge rooftop packaged units. For example, Western Gateway Storage, Ogden, Utah, has installed the two low-charge packaged Evapcold units, from Evapco, each containing only 290 lbs. of ammonia and delivering a capacity of 70TR, to a freezer room at -5°F or below. This is the first installation of the Evapcold technology. (See ["The Road to Low-Charge Ammonia," Accelerate America, June 2016.](#))

Western Gateway initially considered a less expensive Freon option, but its president, David Bornemeier, who prides himself on asking "dumb questions," inquired about ammonia systems that could use less refrigerant, and ultimately decided on the Evapcold system, which was installed in June. "Low-charge ammonia does more with less," he said. "It's more efficient and it's safer for employees and the environment."

The first cost was comparable to that of traditional ammonia systems, he added.

Another low-charge packaged unit, from NXTCOLD, is being deployed at Los Angeles Cold Storage and at Lineage Logistics' Oxnard, Calif., 100,000-square-foot plant, among other places. John Scherer, manager of engineering at Los Angeles Cold Storage and the developer of the NXTCOLD unit, said at ATMOSphere America that 75 units would be installed by the end of the year, including multiple units at a single location. (See ["Breaking with Tradition," Accelerate America, April 2015.](#))

The Oxnard unit has 25 pounds of ammonia and delivers a capacity of 50 tons (or 8 oz./TR). The unit saves 9% in kWh compared to the central ammonia system, or about \$100,000 per year; in an optimum scenario that includes demand control, it saves 13% in kWh, over \$157,000 per year.

Based on research done at Oxnard, Southern California Edison is offering custom incentives of \$0.08/kWh of energy saving, and \$150/kW of peak demand reduction. (See [story page 50.](#)) NXTCOLD is negotiating with the utility for "year-to-year demand credits, perpetuating year after year," said Scherer. "That's a new thing in the industry and it's gigantic." **CM & MG**

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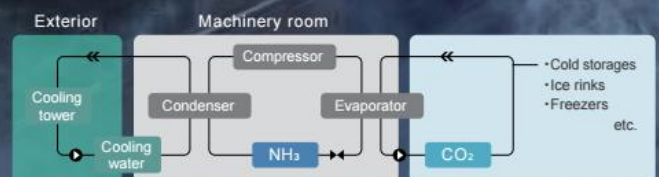
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'I'LL HAVE CO₂ AND AMMONIA WITH THAT'

McDonald's franchisee Caspers reinvents its distribution business with a new warehouse cooled by an ammonia/CO₂ and low-charge ammonia DX system

— By Andrew Williams & Marc Chasserot



“We do anything that's environmentally friendly and makes good business sense.”

Caspers Cold Storage and Distribution is in the process of changing its identity as a business; part of that change is moving to environmentally friendly natural refrigerants.

Caspers, based in Tampa, Fla., is one of Florida's oldest third-party logistics companies. The business began in 1973 as an owner-operator franchisee of McDonalds restaurants, and currently has 53 outlets in the Tampa area; in 1998, Caspers also became a storage and distribution center for its restaurants.

Now, Caspers plans to sell off the McDonalds distribution business (holding onto the restaurants) in favor of starting a new warehouse and transportation operation providing frozen-food storage for other companies.

“We identified that there is a market for cold storage in this area,” CEO Kim Seigler told *Accelerate America* at its Tampa headquarters.

The construction of the new facility — which will include a main freezer room and two blast freezers — would seem to herald a dramatic change to Caspers' business model. “We're going from servicing [our restaurants] to servicing many others,” Seigler said. “But we have the expertise, in the transportation, the distribution and the storage. So while it looks like a big change, it's not.”

continued on p.38 →

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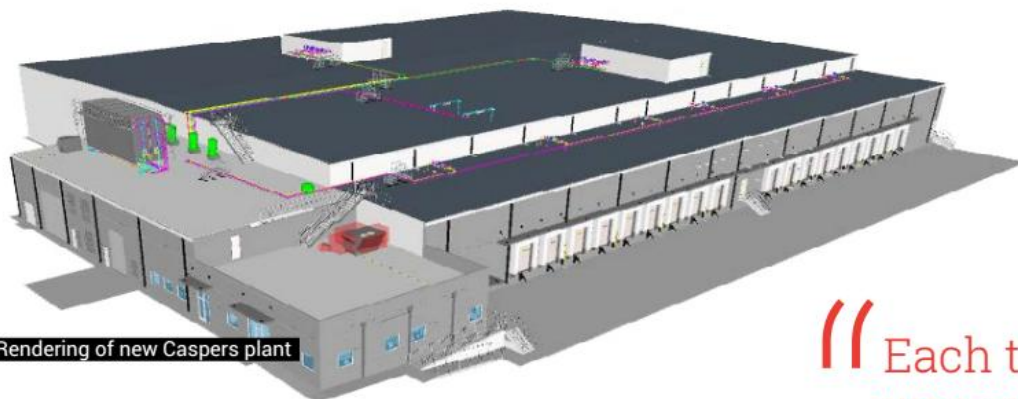
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Rendering of new Caspers plant

→ INSTALLATION IN TWO WEEKS

Caspers' new 116,000-square-foot facility – slated to begin operations in the first quarter of 2017 – will rely on a combination of low-charge ammonia and CO₂ refrigeration, in contrast to its existing 30,000-square-foot building, which has used an HFC system, noted Seigler. The new system will be provided by Stellar, a design, contracting and servicing company for industrial refrigeration.

With Stellar building the entire system offsite, onsite installation will be completed in just two weeks “for final piping and electrical connections,” said Brandon France, director of packaged solutions at Stellar.

Why did Caspers opt to go down this route? “Once you get up to that type of cubic feet, Freon is not cost-effective – so that’s first and foremost,” he said. “Second, it’s about being environmentally conscious.”

Another important element is staying ahead of the regulatory curve. “If I’m going to be here for 25 years, I’d rather spend more money now – it wouldn’t make sense for me to put [a Freon] system into this facility, because I’d have to change it in a few years,” said Seigler.

Caspers’ long involvement with McDonalds produced a list of contacts in the cold storage business, whose expertise Seigler was able to tap into when deciding which type of system to install in the new facility.

Seigler acknowledged that he is less familiar with the CO₂ element. But ammonia-CO₂ systems have become standard technology for new builds in Europe in recent years, and “that makes me very comfortable with it,” he said.

TWO AMMONIA PACKAGES

The new facility’s engine room will comprise two packaged ammonia refrigeration systems, including an ammonia/CO₂ cascade system. The equipment delivers ammonia to a -10°F freezer cooled by two separate penthouse units, each with three low-charge DX ammonia evaporators, that have a total capacity of 353TR; ammonia also goes to a 35°F dock area cooled by six ceiling-hung low-charge DX ammonia evaporators with a capacity of 86TR. Recirculated CO₂ is used in two blast-cell evaporators that go down to -45°F; each cell has a load of 48TR.

“Each temperature level was evaluated and optimized for increased performance.”

The approximate ammonia charge of the system is 5,500 pounds, well below the 10,000-pound threshold that calls for stricter regulations. The CO₂ charge is approximately 3,000 pounds.

By utilizing ammonia for higher temperature loads and CO₂ for low temperature loads, the system reduces the required pump, pipe and compressor sizes in the low-temperature system, noted France.

At the low temperature required for the blast freezers, the CO₂ is able to operate with a positive pressure. “This makes it easier to keep contaminants and non-condensables out of the system, enabling it to operate at peak efficiency,” France said.

In addition, the system’s ammonia compressors operate variable frequency drives and reciprocating compressors on the CO₂ side “for the best part-load efficiencies,” said France. “Each temperature level was evaluated and optimized for increased performance.”

France said he expects maintenance costs for the system to be lower than that of a conventional system.

The main challenge associated with ammonia technology is often the public’s perception of ammonia safety, noted France. But he firmly believes that the safety features fitted to modern ammonia equipment, such as pressure relief systems, gas detectors and emergency ventilation, “make them safe and effective alternatives to HFC refrigerant systems.”

Caspers is putting the adoption of natural refrigerants at the heart of its wider corporate sustainability strategy. “We do anything that’s environmentally friendly and makes good business sense,” Seigler said. This includes installing photosensitive LED lighting, which illuminates the aisles only when people access them.

With high-GWP refrigerants being banned or gradually phased out around the world, chemical companies are increasingly offering low-GWP synthetic replacements. Did Caspers ever consider taking that path? Seigler responded with an analogy. “If you buy a boat, do you buy one that has a hole in it and has been repaired? Or do you buy a new boat?” **AW & MC**



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CARREFOUR PROVES CO₂'S METTLE

The French retail giant shows in Spain that enhanced CO₂ transcritical systems can operate on average more than 45% more efficiently than HFC installations in warm climates – and now it's bringing the technology to Brazil.

- By Andrew Williams

As a global food retailer, with 12,296 stores in 35 countries across five continents, Carrefour Group has to operate in all types of climates. So when the company, based near Paris, started rolling out transcritical CO₂ refrigeration systems in 2011, it had to address the efficiency issues the technology experiences in higher ambient temperatures.

Take Spain, where Carrefour has installed CO₂ transcritical systems in 18 hypermarkets and one supermarket. Its first transcritical CO₂ hypermarkets were in the north of Spain, where maximum



Paulo Martini, Carrefour

temperatures tend to be moderate. “Energy consumption there for the new systems was low, even compared to subcritical installations,” said José Francisco Mollá, technical director of Carrefour Spain.

“This, together with the fact that we didn’t encounter any significant problems, encouraged us to continue doing CO₂ installations in places where ambient temperatures are higher,” Mollá noted.

Technology manufacturers worked in tandem with Carrefour to find the answer to the performance challenges in high ambient temperatures. Several elements were added to the design: parallel compression, subcoolers and ejectors, said Ivan Díaz, Carrefour Spain’s national Refrigeration & HVAC manager.

The results so far have been impressive: an average of over 45% energy efficiency savings in comparison to the standard HFC installations in place previously. ([See box, page 42.](#))

Paolo Martini, refrigeration and HVAC manager, urges governments or end users harboring lingering doubts as to the suitability of CO₂ in high ambient temperature conditions to run tests to see the results for themselves.

ELIMINATING HFCs

Carrefour, which has annual sales topping \$111 billion, operates a range of formats, including 1,481 hypermarkets, 3,462 supermarkets, 172 cash & carry stores and 7,181 convenience stores.

Its environmental goals are no less expansive, aiming to reduce carbon emissions 40% by 2025 and 70% by 2050 (compared to 2010 levels), in part by reducing emissions generated from refrigeration.

To accomplish this, Carrefour is phasing out HFCs and replacing them with CO₂ in its larger stores. By the end of 2015, it had 260 stores with CO₂ technologies in seven countries, including 170 with hybrid systems and 90 with CO₂ transcritical.

“We’re moving to eliminate HFCs,” Martini said. “This is the goal that we’d like to reach – that’s for sure!” By adopting natural refrigerants, “you can reduce your [carbon] impact and consume less energy.”

Carrefour decided to go down the natural refrigerants route in 2009, first installing hybrid systems to help familiarize staff with how CO₂ works as a refrigerant. “It has been a process to improve our knowledge, installers’ knowledge, and the availability of components,” Martini said.



The decision to switch to CO₂ transcritical in Europe in 2011 has proven so successful that Carrefour is planning to roll out the systems in other parts of the world – starting with Brazil.

With several years of experience, Carrefour has greater confidence in, and understanding of, natural refrigerant technologies. “Now we are exporting this knowledge, both internal and external, to other countries,” Martini said.

At the same time, Carrefour is dramatically reducing the number of new hybrid system installations. “By the second half of 2015, we had more projects in CO₂ transcritical than in hybrid,” Martini said. “For [supermarkets] and hypermarkets, I really believe that CO₂ [transcritical] is the best solution,” he said.

However, Carrefour is still evaluating other natural refrigerant solutions for its convenience stores and smaller supermarkets, which make up the majority of its store base, Martini said. Hydrocarbon plug-in systems may be an effective solution for convenience stores, he noted.

MOVING TO BRAZIL

In April 2016, Carrefour installed two transcritical CO₂ packs in Brazil – its first beyond Europe’s shores. “We’re also thinking about following the same approach in other countries,” Martini said.

Carrefour has two store brands in Brazil – Carrefour and Atacadão, its cash & carry format. The first CO₂ transcritical installation was in a Carrefour hypermarket in Cambuci, a district of São Paulo, with the second in an Atacadão store in Atibaia, a municipality in São Paulo state ([see story, page 61](#)). Both systems use parallel compression and adiabatic gas coolers to handle the higher ambient temperatures.

continued on p.42 →

CO₂ TRANSCRITICAL IN A WARM CLIMATE

Carrefour's Gavà, Spain, hypermarket operates an efficient transcritical refrigeration system in a warm climate. Here are some particulars:

- Store size: 89,340 square feet.
- Refrigeration: Carrier CO₂ transcritical system with parallel compressor and subcooler.
- Danfoss controller.
- Alfa Laval plate heat exchanger to reclaim heat for hot water.
- Carrier subcooler improves system performance by cooling down discharge of gas cooler when ambient temperature is high.
- 46% more efficient than previous f-gas DX system.



Transcritical CO₂ refrigeration system in Carrefour store in Spain

→ Given its success with transcritical CO₂ systems in warm climates like Valencia and Malaga, Spain, Carrefour is confident the Brazilian stores will follow suit, though performance data are not yet available. "I've already seen that the central packages are working pretty fine," said Martini. "Since 2013, we've been moving the so-called CO₂ equator southwards. The goal is to prove that this technology delivers good service results even in Brazil. Just like we did in Spain."

One oft-cited obstacle to greater market penetration of natural refrigerant-based systems is the lack of technicians trained in using the technologies. Martini, however, painted a brighter picture, insisting the situation is improving as quickly as the technology itself is developing.

"I think it's getting easier," he said. "In Europe it definitely is. But we need to work on training in South America and Asia, for sure. Here in Europe, installers are also providing more options to do training."

Technology manufacturers are also stepping up to fill the training gap. In Germany, for example, Bitzer inaugurated a new international training center – the Schaufler Academy – in February 2016. Also in Germany, Carrier opened its CO₂ OLAcademy in 2015.

"With the increased training in refrigeration, both from industry, but also from public organizations, we now have a good number of options for training our technicians," said Martini.

Martini is calling on other large retailers to join Carrefour in using natural refrigerants. "The more of us there are, the better it is for everybody," he said. "Why not work together, even if we're competitors in other aspects? Regarding technologies, it's good to exchange information between us. To work together to widen the use of natural refrigerants."

Adopting natural refrigerants now avoids new investment costs further down the line, he noted. "At Carrefour, we would like to go straight to a final solution. By using CO₂ or other natural refrigerants, we are also avoiding [the risk] that in two or three years' time, there may be another update of the [European Union] F-Gas Regulation, limiting other gases and decreasing even more the GWP of the gases that we're allowed to use in our systems."

Carrefour clearly wants to be seen as a leader in natural refrigerant adoption. "We'd like to show that it's possible to use natural refrigerants in our sector," Martini said. **AW**

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SKATING ON GREEN ICE

Patine Leisure taps Mayekawa's NewTon NH₃/CO₂ system and solar panels to turn its Japanese ice rinks into models of efficiency

- By James Ranson and Yukari Sahashi

Ice-skating rinks in Japan are not what they once were.

From a peak of as many as 550, the number of rinks has dwindled to between 150-170 in 2016. This is despite an upturn in interest in figure skating following native Shizuka Arakawa's gold medal-winning performance at the 2006 Turin Olympics.

The decline is due largely to higher energy costs. But now the trend is starting shift, thanks to the work of companies like Patine Leisure, which are adopting efficient natural refrigerant cooling technology.

Patine Leisure is a specialist in the ice-skating business, designing and installing rinks while operating and managing around 50 rinks throughout Japan. Overall, its activities cover some 90% of the ice-rink market in Japan, and it plans to expand its business to other Asian countries.

In 2014, Patine Leisure turned a corner by partnering with Mayekawa, a leading distributor of industrial natural refrigerant cooling technology, to open a next generation ice skating rink in Saitama that uses Mayekawa's NewTon S NH₃/CO₂ packaged units and solar panels.

This was the culmination of a four-year journey that began in Canada by Akinori Ogiwara, Patine Leisure's president and a former speed skater. Since then, "becoming environmentally friendly and energy efficient by using natural refrigerants" has become one of the company's core ambitions, said Ogiwara.

Akinori Ogiwara, Patine Leisure





NewTon S system at Saitama Ice Arena

Today there are eight ice rinks systems – Patine Leisure's and others – that use natural refrigerants in Japan. Around 150 rinks still employ R22 as the primary refrigerant, but as Patine Leisure has a stake in a majority of them, it hopes to convert as many as it can to natural refrigerant technology by 2020.

SHOCKING SAVINGS

During his initial trip to Canada, Ogiwara learned about an ammonia/CO₂ cooling technology from Mayekawa that was available in Sweden. He expected to hear about energy savings in the realm of 10%. What he discovered came as a shock: the energy savings were in fact closer to 30%.

Excited by the prospect, Ogiwara and his team took the opportunity to see the system in action at a Swedish national institute with representatives from Mayekawa. Following the expedition Mayekawa worked with Patine Leisure for two years on a joint R&D project to develop a NH₃/CO₂ trial system for an ice rink in Japan.

After returning to Japan, Ogiwara started trials at the company's factory in Karuizawa. The testing took two years, using ammonia freezers and CO₂ refrigerant, and comparing cooling pipes made of copper, aluminum, and other materials. The results revealed even higher energy savings of 50%.

GOING SOLAR

Following the Fukushima Daiichi nuclear and tsunami disaster in 2011 – and the subsequent rise in the cost of grid and nuclear energy – the Japanese government actively promoted renewable energy solutions such as solar power generation.

Under the circumstances, Ogiwara turned to solar not only to save on energy bills, but also to bring profits to the business by producing and selling it. Solar was tested at a curling facility in Karuizawa and at another facility in Sapporo, before being installed at one of its rinks in Nishinomiya. Given the positive results, Patine Leisure embarked on the construction of a new ice-skating rink in



From left: Emiko Lida and Akinori Ogiwara of Patine Leisure; and Kazushi Kobayashi, Kanto Block

Niigata Prefecture through the Private Finance Initiative system (PFI) whereby a local government builds the facility, and a private company (Patine Leisure) manages administration.

The move to solar led to a 50% drop in comparable energy costs at the Niigata ice rink within two years and has helped Saitama Ice arena, which has 1,680 solar panels, to become a model for pairing solar energy with natural refrigerant technology.

After installing three NewTon systems at the Nishinomiya and Sapporo locations it was determined that two would suffice at the Saitama Ice Arena, though it includes a main ice-skating rink and a sub rink that are open 16-17 hours a day. This has proven to be true even in the summer.

As a result, initial costs were slashed while the solar panels installed also provided a heat insulation effect. Overall the facility, which includes LED lighting has saved 50% in comparable energy costs.

The two NewTon units were placed on the roof of the arena while monitors were located in a staff room on the ground floor. Here, the temperatures of the ice as well as the CO₂ pressure are monitored and modulated.

The introduction of CO₂, with its innate higher pressures and consistent temperature, has also assured a more even ice surface temperature and consistently higher quality of ice.

Buoyed by system performance above preliminary expectations at its Japanese arenas, Patine Leisure hopes to take Mayekawa's technology to Southeast Asia. However, its subsidy scheme places strict restrictions on follow-up projects, which may hinder those ambitions. Also, the price of energy is expensive in Southeast Asia while the cost of exporting systems and finding suitable components is higher, too.

Meanwhile, Patine Leisure is working on a new speed-skating ice rink project in Japan. If all goes according to plan, construction will start in 2017 and be completed in 2018. **JR & YS**



From left: Tom Land, Marc Chasserot (shecco), Agustin Sánchez Guevera, René Desjardins, Glenn Gallagher, Randall Haseman (UL), Tony Lundell (IIAR) and Klara Skacanova

GRAPPLING WITH HFCs, NORTH AND SOUTH OF THE BORDER

As the world awaits a global approach to HFCs, Canada has developed its own plan while Mexico looks for funding to support its phase-down objectives

– By Michael Garry and Justina Tamasiunaite

In November 2015, 197 countries committed to work within the Montreal Protocol to find an agreement in 2016 on a global phase down of HFCs. This marked a major breakthrough after seven years of unsuccessful attempts to bring HFCs under the treaty.

The most recent Montreal Protocol meeting on this issue took place last month in Vienna, and the final meeting of the year is scheduled for October in Rwanda. ([See story, page 10.](#))

“2016 is the key year for making progress towards a global HFC phase down,” said Klara Skacanova, deputy manager – market development for Brussels-based shecco, at the standards and regulations session at ATMOSphere America in June. “The global HFC phase down will soon become a reality – whether it’s this year or next year, it’s going to happen.”

One of the proposals for an HFC phase down came from the North American countries, the U.S., Canada and Mexico, which were all represented at the ATMOSphere session. Each has been trying to reduce the use of HFCs in advance of a global agreement.



Glenn Gallagher, California Air Resources Board

"Regulatory action at the national level to reduce emissions of HFCs is intensifying across the world, said Skacanova, who added that this represents "opportunities for natural refrigerants."

CANADA PROPOSES HFC RULES

René Desjardins, controls development engineer for Environment Canada, the Canadian government's environmental agency, outlined where Canada stands today regarding HFCs and where it proposes to go.

HFCs are not manufactured in Canada but are imported in bulk and in pre-charged cooling equipment and other products. Currently, federal, provincial and territorial regulations prohibit the release of HFCs in refrigeration, air-conditioning, fire-extinguishing and solvent systems. But Canada does not prevent the entry of HFCs into the market or limit their usage.

However, the Canadian government has developed a series of proposed regulatory measures to reduce HFC consumption. The first is a phase-down measure for companies that import bulk HFCs, which is aligned with the North American Montreal Protocol plan. It would establish reduction steps (calculated in CO₂ equivalent) from a baseline level (HFC imports in 2014 and 2015), starting with a 10% reduction in imports in 2019; a 35% reduction in 2024; a 70% reduction in 2030; and an 85% reduction in 2036, where it stops.

"HFCs in pre-charged equipment would not be included in this phase down," said Desjardins.

However, imports and manufacture of pre-charged equipment and other products containing HFCs would be targeted under another proposal that establishes product-specific controls. This would prohibit, by a specific year, the import and manufacture of specific systems that contain, or are designed to contain, any HFC or HFC blend with a GWP greater than a designated limit.

For example, centralized refrigeration and stand-alone low-temperature commercial refrigeration could not contain HFCs with a GWP above 1,500 starting in 2020; the GWP limit for stand-alone medium-temperature refrigeration would be 650 in 2020; and the GWP limit for domestic refrigeration and mobile air conditioning would be 150 by 2025 and 2021, respectively.

"People could continue to use equipment currently in use," said Desjardins. "We're targeting manufacture and imports."

The main driver for the Canadian government is the HFC phase down, he noted. "We have used that for HCFCs and it worked very well." The limits on specific products "are there to support the phase down."

Environment Canada has received comments on the proposals from interested stakeholders and is "currently considering the comments." Pre-publication of a proposed final regulation, followed by a 75-day public comment period, is expected in late 2016/early 2017.

MEXICO LOOKS TO MONTREAL PROTOCOL

As a developing country, Mexico has received funding from the Multilateral Fund of the Montreal Protocol for the transition away from ozone-depleting CFCs and HCFCs. Mexico is now looking forward to an agreement within the Montreal Protocol on HFCs that would enable a similar phase down of HFCs in the country, said Agustín Sánchez Guevera, national coordinator of Mexico's Ozone Protection Unit, who is responsible for the phase outs of CFCs and HCFCs.

"To control HFC emissions, the best way is to phase down consumption and production as we do [with CFCs and HCFCs] in the Montreal Protocol," he said.

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REACTION TO CARB'S HFC PLAN

The California Air Resources Board (CARB) has developed one of the most ambitious plans in the world for reducing emissions of short-lived climate pollutants (SLCPs), including HFCs, which it released in April.

Among the proposals in the SLCP strategy is a prohibition on refrigerants with GWPs of 150 in new stationary non-residential refrigeration equipment, beginning Jan. 1, 2020. (See ["Leading By Example," Accelerate America, December 2015-January 2016.](#)) The plan includes an HFC phase down in California in the absence of any global or national phase-down plan. "We'd love to see a [national and] global phase down, but we're not going to wait for that to happen," said Glenn Gallagher, air pollution specialist for CARB.

During the official comment period (through May 26, though CARB is still accepting comments), CARB received "25 substantial comments on HFCs," mostly from OEMs. "Most accepted an inevitable HFC phasedown if it is gradual," said Gallagher. "They were overwhelmingly against the 2020-2021 start for low-GWP equipment, which was not a big surprise."

In addition, the OEMs insisted that CARB align with the EPA on national requirements to avoid California-only regulations. "That's actually what we want," he said. "Nobody really wants two standards in the same country."

CARB's next step is to tweak the SLCP plan and take it to its board in the fall. Following approval from the board, CARB will commence the HFC rulemaking process in 2017. It will hold many stakeholder meetings from 2016 to 2018, in anticipation of issuing new regulations in late 2018 or early 2019.

Gallagher said CARB welcomes being educated on natural refrigerant alternatives to HFCs. "The industry is moving so fast we can barely keep up with it."



Glenn Gallagher, CARB

“To control HFC emissions, the best way is to phase down consumption and production as we do [with CFCs and HCFCs] in the Montreal Protocol.”

→ Mexico passed a Climate Change General Law in 2012 that aims at reducing overall greenhouse gas emissions by 30% (compared to 2000 levels) as of 2020 and by 50% as of 2050. The goals “could be reached if an international regime like the Montreal Protocol is established for the technology and financial support to developing countries,” said Sánchez Guevera.

Mexico has also set up a special program targeting short-lived climate pollutants such as HFCs, as well as a national emissions registry requiring companies to report their emissions of greenhouse gases like CFCs, HCFCs and HFCs. The country has also developed codes to monitor HFC imports and safety standards for flammable gases.

A key barrier to the adoption of natural refrigerants in Mexico, said Sánchez Guevera, is the lack of a trained service sector. “If manufacturing companies don't have servicing in the market, they can't put their products in the market. So they are waiting until we have well-trained technicians in the service sector.”

His hope is that an HFC amendment within Montreal Protocol will “give us funding to train technicians and allow the government to set rules in order to use alternatives like natural refrigerants.”

Tom Land, manager of the EPA's GreenChill Partnership, pointed out that the Montreal Protocol's Multilateral Fund, which is focused on helping developing countries transition away from HCFCs, “has a clear bias toward leapfrogging industries over HFCs into [natural refrigerants like] hydrocarbons for small air-conditioning units. We're leaning against high-GWP solutions and toward the lowest GWP solution, which puts money into the pockets of natural refrigerants.” **MG & JT**



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Ammi Amarnath, EPRI



Neal Latham, ComEd



PUTTING MONEY ON THE TABLE

Utilities like Southern California Edison, Bonneville Power Administration and ComEd are offering companies incentives to help finance energy-efficient natural refrigerant projects

— By Michael Garry

In the U.S., utilities budgeted about \$6 billion in 2013 to promote energy efficiency through incentives.

Part of those funds were used to support “newer technologies” that save energy, such as those that use natural refrigerants, said Ammi Amarnath, senior program manager for the Electric Power Research Institute (EPRI) at the start of a panel discussion on utilities and incentives at ATMOsphere America 2016 in Chicago.

EPRI, a Palo Alto-based R&D organization funded by utilities around the world, aims to stimulate innovation and help accelerate energy-efficient technology “to commercial development,” said Amarnath. Natural refrigerant systems are among the technologies that EPRI is targeting.

The three utilities in the panel discussion all acknowledged the delays often associated with incentive funding for natural refrigerant technologies, particularly custom projects.



Paul Delaney, Southern California Edison



Ryan Fedie, Bonneville Power Administration



Glenn Gallagher, California Air Resources Board

\$8 MILLION FOR EMERGING TECHNOLOGIES

One major utility that has started offering custom incentives to companies using natural refrigerant systems is Southern California Edison (SCE), which serves nearly 14 million residents over a wide swath of the Golden State. SCE has about \$8 million to spend on incentivizing the adoption of "emerging technologies," said Paul Delaney, senior engineer for the utility. "It's about how helping jump over the chasm and moving ahead with technologies that make a lot of sense."

Based on research done on a low-charge ammonia packaged system at a Lineage Logistics cold storage warehouse in Oxnard, Calif., SCE is offering custom incentives of \$0.08/kWh of energy saving, and \$150/kW of demand reduction. "For any technology that saves energy and demand, we can always do a custom incentive," said Delaney. These incentives require "before and after measurement" to validate the energy savings.

Because SCE serves a 50,000-square-mile area with eight climate zones, some incentives, including those for

natural refrigerant systems, take a "hybrid of calculated" approach based on temperature and application.

Delaney acknowledged that SCE likes deemed (express) incentives, designed for technologies that have proven efficiency track records. "Those have lower administrative costs and are straightforward."

Another low-charge ammonia system SCE is studying is the NewTon 3000, an ammonia-CO₂ packaged system with 220 lbs. of ammonia charge. The system is installed at a food processor in Irvine, Calif., the first U.S. deployment of the NewTon, made by Japanese OEM Mayekawa.

In addition to low-charge ammonia systems, SCE is looking at ultra-low-temperature freezers, self-contained display cases that use propane, and high-efficiency R22 replacements.

Delaney noted that incentives for custom projects may be delayed while they are evaluated by the California Public Utilities Commission. However, SCE is moving toward a "performance-based" program

that would include up-front funding followed by incremental payouts during validation.

NO NEW POWER PLANTS

The Bonneville Power Administration (BPA) is a federal utility wholesaler that sells and transmits carbon-free power (generated by hydro and nuclear sources) to retail utilities in the Pacific Northwest. BPA is offering incentives to "spur new technologies that make businesses and homes more efficient," said Ryan Fedie, engineering manager for BPA.

In its efficiency programs, BPA is following the lead of the Northwest Power and Conservation Council, which is striving to offset 90% of the load growth in the Pacific Northwest over the next two decades via energy efficiency and demand management. "The goal is to not build new power plants," Fedie said, and to transform end uses to be more energy efficient. "And dollars are available to build energy efficiency."

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→ Like SCE, BPA provides “one-off incentives for energy reduction” but is trying to move to more deemed incentives, which are “more standardized, make dollars available earlier, and don’t have to be validated,” Said Fedie.

BPA stresses data collection to determine the efficiency of new technology. To that end “we go on site and monitor electricity use by submetering circuits,” he said. For new equipment, that process could take up to a year.

Data supporting the business case is used to persuade end users who are “hesitant to deploy new equipment,” said Fedie. “We show the end user why they should make the investment.”

WIDE-RANGING PROGRAM

ComEd, an electric utility that serves 3.9 million customers in the northern Illinois region that includes Chicago, started its energy-efficiency program in 2008 following passage of state legislation. The program covers assessments, incentives, discounts and optimization, explained Neal Latham, ComEd’s custom and industrial systems program manager.

The incentives program includes standard incentives for commercial and industrial lighting, HVAC and refrigeration. ComEd has a new “comprehensive energy savings” offer such whereby “the more projects are completed, the greater the incentive.”

ComEd’s custom incentives program provides cash for more complex programs not covered by the standard program. “If you’ve got something new and it saves energy, bring it to us,” said Latham.

To speed up the delivery of custom incentives, ComEd is “looking at phased payments that would start when the equipment arrives,” said Latham. “We’re doing a small pilot.”

For new construction or a major renovation, ComEd offers incentives for projects that implement at least two “significantly-beyond-code conservation measures,” including HVAC and refrigeration. The earlier in the design process the incentive is applied for, the larger the incentive, he noted.

ComEd also offer an optimization program targeted at medium-to-large industrial customers; refrigeration is among the systems that can be studied. In addition, a retro-commissioning program is available to identify and implement low-cost energy-saving improvements to buildings. **MG**

CALIF. INCENTIVE FUNDS ON HOLD UNTIL 2017

California’s refrigerant incentive program, which has earmarked \$20 million for businesses planning to install low-GWP refrigeration equipment, is on hold until 2017.

That was the word from John Bush, senior engineer for the Electric Power Research Institute (EPRI), who spoke on behalf of the California Air Resources Board (CARB) July 26 at EPRI’s Energy Efficiency & Demand Response Symposium in Long Beach, Calif.

The reason cited for the delay was “reduced cap-and-trade proceeds,” said Bush.

The refrigerant incentive program had been expected to kick off in 2016 as early as July, pending approval of the California state budget. The program was included in CARB’s Short-Lived Climate Pollutant (SLCP) strategy, aimed at reducing emissions of SLCPs, including HFCs.

Once the \$20 million funding for the incentive program is finalized, CARB will be open to public comment on how the funding should be used, and then will start soliciting applications for award grants, said Glenn Gallagher, air pollution specialist for the California Air Resources Board (CARB), at a panel discussion on utilities and incentives at ATMosphere America in June in Chicago.

The funding will go primarily to small retail food businesses, particularly in disadvantaged communities, though any business or non-profit can apply, and other applications such as air conditioning will be considered.

Gallagher said CARB is open to help from California utilities in identifying recipients for funding and even applying on behalf of businesses. “We’re very excited about possible grants from another source,” said Paul Delaney, senior engineer for Southern California Edison, a participant in the panel discussion.

The program is technology-neutral, but is geared toward new systems using refrigerants with a GWP of under 150, as well as retrofits of existing equipment that reduce greenhouse gas emissions, and stand-alone refrigeration units that use hydrocarbon refrigerants.

CARB plans to apply for a fresh \$20 annually over five years for a total of \$100 million, said Gallagher.

He noted that unlike utility incentives that are focused on energy efficiency, the refrigerant incentive program is about the refrigerant’s GWP. “This is not electricity reduction; it’s greenhouse gas emission reduction.”



Glenn Gallagher, California Air Resources Board



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COLD CHAIN CONVERGES IN CHICAGO

Meeting for the first time at McCormick Place, the Global Cold Chain Expo and FMI Connect showcase natural refrigerant systems for cold-storage operators and food retailers, respectively

— By Michael Garry

The inaugural Global Cold Chain Expo, held at Chicago's McCormick Place Convention Center June 20-22, marked several firsts in the cold-storage industry.

It was the first time the Global Cold Chain Association (GCCA) convened a trade show exhibition separate from its annual IARW-WFLO Convention, which was held in April with presentations, networking opportunities and a small supplier showcase.

And for the first time GCCA partnered with another trade group — the United Fresh Produce Association — in putting on co-located industry events. In addition, the two trade groups shared McCormick Place with the International Floriculture Expo and Food Marketing Institute (FMI) Connect, the latter attended by top executives in the supermarket industry.

Total attendance at the shows approached 13,000, including 1,200 cold-chain executives from 18 countries and 165 exhibitors at the Global Cold Chain Expo. "For the first time, all sectors of the world's cold chain came together under one roof," said Eben James, chairman of IARW and president/CEO of Trenton Cold Storage, Trenton, Ontario.

Accelerate America interviewed a number of exhibitors at the Global Cold Chain Expo and FMI Connect about their natural-refrigerant solutions, and compiled the following report.



Global Cold Chain Expo

LOW-CHARGE BUZZ

Low-charge ammonia, an increasingly popular trend in the cold-storage industry, was in play at a number of Global Cold Chain Expo booths. "Low charge is one of the biggest things we're seeing," said Hanks McCrory, business development manager, national accounts for contractor and manufacturer Cimco Refrigeration.

"The primary buzz here is about low-charge," added Mark Turner, national director of sales for contractor Stellar, which designs custom low-charge ammonia skids using glycol or chilled water. "The motivator is to get below 10,000 lbs. of ammonia because they don't want to deal with the compliance side, especially in California."

Colmac Coil was promoting its low-charge DX evaporator coils, which it sells to contactors who install them in low-temperature applications in concert with a machine room. Colmac also provides the coils to companies like NXCOLD and Azane that employ them in low-charge package units.

"The market didn't exist 24 months ago and now we're seeing plants with 30 low-charge units going in," said Todd Shelden, sales manager, Colmac Coil.

There are still hurdles to overcome as the industry transitions to low-charge systems, Shelden noted. In low-charge DX systems, the maintenance crew needs to adjust to technology like electronic expansion valves that are not present in traditional large-charge, recirculated ammonia systems. And the maintenance costs of low-charge packaged units remain a challenge in installations with many units.



HILLPHOENIX'S CO₂ AND NH₃/CO₂ SYSTEMS

On its industrial side, Hillphoenix markets transcritical CO₂ systems to a variety of small-to-medium-size end users, including ice rinks ([see "Skating on CO₂-Made Ice," Accelerate America, May 2016](#)), pharmaceutical companies, food processing plants and cold-storage facilities.

For example, Hillphoenix's transcritical systems are installed at five Roche and Genentech (a division of Roche) pharmaceutical facilities in North America.

Hillphoenix is partnering with Bitzer on its first deployment of an ammonia/CO₂ cascade system at a 500,000-square-foot food processing facility in Mexico that serves restaurant chains, said Tim Henderson at the company's Global Cold Chain Expo booth. The installation, which will be completed by the end of the year, includes an NH₃/CO₂ system for low-temperature loads and an NH₃/glycol system for medium-temperature loads. In both cases ammonia is the primary, low-charge refrigerant confined to the compressor-condenser area.

Had a transcritical CO₂ system been used at this facility, the facility's size would have required a large number of transcritical compressors; this led the food processing company to opt for the NH₃/CO₂ system. The availability of a large transcritical compressor for industrial applications would have reduced the number required, noted Henderson. But currently the largest transcritical compressor is a 4-cylinder, 30hp unit. Bitzer has developed one that is 6-cylinder, 50hp, but it still needs UL approval, which should come by the end of the year, said Joe Sanchez, engineering manager, Bitzer U.S.

Bitzer will be marketing the larger compressor to supermarkets along with industrial facilities. "Stores using eight compressors in parallel could knock that down to five or six compressors, which would be a big cost advantage," said Sanchez.

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→ At the Global Cold Chain Expo, Bitzer discussed low-charge ammonia systems; the company supplies open-drive screw compressors to all of the major low-charge OEMs for capacities ranging from 10-150TR. "The beauty of low-charge is that you can dial into the exact size," said Sanchez.

The Environmental Protection Agency's proposed delisting of R404A, R407A, R410A and R507A, among others, for new cold-storage warehouses as of 2023 could impact condensing unit manufacturers, and lead to more low-charge ammonia and transcritical CO₂ installations, noted Sanchez.

MORE CO₂ AND NH₃/CO₂

Krack Corp., a division of Hussmann that makes evaporators for commercial walk-in coolers and freezers, among other products, exhibited at the Global Cold Chain Expo adjacent to Hussmann transcritical CO₂ partner Systemes LMP.

Currently, Krack supplies evaporator coils for commercial transcritical applications, but not industrial. "But that's what we're working toward," said Bob Baker, regional sales manager, Krack Commercial, Wentzville, Mo. "We're doing pressure tests on evaporators for industrial CO₂ equipment at our R&D plant."

Heatcraft, which has installed 50 CO₂ cascade systems in supermarkets (including an NH₃/CO₂ system at a Piggly Wiggly store in Georgia), "is starting to get more requests for CO₂ systems in the industrial space," including transcritical and cascade, said Ajit Kailasam, cold storage manager for Heatcraft at Heatcraft's Global Cold Chain Expo booth. The industrial CO₂ systems handle capacities ranging from 100TR to 300TR.

While the price of industrial CO₂ systems is not at the point where "the market is ready to embrace them," it is coming down, thanks to lower component costs, said Kailasam.

Carnot Refrigeration offers both NH₃/CO₂ and CO₂ transcritical systems to the cold-storage market; the latter has fewer components and is less expensive, noted Frederic Houle, account manager for Carnot. "We can do a system with ammonia, but we think CO₂ [transcritical] is better."

Many large cold-storage operators are resistant to changing from traditional ammonia systems, said Houle, adding, "We're trying to improve that."

In Canada, Carnot has CO₂ industrial transcritical systems in five cranberry warehouses, noted Houle. More than 100 supermarkets in Canada and the U.S. use Carnot's commercial transcritical system.

At the Global Cold Chain Expo, Danfoss promoted the updated version of its ICF Flexline industrial control valves, the ICF (H) A4A, which has flanges that enable it to directly replace all common flange control valves. At the same time the modular unit interchangeably supports three different valves – motorized control, pilot operated and gas-powered. The ICF (H)A4A was introduced late last year.

Danfoss also showcased a stainless steel version of its ICF valve station, released in March, which includes myriad valves such as stop, expansion and solenoid. "More and more on the food side, people want stainless steel valves," said Terry Chapp, national business development manager, industrial refrigeration, North America, for Danfoss. "They're tired of fighting corrosion."



Danfoss ICF valve station



Hillphoenix AdvansorFlex, a downsized transcritical CO₂ unit, at FMI Connect booth

FMI Connect

ADVANSORFLEX AT 30-40 STORES

Hillphoenix has already installed its recently introduced AdvansorFlex CO₂ transcritical unit – a downsized, less expensive version of its traditional Advansor CO₂ transcritical booster system – in 30-40 U.S. stores, said Derek Gosselin, the Conyers, Ga.-based company's systems technical sales manager.

Gosselin said the stores are operated by “national small-format companies,” declining to name them for publication without their permission. He discussed the system with *Accelerate America* at Hillphoenix's FMI Connect booth; the interview took place about 15 feet from an AdvansorFlex demonstration unit, which attracted a number of inquiries at the show.

AdvansorFlex, introduced in December 2015, “is a great attempt to reduce the cost of [a transcritical] system so that it's more competitive with HFC [systems],” said Gosselin. “It opens the door to providing a lower-cost solution for small formats, about 15,000 to 18,000 square feet.” These would include small-format supermarkets, dollar stores and convenience stores. Multiple units could be employed in larger stores.

AdvansorFlex can be located either inside or outdoors, and takes up less floor space in back rooms, equipment rooms, mezzanines, and rooftops than traditional rack systems. It is designed for straightforward installation, ease of maintenance, and reliable, cost-saving, day-to-day operation, said Hillphoenix.

The standard Advansor system has been widely installed in Europe and is beginning to make headway in the U.S. and Canada, with installations at stores operated by Whole Foods, Kroger, Roundy's, Food Lion and DeCicco & Sons, among others.

Like the Advansor, AdvansorFlex reduces energy costs by 5% to 18% compared to an HFC system, depending on the ambient climate, according to Hillphoenix. Installation costs of the AdvansorFlex run 12% to 18% less than those of a standard HFC system as a result of smaller copper tube sizes and less insulation, wiring and labor.

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FRASCOLD BACKS PROPANE CHILLER

Frascold USA, a division of Italian compressor maker Frascold, is supporting the adoption of propane/glycol chillers using its compressor technology in the U.S.

The chillers, which are used in European supermarkets but not in the U.S., employ on average 20-30 lbs. of propane as the primary refrigerant, and glycol as the secondary refrigerant in medium-temperature applications, said Kristian Ellefsen, CEO of Frascold USA, in an interview at the Frascold's Global Cold Chain Expo booth.

The current charge limit on propane is 150g. Approval from the Environmental Protection Agency and local fire departments would be needed to allow adoption of a propane chiller in the U.S. “We keep pushing,” said Ellefsen.

“We should be able to go beyond 150g,” he added. “There's more than that in a propane grill, and you set that on fire. So why worry about it in a chiller on the roof?”

Moreover, safeguards are designed into a propane chiller. “It's a closed system, so there's no oxygen available for a fire,” said Ellefsen. “And when you do have a leak, the propane goes up into the atmosphere.” Propane has a GWP of three, making it a non-factor in global warming. “We're trying to get people in the U.S. to understand how environmentally friendly and how safe it is.”

Frascold has three compressor lines that can accommodate a propane chiller: semi-hermetic reciprocating, semi-hermetic screw, and compact screw.

Ellefsen said U.S. food retailers and craft beer breweries are interested in propane chillers, which are being tested by OEMs that he declined to name.

One major U.S. food retailer, which asked not to be named, plans to pilot a propane/CO₂ cascade refrigeration system.



Kristian Ellefsen, Frascold USA



Hussmann's FMI Connect booth

→ HUSSMANN MULLS MOVES

While U.S. refrigeration manufacturer Hussmann touted its recent acquisition by Japanese electronics giant Panasonic at FMI Connect, the Bridgeton, Mo.-based company did not divulge which Panasonic refrigeration products it would be bringing to the U.S. market.

"We're trying to introduce Panasonic to our customers," said Andres Lacassie, director, retail products portfolio, Hussmann, at the company's booth. "We're going to use their technology in the future to provide additional value to the market."

But he added that Hussmann has not decided "what we are going to bring or by when. We are reviewing what makes the most sense for the market and our customers."

Panasonic's \$1.5 billion acquisition of Hussmann was announced late last year and closed on April 1. Hussmann is continuing to operate autonomously as an independent subsidiary of Panasonic. "It takes time until we understand each other, and we understand their value proposition to the market, and how we can support it," said Lacassie.

In Japan, Panasonic markets transcritical CO₂ condensing units to small-format outlets like convenience stores. The company hopes to leverage Hussmann's sales and service network to introduce its CO₂ units to small-format stores and foodservice establishments in the U.S., Canada and Mexico. ([See "Panasonic's Hussmann Acquisition Signals Confidence in CO₂," *Accelerate America*, April 2016.](#)) Panasonic's CO₂ condensing unit has not yet been UL-certified, noted Quentin Crowe, product manager for Hussmann.

Meanwhile, Hussmann is also in a partnership with Quebec-based Systemes LMP to market CO₂ transcritical rack systems to large-format retailers. "We're seeing tremendous activity with CO₂ [racks] in supermarkets," said Lacassie. He said Hussmann does not see a conflict between Panasonic and Systemes LMP. "They are complementary."

Hussmann has also supplied self-contained cases using propane as a refrigerant to two Texas retailers – H.E. Butt Grocery and Lowe's Markets. "We feel [propane units] will play a part in the future," said Lacassie. **■ MG**

REGULATORS KEEPING EYE ON LOW-CHARGE SYSTEMS

It is well known that U.S. facilities with 10,000 lbs. or more of ammonia refrigerant face strict regulatory requirements under the Environmental Protection Agency's Risk Management Plan (RMP) and the Occupational Safety and Health Administration's Process Safety Management (PSM) program.

But what about facilities with under 10,000 lbs. of ammonia charge, including many of the new breed of low-charge ammonia systems? How much scrutiny do they face under the agencies' less restrictive General Duty Clause?

"Both agencies are trying to apply PSM- or RMP-like requirements to facilities under 10,000 lbs.," said Lowell Randel, vice president of government and legal affairs for the Global Cold Chain Alliance, in a presentation at the Global Cold Chain Expo 2016 in Chicago last month. For example, if a company runs some facilities with more than 10,000 lbs. of ammonia, and others with less than 10,000 lbs., the agencies will expect the latter "to apply the same hazard reduction principles" as the former.

Overall, though, the regulatory burden does lessen with a charge under 10,000 lbs. "Your reporting and documentation requirements are a lot less, and you're not subject to programmed inspections," said Randel. Moreover, a 500-lb. system will present a much different type of hazard protocol than a 9,000-lb. system, even though both are under 10,000-lbs.

Still, EPA or OSHA could do a general-duty inspection, or one following an accident or complaint, in a facility with less than 10,000 lbs. of ammonia. "And once an agency is inside your building, they are going to want you to address the same kinds of hazards in the general duty clause as in RMP/PSM facilities."

Randel said that industry associations are meeting with the agencies to discuss low-charge ammonia systems and the lesser hazards that they present. "They're listening; they understand the hazards are different," he said. "But they say there are still some of the same hazards as in larger systems."

The International Institute of Ammonia Refrigeration (IIAR) has an ammonia resources manual (ARM) that offers general-duty clause guidance to ammonia refrigeration operators. The organization is now looking at developing a similar manual for low-charge systems with 500 lbs. or less of ammonia – an "ARM-light," said Randel. "We're hoping down the road, if people follow that manual, they would be meeting the general-duty clause. But we've got a ways to go."



Lowell Randel, GCCA



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GOING NATURAL IN BRAZIL

A two-day workshop in São Paulo covered many of the natural refrigerant trends seen in North America, as Brazil pursues alternatives to HCFCs and HFCs

— By Alvaro de Oña

With Brazil seeking to eliminate 51% of existing HCFCs by 2021, its refrigeration industry is exploring alternatives such as natural refrigerants to ensure a smooth transition – despite the economic crisis currently engulfing the country.

Many natural refrigerant options for industrial and food retail applications were discussed by more than 200 experts at a two-day workshop in São Paulo last month called “&R” to highlight its focus on refrigeration solutions. Among these were: low-charge ammonia; cascade systems using ammonia or hydrocarbons with CO₂; hydrocarbons; transcritical CO₂; and water-based chillers. Training of technicians and engineers, along with a clearer focus on improving energy efficiency, appeared as top priorities for Brazil in the medium term.

Hosted by the most prominent Brazilian HVAC&R Associations (including ABRAVA, ASBRAV and ASHRAE’s Brazilian chapter),

the workshop devoted the first day to industrial refrigeration applications, and the second to food retail solutions.

LOW-CHARGE POSSIBILITIES

Eric Smith, vice president and technical director for IAR (International Institute of Ammonia Refrigeration) presented IAR-2, the association’s newly updated safety standard for ammonia. The standard, which provides clear guidelines on the safe installation and handling of ammonia systems, for the first time addresses low-charge ammonia packaged systems, considered by many to be a “game changer” for industrial refrigeration.

As an example, Carlos Suffert, a director for SPM, cited an industrial plant that went from using eight tons of ammonia in a centralized system to a cascade design requiring only 132 lbs. of the refrigerant for each circuit.



&R Workshop

Celina Bacellar, industrial refrigeration manager, Latin America for Johnson Controls, focused on chillers developed specifically for natural refrigerants, such as the compact packaged ammonia chillers. She also described an innovative propane-based chiller that had recently been installed in Costa Rica, offering excellent performance and reliability.

Speaking from an end user perspective, René Van Gerwen, former global head of refrigeration at Unilever, called on contractors and suppliers to be more proactive about offering solutions to improve efficiency and sharing know-how. He anticipates more stringent safety standards and a strong focus on efficiency improvements – as well as a wider uptake of natural refrigerants – as major trends for the sector.

CO₂ IN FOOD RETAIL

The transition away from ozone-depleting substances towards natural refrigerants in the food retail sector was also widely discussed.

Rogério Marson, representing Brazilian supplier Eletrofrío, explained how the company is developing a wide range of solutions based on CO₂ to eliminate R22 in new installations, either in direct systems or as a secondary fluid. Marson also announced that a new store using transcritical CO₂ would open next year in the city of Curitiba, in southern Brazil.

Marcos Euzébio, applications engineer for Bitzer, focused on the performance of CO₂ compressors across the South American continent. Euzébio also highlighted the importance of training technicians and industry experts as a key to successfully transitioning away from HCFCs and HFCs in Brazil.

The importance of training for the sector was also highlighted by Dennis Huehren, representing GIZ Proklima, which promotes green-cooling technologies globally. He showed how the organization is making a strong effort to disseminate knowledge about hydrocarbon safety in Brazil, including the free distribution of a dedicated manual in Portuguese adapted to the Brazilian market. **AO**

BRAZIL'S SECOND TRANSCRITICAL STORE

The second supermarket to use a transcritical CO₂ system in Brazil, an Atacadão outlet, opened its doors officially on June 16 in Atibaia, in the state of São Paulo.

Having successfully tested the system, store managers expect it to improve the store's energy efficiency and deliver reliable operations in the hot and humid conditions of south Brazil.

Brazilian retailer Atacadão, part of the Carrefour group since 2007, specializes in the "Cash & Carry" concept. With over 124 stores and 22 distribution centers across Brazilian territory, it is one of the national leaders in its sector. The new store reflects the group's policy to gradually introduce natural refrigerants across all new stores. (The first CO₂ transcritical installation in Brazil was in a Carrefour hypermarket in Cambuci, a district of São Paulo; [see story page 40.](#))

"Surely, natural refrigerants are going to be the solution for most applications in Brazil," said Mauricio Neto, a consultant helping Atacadão in its refrigeration installation at the store, just days before the opening.

His remarks echo the sentiment of many other Brazilian experts, who see an opportunity to leapfrog from ozone-depleting HCFCs directly to natural refrigerants in updating existing installations across the country. The performance and reliability of recent installations with natural refrigerants is therefore crucial to the future deployment of the technology on a wider scale in the region.

With a total commercial surface over 20,000 square feet, the Atacadão store relies on a centralized transcritical CO₂ system. Supplier Advansor provided two racks, with a refrigerant charge of 330 lbs. each. The system includes parallel compression, using Bitzer compressors, and direct evaporation.

Complementary to the centralized system, the store also uses large stand-alone refrigeration cabinets with propane (R290) supplied by Austrian manufacturer AHT.



Transcritical CO₂ system at Atacadão store.

EMBRACO STEPS UP HYDROCARBON FOCUS

Seeing a ripe market for propane units in the U.S., the Brazilian compressor maker is introducing a made-for-America compressor and a plug-and-play condensing unit

— By Andrew Williams



I've been working for Embraco for three years," said John Prall, technical support engineer at Embraco North America, during an interview at ATMOsphere America in Chicago in June. "When I first started, all I dealt with was HFC compressors. This year, I'd say 90% of my efforts are dedicated to hydrocarbon compressors."

Indeed, the Brazilian compressor giant is putting a great deal of emphasis on hydrocarbon units this year. In the U.S. hydrocarbon (mostly propane) compressors are expected to represent 20% of the company's U.S. sales, up from 11% in 2013, said Marek Zgliczynski of Embraco at ATMOsphere America's State-of-the-Industry session ([see page 14](#)).

At the AHR Expo in Orlando, Fla., in January, Embraco unveiled two hydrocarbon compressors — the EMC (formerly EM3) and the Fullmotion variable-speed compressor — and a hydrocarbon condensing unit, the Plug n' Cool. (See "Natural Refrigerant Components on Parade," *Accelerate America*, February 2016.)

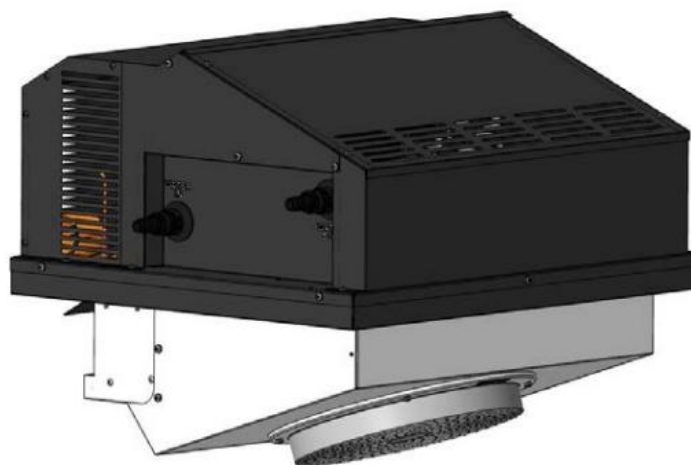
Hydrocarbon technologies are attractive to customers because they perform efficiently while at the same time benefitting the environment. "It's a win-win for everyone," Prall said.

Prall believes efficiency and performance will always come first, but sees "pockets of the market that do care more about the environment." These factors, along with government regulation, are helping to grow the market for hydrocarbon technology in the U.S., he said.

BUILT IN NORTH AMERICA

At ATMOsphere America, Embraco showcased the EMC and the Plug n' Cool. The EMC, a third-generation product manufactured in Mexico, is designed specifically for the North American market. "It's going to be our first commercial product built in North America," Prall said. "We're designing it for a very wide envelope, so it can be used from freezers to bottle coolers to ice machines."

Set for launch in October, the new compressor harnesses improved motor technology and valve design to improve efficiency by 25%-35% compared to Embraco's current hydrocarbon offering. "It's going to be cost-neutral to the product that it is replacing, roughly," Prall said. "Efficiency for free!"



Plug 'n Cool propane system

Most of the applications using the EMC require charges of 60g-70g, well within the 150g charge limit imposed by the Environmental Protection Agency.

The Plug n' Cool system for propane, meanwhile, is a complete cooling system designed for reach-in coolers in grocery stores, supermarkets and professional kitchens. It is "plug and play" solution that simplifies the installation process, allowing design engineers to easily build market-ready, water-cooled display systems.

As a result of its modular concept, Plug n' Cool allows owners to move machines piece by piece, providing flexibility in the store layout based on specific needs and preferences.

The system is cost-effective for retailers, "as they are able to maintain the systems themselves with a sufficient water supply and lines to cabinets," said Prall.

A case study presented at ATMOsphere America compared Embraco's Plug n' Cool system to a DX remote refrigeration system. The study found that Plug n' Cool reduced the refrigerant charge by 98% (330 pounds to six pounds), and cut overall energy consumption.

"Plug n' Cool allows original equipment manufacturers to use a natural refrigerant, which is significantly better for the environment," said Prall. **AW**

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Issue #17

July-August 2016

Publication date: Jul. 19

Focus: Accelerate America Award Winners. Includes coverage of ATMOsphere America, FMI Connect/Global Cold Chain Expo.

Ad submission deadline: Jul. 8

Issue #18

September 2016

Publication date: Sep. 6

Focus: Food Retail.

Distribution at FMI Energy & Store Development Conference, Sept. 11-14.

Ad submission deadline: Aug. 26

Issue #19

October 2016

Publication date: Oct. 11

Focus: Transport refrigeration. Includes coverage of FMI Energy & Store Development Conference.

Ad submission deadline: Sep. 30

Issue #20

Nov. - Dec. 2016

Publication date: Nov. 15

Focus: Regulations and Standards.

Ad submission deadline: Nov. 4

Additional Topics:

- » Ice Rinks
- » Data Centers
- » New Technology
- » Mobile Air Conditioning
- » Buildings (residential)
- » Buildings (hospitals, universities, offices, government, hotels, sports, shopping centers, airports)
- » Research

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