

# ACCELERATE

ADVANCING HVAC&R NATURALLY

MAGAZINE

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ANDERSON

◎ TARGET

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FOR COURCHESNE LAROSE

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MAJOR CLIMATE  
ACCORDS IN 2015?



SPECIAL  
2015  
AHR EXPO  
ISSUE



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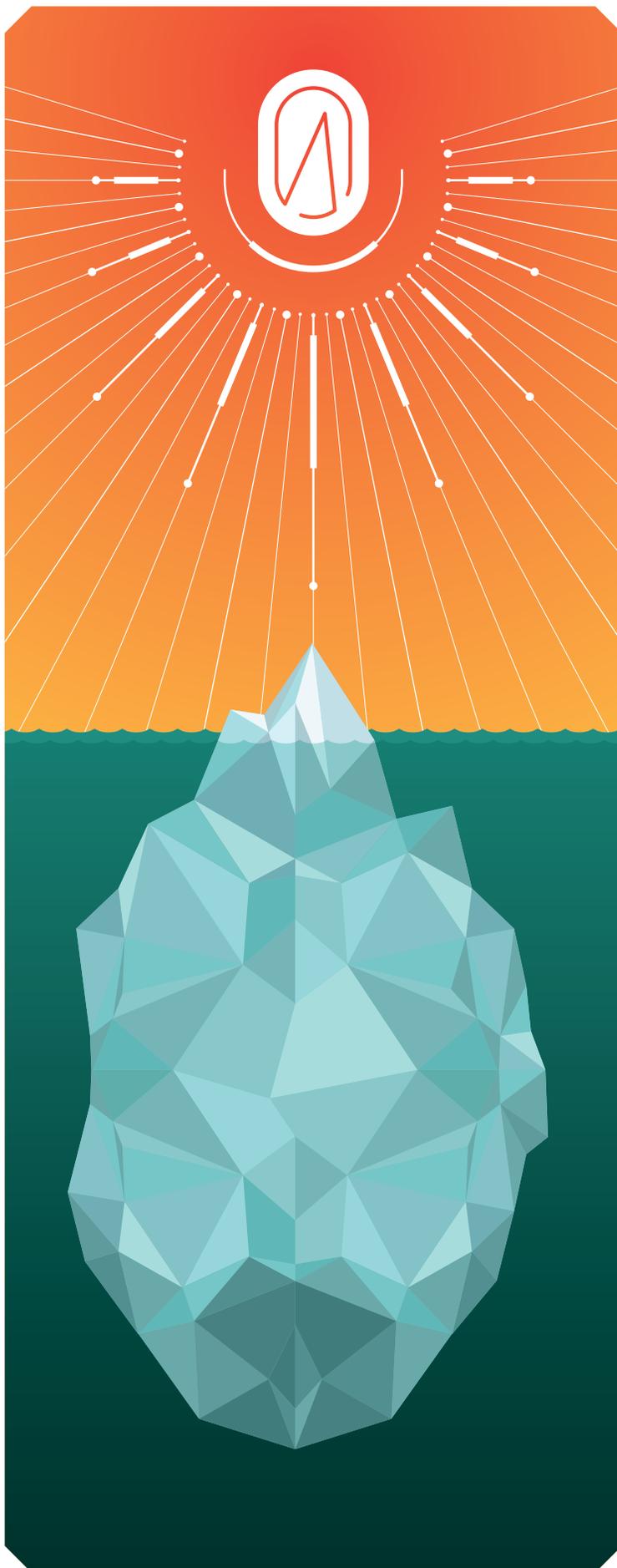
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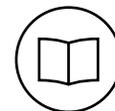


ENGINEERING  
TOMORROW

*Danfoss*



Publisher's note by [Marc Chasserot](#)



## TIP OF THE ICEBERG

Welcome to issue 3 of *Accelerate America*. It's our AHR Expo special issue, and our first to be printed and distributed at a major trade show.

We've been covering great people since the launch of the magazine late last year and the feedback has been excellent. Our readers like our content and they want more cutting-edge reporting about natural-refrigerant-based technologies and how these are going to disrupt and spur innovation within the HVAC&R industry across North America.

As we settle into an exciting 2015, I have great news for you – we've only just started. This truly is only the "tip of the iceberg." On the back cover of this issue, you will find our updated Editorial Calendar for the coming year, where we clearly show that *Accelerate America* will cover a wide variety of sectors within HVAC&R. Not just food retail and industrial refrigeration. We will cover many trade shows every month and talk to industry insiders about their expectations for natural refrigerants and related technologies. We will go all over North America and even internationally, when it is relevant to the market in North America.

Importantly, we will have a few surprises for our readers over the coming months with special issues, supplements and more.

We start now with our special supplement to issue 3 called the *Guide to Natural Refrigerants at the 2015 AHR Expo*. In over 40 pages of great content you will find exclusive interviews, products, and a company directory, as well as an events planner and hall maps showing you where to find these companies. With more than 80 companies listed, it's the biggest showing of natural-refrigerant-related products ever at the AHR Expo. I know, because I've been going to the AHR Expo for well over a decade. This is exciting news and I believe it sets in motion a promising 2015.

This issue will be packaged with the *Guide* and made available at the AHR Expo, so be sure to pick up your free copies. The *Guide* will save you time at the show in finding all the market leaders and their products and services.

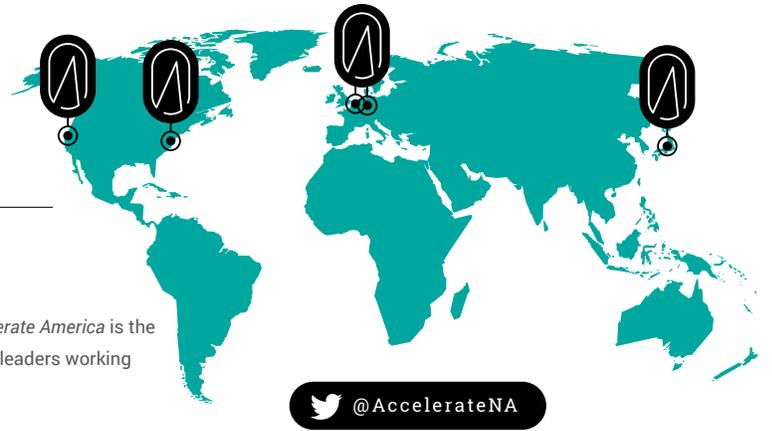
And feel free to send me your comments and suggestions at [marc.chasserot@shecco.com](mailto:marc.chasserot@shecco.com). We are always looking for new ideas!

MC

NORTH AMERICAN EDITION ISSUE #3, FEBRUARY 2015

# ACCELERATE

ADVANCING HVAC&R NATURALLY



## ABOUT ACCELERATE AMERICA

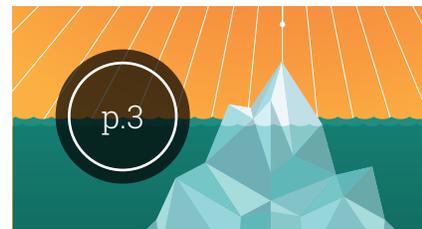
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<http://accelerate.shecco.com>



Paul Anderson from Target

## Why Target opted for CO<sub>2</sub> as its prototype



### Tip of the iceberg

Publisher's note by Marc Chasserot



### Taking the plunge

Editor's note by Michael Garry



### Events planner

The events in February, March and April 2015



### Natural refrigerants surge at Chicago expo



### Sobeys: Set for life



Courchesne Larose:  
'Our motivation:  
To be more green'



### Are major climate accords on the horizon?

Preliminary agreements at the Lima Summit and the Montreal Protocol meeting in Paris could lead to breakthroughs in 2015, though barriers remain.



Greener China is  
turning towards  
natural refrigerants

Danfoss is pushing  
the market towards  
natural refrigerants



Hillphoenix:  
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# ISSUE #3

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Accelerate's network of offices stretches from Brussels to Tokyo. Accelerate America is published monthly except for a mid-year and year-end double issue. The views expressed by the contributors are not necessarily those of the Publisher. Every care is taken to ensure the content of the magazine is accurate but we assume no responsibility for any effect from errors or omissions.

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Editor's note  
by Michael Garry



# TAKING THE PLUNGE

Last September, Paul Anderson, senior group manager, engineering for Target – and the fellow on the cover of this issue – had the honor of participating in a meeting at the White House focused on slashing emissions of HFCs (hydrofluorocarbons), the potent group of climate-changing greenhouse gases used throughout the HVAC&R industry.

President Obama wasn't there – he was in Atlanta at the Centers for Disease Control and Prevention dealing with the Ebola issue – but a number of other dignitaries were in attendance, including John Podesta, a counselor to the President and former chief of staff for President Clinton; Gina McCarthy, administrator, Environmental Protection Agency; Ernest Moniz, secretary, Department of Energy; and Chris Murphy, U.S. Senator from Connecticut.

There were also representatives from 21 other private-sector companies that, like Target, were making a commitment to reduce emissions of HFCs in some way. In total, their efforts would cut cumulative global consumption of these greenhouse gases by the equivalent of 700 million metric tons of carbon dioxide through 2025, equivalent to 1.5% of the world's 2010 greenhouse gas emissions and the same as taking nearly 15 million cars off the road for 10 years.

That's a small but significant percentage because it buys time for dealing with the overall issue of climate change. And compared to the far more difficult challenge of controlling fossil fuel emissions, HFCs represent "low-hanging fruit" ready to be plucked.

The commitment made by Target is the basis of this month's cover story. Anderson revealed a big part of that commitment last June at shecco's ATMOSphere America conference when he announced that the national retailer had selected a hybrid cascade system using carbon

dioxide on the low-temperature side and R134a on the medium-temperature side as its prototypical design for refrigeration in PFresh outlets. At the White House, he referred to that and mentioned several other initiatives you can read about in our story.

We also have an article about Sobeys' remarkable embrace of CO<sub>2</sub> technology, mostly transcritical systems, in 70 of its Quebec stores and another 11 in other Canadian provinces. The company is adding 15-20 new CO<sub>2</sub>-refrigerated stores annually.

These two major retailers have found enough benefits in systems using natural refrigerants to take the plunge and implement them in new and remodeled stores, becoming the first retailers in their respective countries to do so. Besides helping the environment, their decisions are based on solid business metrics. Both, for example, have seen energy savings in these systems. Initial equipment costs are more favorable for Sobeys, given its much larger deployment, than they are for Target, but Anderson is convinced those costs will come down for his company as well.

If the other companies at the White House – Kroger, Coca-Cola, PepsiCo and Red Bull among them – continue to honor their commitments, the market in North America for HFC alternatives like natural refrigerants should soar. And the climate will be a lot better for it **MG**



## Listen to the Difference

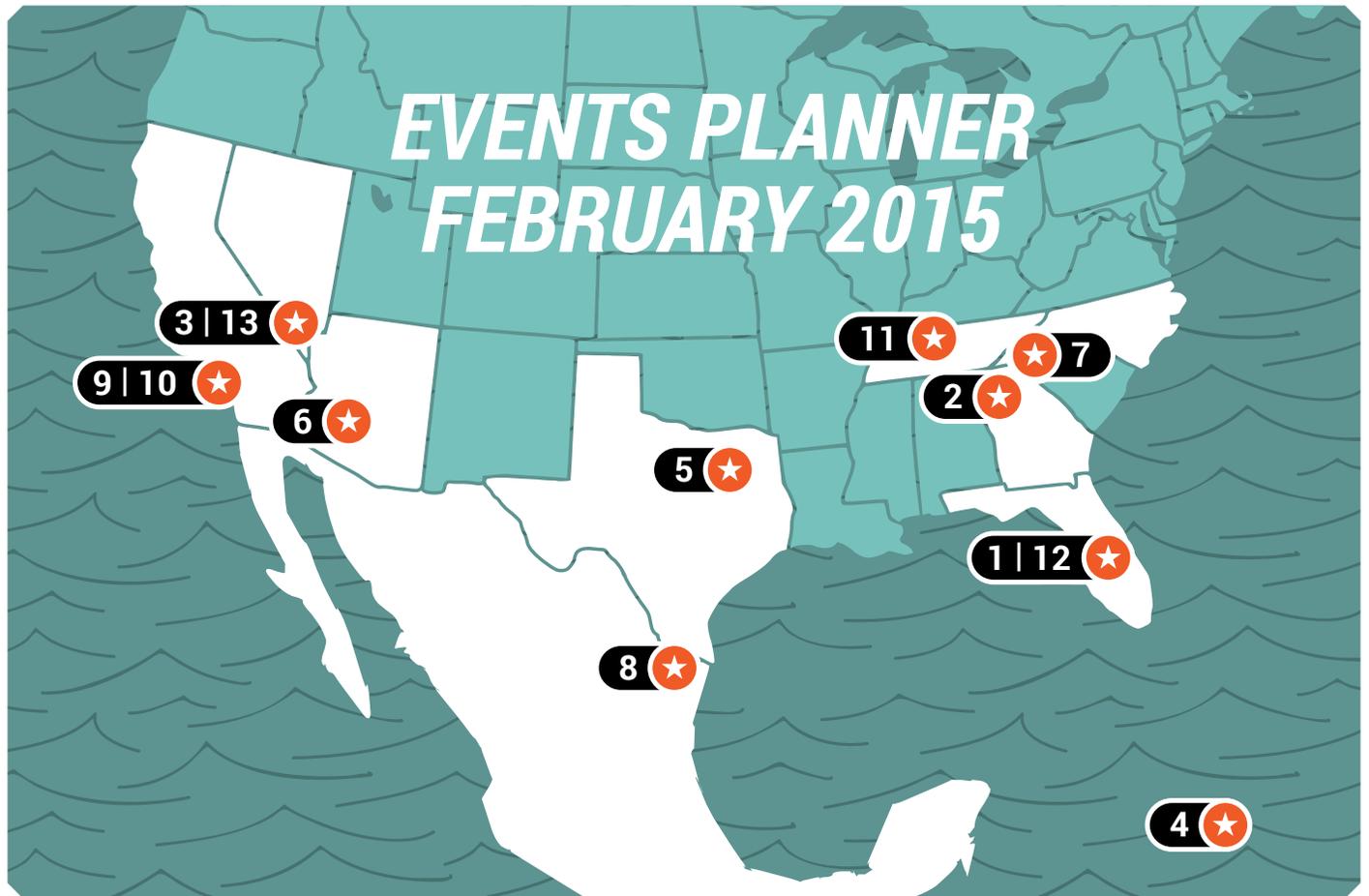


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# EVENTS PLANNER FEBRUARY 2015

- 1** February 5 - 7 - Orlando, FL  
**MACS 2015 Training Event & Trade Show**  
[http://www.macsw.org/imis15/2015\\_Training\\_Event/](http://www.macsw.org/imis15/2015_Training_Event/)  
 twitter : @MACS\_Worldwide / #MACS2015TrainingEvent

**8** February 18 - 20 - Monterrey, Mexico  
**EXPOCARNES 2015**  
<http://expocarnes.com>  
 twitter : @EXPO\_CARNES / #expocarnes2015
- 2** February 7-11 – Atlanta, GA  
**50<sup>th</sup> WFLO Institute**  
<http://www.gcca.org/wflo-institute-cold-chain-education-training/>  
 twitter : @gccaorg / #wflo

**9** February 19 - 21 – Anaheim, CA  
**The NAFEM Show 2015**  
<http://www.thenafemshow.org>  
 twitter : @TheNAFEMShow / #TheNAFEMShow
- 3** February 8-11 – Las Vegas, NV  
**NGA Show**  
<http://www.nationalgrocers.org/the-nga-show/the-nga-show--home/>  
 twitter : @NationalGrocers / #NGAShow

**10** February 21 - 25 - Anaheim, CA  
**AFFI-CON 2015**  
<http://afficon.affi.org>  
 twitter : @FriendsofFrozen / #afficon
- 4** February 11 - 14 - San Juan, Puerto Rico  
**National Turkey Federation Annual Conference**  
<http://www.eatturkey.com/content/conventions-and-conferences>  
 twitter : @TurkeyGal

**11** February 22 - 24 - Nashville, TN  
**Annual Meat Conference**  
<http://www.meatconference.com>  
 twitter : #meat-conference-2015
- 5** Feb 12 - 13 - Dallas, TX  
**5<sup>th</sup> Annual American Food Manufacturing & Safety Summit 2015**  
 twitter : @FoodMfgNetwork

**12** February 22 - 25 - Orlando, FL  
**Retail Supply Chain Conference 2015**  
<http://www.rila.org/events/conferences/supplychain/Pages/default.aspx>  
 twitter : @RILAtweets / #RILASupplychain
- 6** Feb 15 - 17 - Phoenix, AZ  
**2015 Supply Chain Conference**  
<http://www.fmi.org/forms/meeting/MeetingFormPublic/view?id=1F583400000731>  
 twitter : @FMI\_ORG

**13** February 24 - 26 - Las Vegas, NV  
**2015 AWMA Marketplace & Solutions Expo**  
<http://www.awmashow.com>  
 twitter : @AWMAinfo
- 7** February 16 - 20 – Charlotte, NC  
**48th Industrial Refrigeration Workshop**  
<http://global.k-state.edu/conf/industrialrefrig/>

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**Together, we can save energy and the planet.**

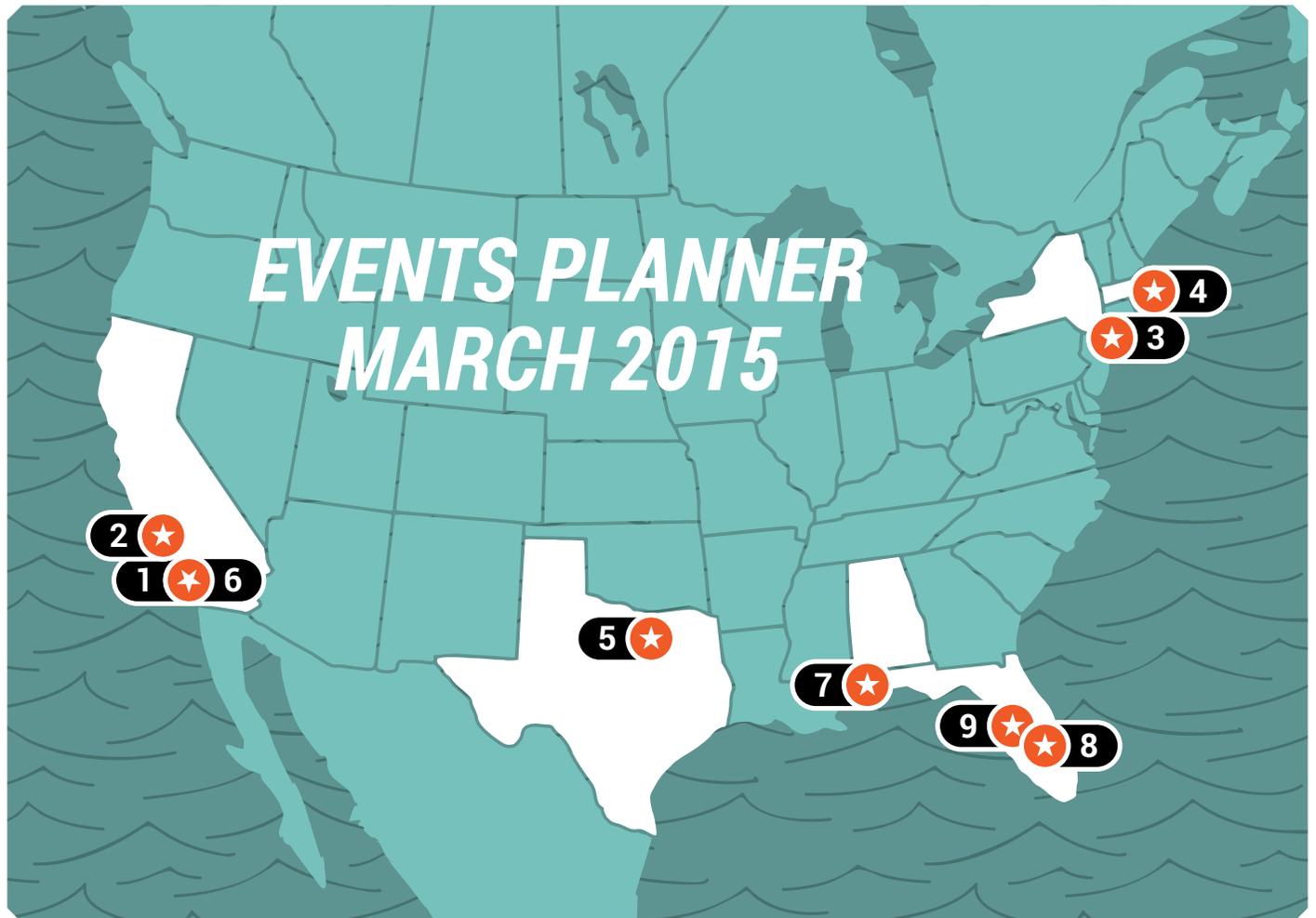
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 fluid & gas handling  
 hydraulics  
 pneumatics  
 process control  
 sealing & shielding



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- 1** March 1 - 4 - Carlsbad, CA  
**35<sup>th</sup> Annual Conference & Exhibition, Refrigerated Foods Association**  
<http://www.refrigeratedfoods.org/rfa-conference>

**6** March 22-25 – San Diego, CA  
**2015 IIAR Industrial Refrigeration Conference & Exhibition**  
[http://www.iiar.org/iiar/WCM/Events/WCM/Events/2015\\_Conference/2015%20Program/2015\\_IIAR\\_Conference\\_Information.aspx?hkey=ee37d734-7ec0-4fb4-a8f1-9d455ab66e2d](http://www.iiar.org/iiar/WCM/Events/WCM/Events/2015_Conference/2015%20Program/2015_IIAR_Conference_Information.aspx?hkey=ee37d734-7ec0-4fb4-a8f1-9d455ab66e2d)
- 2** March 4 - 8 - Anaheim, CA  
**Natural Products Expo West**  
<http://www.expowest.com/ew15/public/enter.aspx>  
**twitter : @NatProdExpo / #ExpoWest**

**7** March 22 - 26 - Point Clear, AL  
**45<sup>th</sup> Annual Food & Beverage Environmental Conference**  
<http://environ-council.affi.org/index.asp?sid=65>
- 3** March 8 - 10 - New York, NY  
**International Restaurant & Foodservice Show of New York**  
[www.internationalrestaurantny.com](http://www.internationalrestaurantny.com)

**8** March 29 - April 1 - Orlando, FL  
**2015 ABA Convention, American Bakers Association**  
<http://americanbakers.org/2015abaconvention/>  
**twitter : @AmericanBakers / #ABACon**
- 4** March 15 - 17 - Boston, MA  
**Seafood Expo North America / Seafood Processing North America 2015**  
<http://www.seafoodexpo.com/north-america/>  
**twitter : @bostonseafood / #seafood**

**9** March 31 - April 1 - St. Petersburg, FL  
**Ice Cream Technology Conference 2015**  
[http://www.idfa.org/forms/meeting/Microsite/Ice\\_Cream\\_Tech\\_2015](http://www.idfa.org/forms/meeting/Microsite/Ice_Cream_Tech_2015)  
**twitter : @dairyidfa**
- 5** March 16-19 – Grapevine, TX  
**ACCA Conference & IE3 Expo**  
<http://www.acca.org/education/conference/>  
**twitter : @accausa / #acca15**

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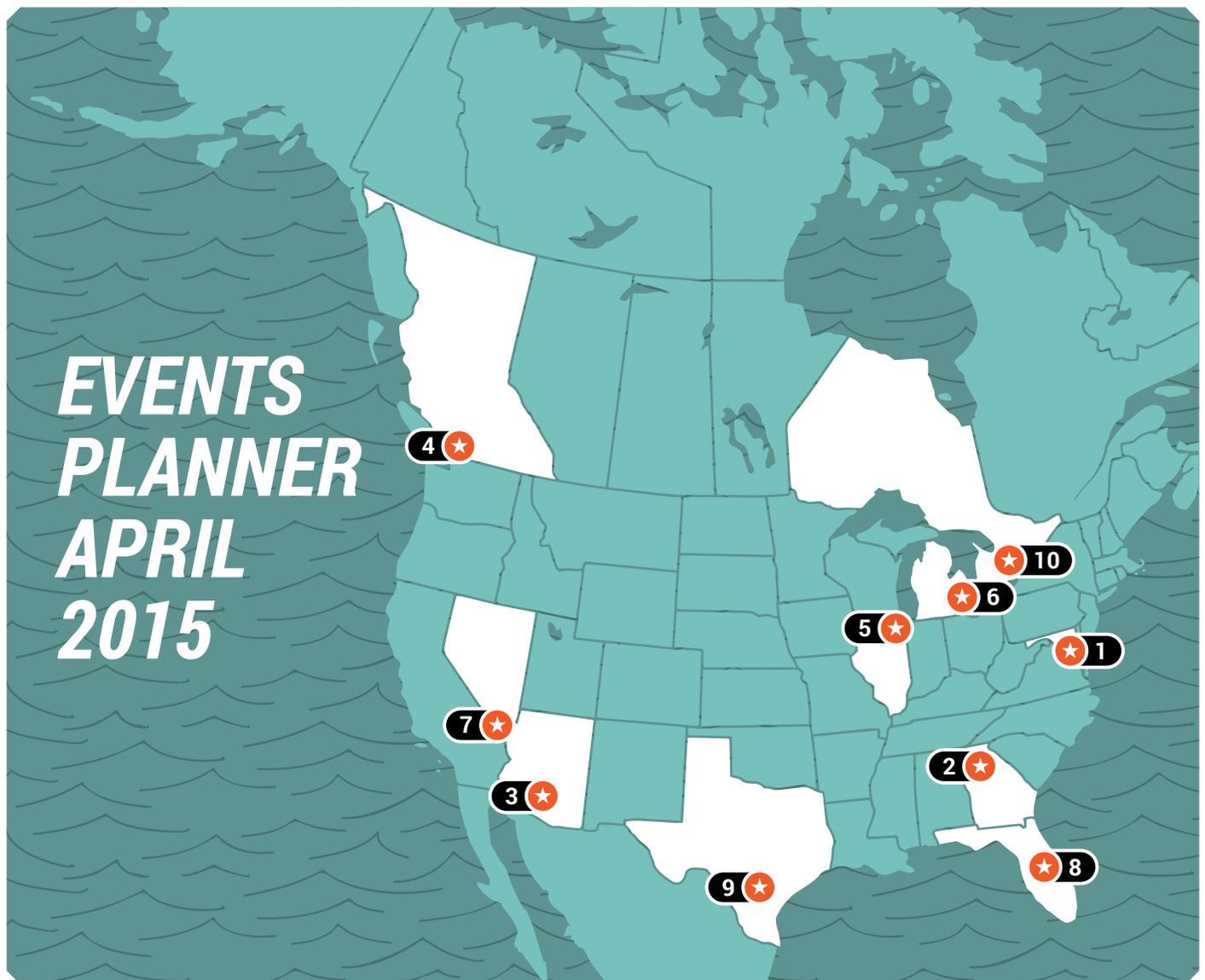
Protocol

TerraChill

Protochill

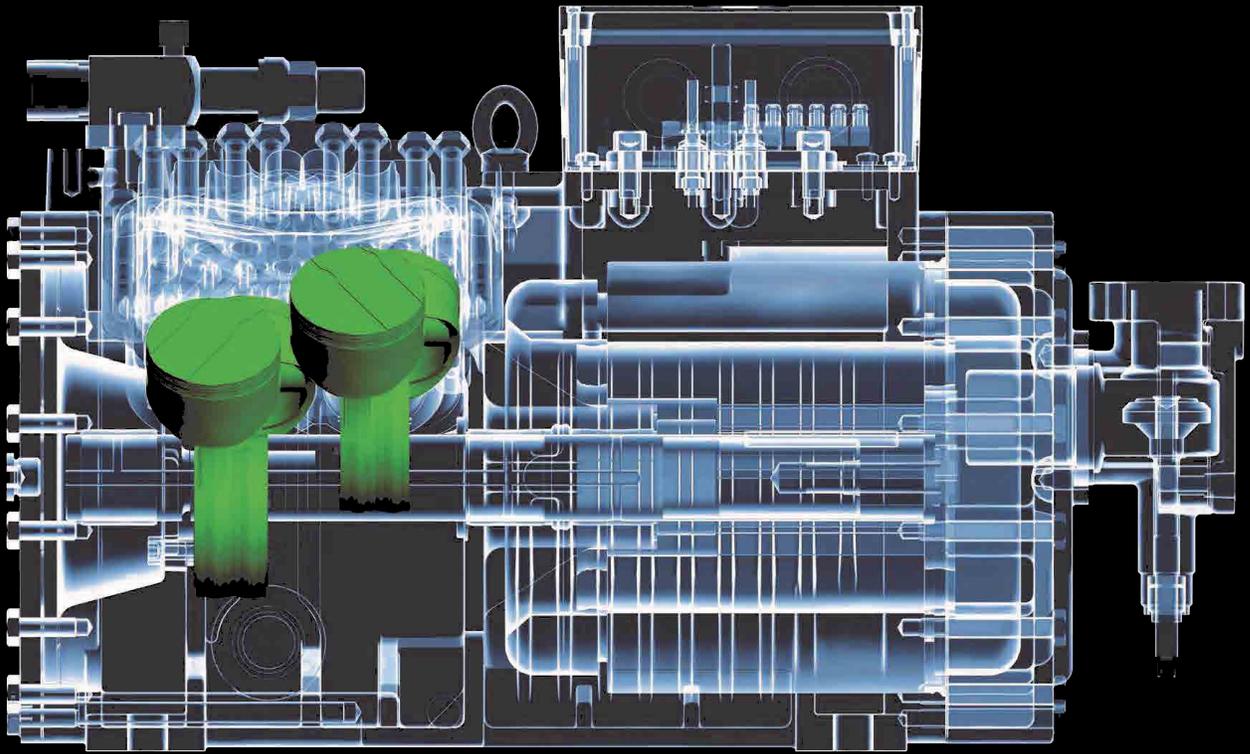
**Providing refrigeration system solutions for any food retail business.  
Contact your Hussmann rep today to discuss the right solution for your business.**





- 1** April 12 - 15 - Washington, DC  
**GMA Science Forum 2015**  
<http://www.gmaonline.org/forms/meeting/Microsite/scienceforum15>  
 twitter : @GroceryMakers
- 2** April 13 - 15 - Atlanta, GA  
**National Logistics & Distribution Conference**  
<http://nldcinfo.com/>  
 twitter : @NLDCinfo / #NLDCinfo
- 3** April 13 - 15 - Tempe, AZ  
**NFRA Executive Conference**  
<http://nfraexecutiveconference.org/>  
 twitter : @EasyHomeMeals
- 4** April 13 - 14 - Vancouver, BC  
**Grocery & Specialty Food West 2015**  
<http://www.cfig.ca/page.asp?id=43>  
 twitter : @CFIGFCEI
- 5** April 14 - 15 - Chicago, IL  
**9<sup>th</sup> Annual American Food Technology & Innovation Summit**  
<http://www.thefoodsummit.com/>  
 twitter : @FoodInnoNetwork

- 6** April 21-23 – Detroit, MI  
**SAE 2015 World Congress & Exhibition**  
<http://www.sae.org/congress/>  
 twitter : @SAEIntl
- 7** April 22 - 24 - Las Vegas, NV  
**2015 NAMA OneShow**  
<http://www.namaoneshow.org/>  
 twitter : @NAMAvening / #NAMAOneShow15
- 8** April 25-29 – Orlando, FL  
**124th IARW-WFLO Convention & Expo**  
<http://www.gcca.org/124th-iarw-wflo-convention-expo/>  
 twitter : @gccaorg / #IARW
- 9** April 26-29 – San Antonio, TX  
**BuildPoint 2015**  
<http://www.buildpointevent.com/>  
 twitter : @BuildPointEvent / #bp2014event
- 10** April 28 - 30 - Toronto, ON  
**SIAL Canada**  
<http://www.sialcanada.com/sial/en/index.sn>  
 twitter : @SIALCANADA / #SIAL2015

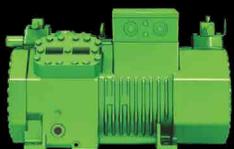


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*Bitzer*

# NATURAL REFRIGERANTS SURGE AT CHICAGO EXPO

— by Elke Milner

shecco's new *Guide to Natural Refrigerants at the 2015 AHR Expo* can help attendees navigate the massive event.

From January 26 to 28, more than 80 companies offering products or services using natural refrigerants will exhibit at the AHR Expo at McCormick Place in Chicago.

That's a significant increase from last year's Expo, and further proof of the evolving North American market for natural working fluids and their associated technology.

The event — formally known as the 2015 International Air-Conditioning, Heating, Refrigerating Exposition — is expected to be the largest AHR Expo ever held, displaying 465,000 square feet (equivalent to nine football fields) of exhibits from more than 2,000 companies spanning every sector of the HVAC&R industry and bringing together more than 40,000 visitors. Not for nothing that the Expo dubs itself the "world's largest HVACR marketplace."

The Expo, co-sponsored by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) and AHRI (Air-Conditioning, Heating and Refrigeration Institute), will also host over 100 educational seminars, workshops and new product presentations.

To help attendees interested in natural refrigerants and related applications navigate the Expo, market development expert shecco is launching its *Guide to Natural Refrigerants at the 2015 AHR Expo* at the event. The publication compiles information on companies offering products and services for natural refrigerants and highlights natural-refrigerant-related events during the trade show.

The *Guide* is designed to connect experts at the event and support attendees and exhibitors

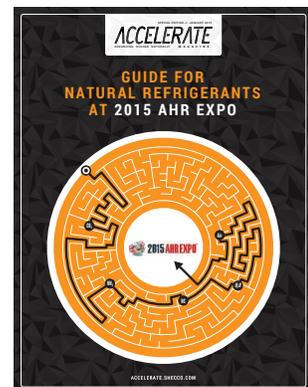
in their planning and outreach strategies. Its product and company directories provide a comprehensive overview of whom and what to look for, with exhibit hall maps highlighting the booths of companies offering natural refrigerant products and services. An event calendar outlines natural-refrigerant-related seminars and presentations taking place at the three-day event.

The *Guide* also includes exclusive interviews with industry leaders covering topics such as natural-refrigerant products at the Expo, their features and availability, the markets with the highest expected growth potential, and policy influences and consequences.

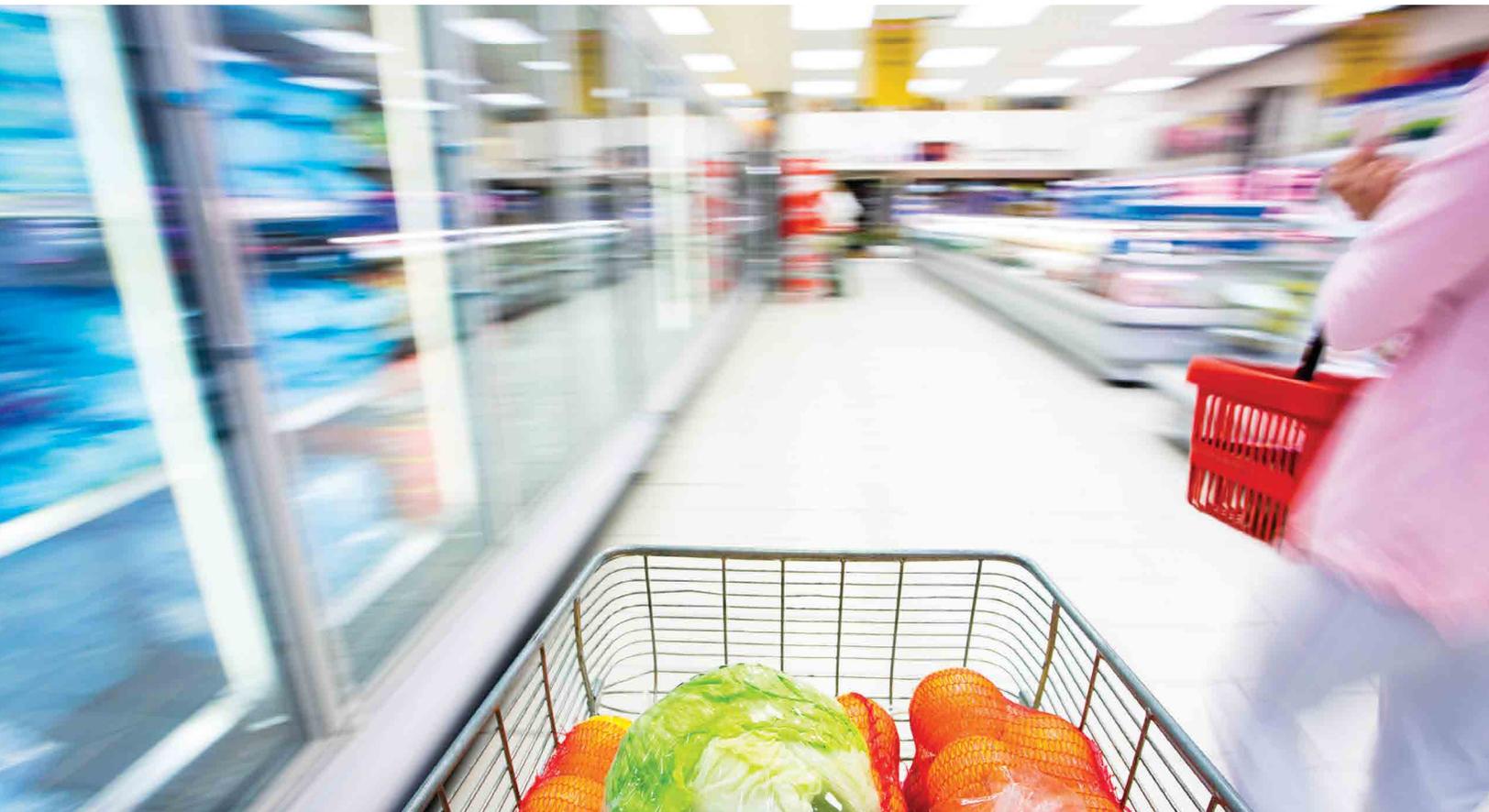
The *Guide to Natural Refrigerants at the 2015 AHR Expo* will be freely available both online and in print at the event at the Media Resource Center, as well as at the booths of the publication's supporters.

Activity at the AHR Expo is expected to be brisk. The results of a recent ASHRAE Journal and AHR Expo survey reflect optimism and high expectations of an improving economy for the industry overall, particularly with regard to new construction projects using commercial cooling and refrigeration. An impressive 87% of respondents indicated their business prospects were either "excellent" or "good" for 2015, and 40% expect the most growth in new construction projects; in last year's results, respondents expected the most out of retrofits and renovations.

The Expo will also feature the 13th AHR Expo Innovation Awards, given to exhibiting companies with the most creative and useful products on the market @EM



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Learn more about the future of refrigerants through the podcast audio below or read the white papers under *CO<sub>2</sub> Solutions* at [EmersonClimate.com](http://EmersonClimate.com)



*Scan to listen to  
the podcast now*

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PAUL ANDERSON

# WHY TARGET OPTED FOR CO<sub>2</sub> AS ITS PROTOTYPE

— By Michael Garry



A CO<sub>2</sub> cascade refrigeration system met engineering chief Paul Anderson's efficiency requirements, but victory on total costs remains down the road.



**Minneapolis** Minnesota



continued on p.18 

→ In the 1980s, as a long-haired teenage drummer dedicated to the music of his “Hair Band” heroes, Paul Anderson was fond of the hard rock ensemble Guns N’ Roses, which achieved worldwide popularity with its debut album, *Appetite for Destruction*.

Anderson still enjoys playing the drums and helping his 17-year-old son, a drummer, and his 15-year-old son, a guitarist, in their musical pursuits as part of a heavy metal band. Professionally, though, Anderson – senior group manager, engineering, for Minneapolis-based Target, where he has worked for seven years – now has more of an appetite for construction, particularly of efficient and climate-friendly refrigeration systems.

That was never more evident than last June at shecco’s ATMOSphere America conference on natural refrigerants, where Anderson unveiled Target’s new prototype refrigeration system, which is more efficient than the company’s conventional model.

The prototype, a hybrid cascade system, will be used in newly opened PFresh stores, which offer an array of frozen foods, meat and dairy as a complement to Target’s traditional general merchandise. Of Target’s 1,783 stores in the U.S., more than 1,200 are PFresh outlets, with another 133 PFresh stores in Canada. Target launched the PFresh format in 2009, making Anderson responsible for the design of its new refrigeration systems. (He recently took on responsibility for all of Target’s engineering disciplines.)

Anderson’s ATMOSphere America announcement was especially notable for a U.S. retailer – historic, really. For not only does the prototype achieve greater efficiencies, it uses carbon dioxide – an inexpensive, generally harmless natural refrigerant with a GWP (global warming potential) of one – as the sole cooling agent for low-temperature cases.

Target thus became the first U.S. food retailer to make a public commitment to running a refrigeration system in new stores and major remodels based in large part on an environmentally friendly natural refrigerant. In North America, it is second only to Sobeys, Canada’s second largest grocer. (See “Set for Life,” [page 24](#).) Target has also started deploying



beverage coolers chilled by the natural refrigerant propane (R290).

On the prototype’s medium-temperature side, it employs R134a (GWP of 1,300), which also helps cool the CO<sub>2</sub>. The PFresh format’s previous prototype had been a DX (direct expansion) system incorporating R404A, with a GWP of 3,900, which means that any leaks in the new prototype make far less of a contribution to global warming. Moreover, the new prototype cuts the amount of HFC (hydrofluorocarbon) refrigerant from about 1,000 pounds to 500-600 pounds.

“It’s a major statement to say that Target is going to standardize on a hybrid [cascade] system,” said

Scott Martin, director of sustainable technologies for Hillphoenix, provider of one of Target’s cascade systems, at a store in Conyers, Ga.

Mike Ellinger, global maintenance and refrigeration coordinator for Whole Foods Market, is an admirer of Targets’ CO<sub>2</sub> / R134a cascade prototype. While Whole Foods is testing a variety of natural-refrigerant systems, Ellinger’s preference would be something similar to the Target system. “It’s not overly complicated and most people can maintain it,” he said. “I’d like us to move more toward that direction.” (See “Taking Natural Refrigerants to the Next Level,” *Accelerate America*, Dec. 2014-Jan. 2015.)



### EVOLUTION OF A PROTOTYPE

It was Anderson's passion for efficiency that drove his journey to find the most optimal refrigeration system for Target, which turned out to be a solution with a major natural component.

The journey began in July 2010, when Target opened a store in St. Paul, Minn., that uses R404A on the primary side with CO<sub>2</sub> as a secondary coolant for low-temperature cases, along with glycol as a secondary refrigerant for medium temperature fixtures.

A year later, Target tried a somewhat different configuration at a new store in San Clemente, Calif., with a CO<sub>2</sub> DX system serving low-temp cases and R134a/glycol on the medium-temp side. A year after that, in 2012, Target opened a store in Los Angeles with a similar refrigeration system.

But the systems pumping glycol for medium-temperature cases were found to have "a significant energy penalty versus a traditional system," said Anderson, who subsequently removed glycol from the test systems.

Meanwhile, Target was testing the hybrid cascade system, starting in June 2012 at a new store in Conyers, Ga., near the headquarters of the system's rack supplier, Hillphoenix. In March 2013, a second store using the system opened in Columbia, Mo., near the headquarters of its rack supplier, Hussmann.

Following a comprehensive, two-year analysis of the hybrid cascade system, Target selected it as the new prototype: CO<sub>2</sub> DX on the low-temp side, and R134a DX for all of medium-temp, with a heat exchanger in between to help cool the CO<sub>2</sub> and make sure its condensing temperatures remain in the subcritical range (under 88°F) where it is most efficient. (Hybrid means that the high-side HFC refrigerant – rather than a secondary fluid like CO<sub>2</sub> or glycol – is used to chill the medium-temp cases.) R134a was chosen for being a "better performing [HFC] fluid than others on the market," said Anderson.

Target plans to open two more stores with the prototype in 2015, one in Lake Bluff, Ill., the other in Ft. Worth, Texas.

With the new prototype designated for Target's PFresh stores, the chain is looking at different technology for its City Target and Target Express formats. Existing SuperTarget stores – combining a full grocery store with a general merchandise assortment – are being transitioned from R22 to R407A, which is a better fit for a drop-in conversion than R134a, Anderson said.

Target will retrofit existing refrigeration systems at PFresh stores with the prototype equipment in the event of a "significant remodel," said Anderson, adding, "It's too soon for that."

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### Target's long history of environmental initiatives includes the following:

- » In the 1960s, contributed to urban renewal, including cleaner waterways.
- » In 1968, became one of the first retailers to institute a chain-wide cardboard recycling program.
- » Was a sponsor of the first Earth Day in 1970 and a supporter of the event ever since.
- » As a member of the Environmental Protection Agency's SmartWay program, optimizes the loading, routing and scheduling of trucks.
- » In 2009, introduced a five-cent incentive every time a shopper uses a reusable bag.
- » In 2010, rolled out a comprehensive in-store recycling program for shoppers.
- » In 2011, joined the EPA's GreenChill program to cut refrigerant charge and emissions.
- » In 2013, announced that all Canadian Target stores would be LEED-certified.
- » In 2014, became the first U.S. retailer to announce a prototype refrigeration system based in part on a natural refrigerant, carbon dioxide.
- » Has received the EPA's Energy Star certification for more than 1,000 stores



FIVE BUCKETS

Armed with a degree in mechanical engineering from Iowa State University, Anderson, likes to break down his analysis of refrigeration systems into five buckets that constitute the total cost of ownership: energy consumption, capital investment in equipment and installation, maintenance, impact on customers (“guests” in Target parlance) and sustainability.

In terms of energy performance, the prototype system did not initially meet Target’s requirements. In 2012, Anderson reported that Target’s CO<sub>2</sub> systems were consuming more energy than a DX system using R404 in the same market. But at the 2014 ATMOsphere America meeting he revealed that the Conyers and Columbus hybrid cascade systems were saving about \$2,000 annually in energy costs compared with the standard DX unit. (The prototype system also produces enough heat to provide hot water in the store.)

In order to achieve that energy saving, Target had to compensate for the energy penalties inherent in the heat exchanger, rack valves and other components in a CO<sub>2</sub> design. That required honing in on the optimal component selection and system design by submetering the energy consumption of many components.

“When we set up the initial stores, we would spend up to seven months fine-tuning the system to identify the barriers to improved efficiency,” he

said. “We kept tuning the component selection to fit the application.” Anderson, who before joining Target worked as an engineer for John Deere, Taylor Industries and Eaton Automotive, strongly believes in tailoring components to the size of a system.

**“ WE WOULD SPEND UP TO SEVEN MONTHS FINE-TUNING THE SYSTEM TO IDENTIFY THE BARRIERS TO IMPROVED EFFICIENCY”**

Target also worked closely with manufacturers to improve efficiency. “The partnership between manufacturers and end users really drives gains in efficiency by promoting understanding of how controls and algorithms are working,” Anderson said. For example, Target’s suppliers optimized the R134a compressors’ horsepower requirements to maximize efficiency.

The energy performance of the prototype system has been consistent, regardless of the rack manufacturer, Anderson said. But he added that Target plans to ultimately settle on one rack supplier.

Anderson is not alone in observing the improved efficiency of the hybrid cascade system. In a

presentation at the Food Marketing Institute Energy Conference last September, Tim Anderson (no relation), principal engineer, Hussmann, noted that a cascade system “is not a bad system in terms of energy, especially when using a direct hybrid system on the medium-temperature side.”

The efficiency improvement, however, has not been enough to compensate for other cost requirements of the hybrid cascade system. For example, capital investment in the technology is still 25% -30% higher than that of the DX system, while installation costs about 5% more. Moreover, maintenance expenses run about \$2,300 per year more than for a DX system. Overall, incorporating efficiency gains, the cascade system costs \$60,000 to \$80,000 more than the conventional model in incremental cash flow, said Anderson.

But he is seeing a slow decline in equipment and installation costs for the cascade system. That won’t be reflected in the two 2015 stores, but should come over the next three to five years as production grows, he said.

At the ATMOsphere America conference, even as he announced the new prototype Anderson acknowledged that there’s still work to do with respect to the total cost of ownership. “But we believe advances in CO<sub>2</sub> technology are absolutely viable,” he said. “We look forward to working with

**continued on p.22** →





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→ our partners to develop solutions that eliminate barriers that still exist today.”

Meanwhile Target is doing all it can to reduce maintenance costs. During the months spent fine-tuning a new system, the chain works with manufacturers and contractors “to ensure that contractors truly understand how to keep systems operating efficiently,” Anderson said. That includes getting accustomed to the higher pressures inherent in the system, including 200 psi on the low-temperature side, 400 psi for medium-temperatures.

Though some U.S. retailers using CO<sub>2</sub> systems have complained about the lack of availability of components or CO<sub>2</sub>, that has not been an issue for Anderson.

In terms of leaks, Anderson found that by switching from R404a to R134a, a lower-pressure refrigerant, leak rates dropped. It’s still too early, he said, to assess leak rates for CO<sub>2</sub>.

Target employs a refrigerant management system (from Verisae) that tracks refrigerant usage, including leaks, across the chain, helping it to comply with the recordkeeping requirements of Section 608 of the Clean Air Act.

Anderson has opted not to use back-up generators for the prototype. “The design of the system ensures that it’ll operate safely in any number of conditions,” he said. All stores have a

generator for “life safety issues.” In the event of an extended power outage – or in anticipation of one – “we’ll find other sources to protect frozen and refrigerated food.” To date the prototype’s uptime – its most palpable impact on shoppers – has been comparable to that of traditional systems.

But Tim Anderson of Hussmann noted that a power loss in a cascade system could result in “a rapid rise of pressure, which can lead to venting of the CO<sub>2</sub> via pressure relief valves.” He suggested using a small dedicated condensing unit powered by a generator that “could keep the [CO<sub>2</sub>] in the receiver cold in a power loss.”

In regard to Anderson’s last bucket, sustainability, Target’s selection of a CO<sub>2</sub> cascade system has been a major plus. The system’s lower energy consumption compared with a traditional DX unit, combined with its reduction of HFC charge and GWP, cuts carbon impact by 65%, eliminating more than 150 metric tons of CO<sub>2</sub> equivalent annually per store.

In its 2013 Corporate Responsibility Report, Target put forth specific company-wide goals for greenhouse-gas-emission reductions it wanted to reach by fiscal 2015, using a 2007 baseline: a 10% emissions drop per square foot and a 20% drop per million dollars of retail sales. Through fiscal 2013, it had reached 7.1% and 7.4% declines, respectively.



The 2013 report also published Target’s 2013 greenhouse gas emissions in metric tons of CO<sub>2</sub> equivalent. Refrigerants accounted for 441,617 metric tons of CO<sub>2</sub> equivalent, which was 63% of Target’s total direct emissions and 22% of its combined direct and indirect emissions.

Target has pursued emission reduction projects like LED lights in refrigerated cases and HVAC variable fan drives, which cut 15,466 and 17,996 metric tons of CO<sub>2</sub>, respectively. But given refrigerants’ large contribution to emissions, Anderson acknowledged using natural refrigerants like CO<sub>2</sub> to curb emissions “certainly supports where we want to go.”



**System Specs**

Target’s prototype cascade system includes the following features:

- » A CO<sub>2</sub> DX system for low-temperature cases.
- » An R134a DX system for medium-temperature cases.
- » Low-temperature system typically has four compressors, each with a capacity of 30,000 BTUs/hour
- » Medium-temperature system typically has five compressors, each with a capacity of 100,000 BTUs/hour.
- » Racks from Hillphoenix and Hussmann.
- » Bitzer compressors
- » Emerson controls.
- » Electric defrost.
- » Heat reclaim for domestic hot water.
- » Cases from Hillphoenix, Hussmann and Zero Zone.

## NOT MAKING THE CUT

In addition to its three pumped-glycol tests, Target considered other possible prototype systems, including transcritical, and pumped CO<sub>2</sub>. “The other systems we looked at have not met our internal hurdle for new technologies we want to apply going forward,” said Anderson.

Though transcritical systems can work well in the cooler climates typical of Target’s home state of Minnesota, Anderson’s team has found them unsuitable after many years of testing. The issue for Target, he explained, is that PFresh stores use fewer refrigerated and frozen cases than a conventional supermarket, and therefore generate less waste heat. As a result, there is not enough waste heat to compensate for the efficiency penalties experienced by a transcritical system, he said.

But what about SuperTargets, which have as much refrigerated and frozen food as conventional supermarkets? “That might be a place where transcritical would work, but we’re not building any more SuperTargets,” he said.

One advantage of transcritical refrigeration is that by eliminating HFCs (including R134a) it protects companies from future HFC regulations. As an HFC user, Target is paying close attention to the Environmental Protection Agency’s current plans to delist certain high-GWP HFCs such as R404A and R507A by Jan. 1, 2016. Even R134a is slated for delisting for new stand-alone food refrigeration and new vending machines,

though not in store-wide systems. “We’re always monitoring the situation,” said Anderson.

Meanwhile, he left the door open to replacing the current prototype with new technology that proves to be a better fit for Target. “It’s an ongoing discussion,” he said.

One possibility is an ammonia (NH<sub>3</sub>)-based store system that would include secondary fluids. Target uses NH<sub>3</sub> to refrigerate its cold storage warehouses, and its ammonia engineers are now collaborating with its store refrigeration engineers. Last year, the chain opened two new refrigerated warehouses in 2014 that use NH<sub>3</sub> for cold storage but glycol to cool office areas, eliminating HFCs in the HVAC system and reducing the carbon impact by 900 metric tons of CO<sub>2</sub> annually.

Last fall Target also began using propane, a hydrocarbon natural refrigerant, in self-contained beverage coolers. This included 13,000 coolers supplied by brands such as Coca-Cola, PepsiCo, Red Bull and Dr. Pepper/Snapple, as well as its own multi-brand unit – from True Manufacturing, model GDM-72-HC-LD – which is being piloted in a store in Minneapolis. The propane coolers reduce energy consumption by 15 million kWh per year. “If all goes well, I can see [propane] playing a larger role in our stores,” he said.

Target is also looking at HFOs (hydrofluoroolefins), a low-GWP (in the 150-600 range)

synthetic alternative, as a possible replacement for R404A or R134a. “We’re working with the chemical producers – Honeywell and DuPont – to test HFOs,” he said. These refrigerants have not yet been approved by the EPA’s SNAP (Significant New Alternatives Policy) program.

In its effort to create more sustainable refrigeration, Target has joined some national programs. In 2010, the chain became a member of the EPA’s GreenChill Partnership, which helps retailers cut their refrigerant leaks and charge. And last September, Target, represented by Anderson, participated in a meeting at the White House of private-sector companies that voluntarily committed to phasing out HFCs.

At the meeting, Anderson spoke about Target’s advancements, including its new prototype, HFC-free HVAC systems in its new warehouses, hydrocarbon-based coolers, HFO testing and GreenChill participation.

“Our internal teams have worked hard with chemical producers, refrigeration system manufacturers and contractors to advance technologies to eliminate our dependency on high global-warming-potential refrigerants,” he said to an audience that included representatives of Coca-Cola, Kroger, PepsiCo, and Red Bull, as well as EPA administrator Gina McCarthy and Secretary of Energy Ernest Moniz. [@MG](#)



Paul Anderson at a White House meeting on HFC reduction.

# SET FOR LIFE

Sobeys, North America's leading user of CO<sub>2</sub>-only refrigeration, chose a future-proof natural solution to avoid having to ever retrofit its systems again. Here's how they did it.

Yves Hugron  
Engineering Director  
Sobeys

— By Jana Topley Lira and Marc Chasserot

Nobody likes change, least of all food retailers. Yet when it comes to refrigeration, the last two decades have seen nothing but a constant turnover in the kinds of refrigerants they are allowed to use.

Fed up with the continuous uncertainty, Sobeys – Canada's second largest food retailer with 1,778 stores (852 of them franchised) – became the first company in North America to do something about it.

What Sobeys did was make transcritical refrigeration using only carbon dioxide – a natural refrigerant not subject to regulatory phaseouts – its standard system for new stores and major renovations.

Today Sobeys has 72 stores (including one opening in March) using a CO<sub>2</sub> transcritical system, and 15-20 stores opening every year with CO<sub>2</sub>, making it the de facto leader of transcritical installations in North America. Out of these new stores, at least 10 are renovations, which are always undertaken while the store is open. Sobeys never loses a day of sales in its transition to CO<sub>2</sub>.

How did Sobeys come to this point?

Sobeys started to take a keen interest in its refrigeration systems in 2008. The Montreal Protocol had long been in place and the retailer knew it would bring more change. HCFCs (hydrochlorofluorocarbons) like R22 were on the way out, and the future of HFCs (hydrofluorocarbons) looked uncertain.

The chain had already experienced the phaseout of ozone-depleting CFCs (chlorofluorocarbons), and transitioned from R11 and R12 to HCFCs, the "new" generation of synthetic refrigerants at the time that also harmed the ozone layer. Now, the Montreal Protocol seems likely to once again phase out another "new" generation of synthetic refrigerants, HFCs, which contribute significantly to global warming. So Sobeys' engineers asked themselves, "Is it wise to jump on the bandwagon and do what everyone else is doing? Should we invest in another generation of synthetic refrigerants?"

The person in charge of refrigeration decisions and everything else relating to building engineering is Sobeys' director of engineering, Yves Hugron.

He works for Sobeys Quebec, one of four divisions – alongside Sobeys Maritime, Ontario, and Western Canada – in Sobeys Inc., based in Stellarton, Nova Scotia.

The retailer's three Anglo Saxon divisions are grouped together, while the French-speaking Quebec division maintains an independent identity, which according to Hugron, helps to differentiate the province's special relationship with food.

For Hugron and Sobeys' engineering team, including equipment advisors Yves Beaugard and Patrick Gareau, continuing to use synthetic refrigerants would offer no guarantees. In 10, 12, or 15 years Sobeys could be faced with another phaseout. As Hugron put it, "Why would we invest in another replacement refrigerant with an uncertain future when another technology using natural refrigerants was emerging in Europe?"

Instead, Sobeys engineers travelled across "the pond" to look at what was being done in the European Union, where the market for commercial CO<sub>2</sub> transcritical refrigeration technology was rapidly developing.

Impressed by what the engineers had seen, Sobeys gathered them, as well as technicians and system manufacturers, in one room, and presented them with a new mandate. The retailer wanted to eliminate synthetic refrigerants from its estate in the long term and needed an alternative solution. Everyone in the room that day was asked: "What can you do to help us achieve our goal?"

## THEN THERE WERE TWO

Initially, 10 companies answered Sobeys call. After a first meeting only six remained, the others not yet able to offer a natural refrigerant solution. Of

## Other Natural Applications

Sobeys' natural refrigerant success in stores has crossed over into its warehousing and distribution operations.

In recent years Sobeys Quebec has transformed all of its eight warehouses from R22, and even a few that were still using R12, to the natural refrigerant ammonia. Some even use CO<sub>2</sub>, such as a frozen meat warehouse expansion for which a cascade CO<sub>2</sub> system was added to the original ammonia system. Others employ ammonia with glycol piped through the warehouse, such as a dairy facility in Trois Rivières.

For Sobeys Quebec's director of engineering, Yves Hugron, these dual systems are preferable to ammonia-only configurations, as he believes that ammonia leaks cannot be completely prevented. In the event of a leak in a warehouse using an ammonia-only system, it has to be completely evaluated. This is not the case in the Trois Rivières warehouse because the ammonia is only kept in the machine room.

## The Next Challenge: HVAC

When it comes to HVAC, Sobeys works with a company specializing in HVAC systems for supermarket stores. These have to be adapted to the high levels of humidity generated in-store by washing and cooking processes, and the spray used to keep the fruit and vegetables fresh. For the commercial refrigeration system, it is very important to have an HVAC system designed to dehumidify the store.

Sobeys is investigating the possibility of using CO<sub>2</sub> HVAC systems, but according to director of engineering Yves Hugron the market is not yet ready. The current natural refrigerant HVAC systems are far too costly when compared with those that use synthetic refrigerants.

Together with Carnot, Sobeys has trialed an integrated CO<sub>2</sub> refrigeration system that is linked to the store's HVAC system. However, the evaporation temperatures have penalized the system's efficiency. For this reason Sobeys still prefers to work with racks with higher evaporation temperatures that are specially designed for HVAC.

those six, Sobeys asked more detailed questions about their suggested solutions, after which only four remained in the running, and eventually only two, Carnot and CSC. These were the only two manufacturers ready to provide Sobeys with the system they were looking for.

Although Sobeys normally requires three systems suppliers to ensure competitive pricing, this was considered an exceptional circumstance.

Both Carnot and CSC understood that CO<sub>2</sub> was a refrigerant with enormous potential — and a GWP (global warming potential) of only one — and both were focused on developing CO<sub>2</sub> technology. (For more on Carnot, see "Refrigerate Differently," [Page 42](#).) As a result, Sobeys worked closely with both manufacturers to develop a CO<sub>2</sub> solution, and agreed to test the first Canadian-made CO<sub>2</sub> systems in the field, in-store.

At the beginning there were not many subsidies to support Sobeys' natural refrigerant endeavor. So it was the engineering department at Sobeys Quebec that acted as the driving force for investing in CO<sub>2</sub>. The other divisions of Sobeys were not fully convinced of the switch. Many thought the Quebec division was crazy.

However, the push for CO<sub>2</sub> refrigeration was eventually transmitted to the CEO, after which the Quebec team had buy-in from the top management to "green" the entire business. This has now started to filter through the different divisions. As a result, CO<sub>2</sub> systems have been installed in the provinces of British Columbia (2), Alberta (3), Saskatchewan (1), Manitoba (2), Ontario (2) and New Foundland (1).

But when talking about natural refrigerants, Sobeys means not only looking at GWP, but taking into account the possibility that a new generation of synthetic refrigerants could be phased out further down the line. For Sobeys that means natural can never mean an HFO (hydrofluoroolefin). "We know that there will be a problem with new synthetic refrigerants, and another 'Montreal Protocol' that says HFOs have to be phased out in 2030 or 2040," Hugron said.

## A GRADUAL PROCESS

Today 85% of Sobeys' supermarkets still use R22, and Hugron acknowledged "we have a long way to go." In 2015 the retailer can no longer install new R22 systems, and only 300,000 kilograms of R22 will be made or imported (down 90% from 1996 levels). This affects all of Sobeys' 1,498 stores, including over 300 in Quebec (many of them franchised). But all will eventually be switched to natural refrigerants.

This will be a gradual process as replacing all systems requires a major investment. The systems that were installed five or six years ago, and which have a lifetime of approximately 15 to 20 years, will still be in operation in 10 to 15 years, unless a store undergoes a major renovation.

Sobeys installed its first CO<sub>2</sub> transcritical system in 2009, and in 2011 it became the standard refrigeration solution for new stores and major store renovations. While CO<sub>2</sub> is used in supermarkets, ammonia is employed in Sobeys' warehouses and distribution centers.

If a corporate Sobeys store replacing R22 needs only a minor retrofit, such as a few more cabinets, it will use an interim synthetic refrigerant, or drop in, for the remainder of the system's lifetime. Otherwise Sobeys will replace R22 with a natural refrigerant.

Hugron thinks the transition to natural refrigerants will be accelerated by the disappearance of R22. While he does not yet feel the pressure to switch all stores immediately, he is aware that the reduction in R22 stocks will mean rising prices — some say exponentially — and that this will cause the replacement process to accelerate.

## “WE DIDN'T WANT TO RELIVE ANOTHER PHASEOUT, A MONTREAL PROTOCOL 3.0”

So why do it? With CO<sub>2</sub>, Sobeys would be set for life. "We didn't want to relive another phaseout, a 'Montreal Protocol 3.0,'" Hugron explained. (This would happen if HFCs, considered potent greenhouse gases, come under the Protocol's authority, as many expect.) "We were and are still in the middle of a 'Montreal Protocol 2.0,' already in phaseout mode, and we did not want to face the same thing again."

While some may still question whether HFCs and other man-made greenhouse gases are causing climate change, for Sobeys it is a pressing problem that must be tackled, said Hugron.

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→ The first generation of CO<sub>2</sub> systems, including cascade models, were prototypes, which experienced a few leaks, used more energy than traditional systems, and experienced growing pains, which can only be expected with a brand new technology. The first CO<sub>2</sub> supermarkets were pioneers; each was a “live laboratory” that has to contend with the problems that come with in-store testing. For example, in some stores the engineering team had to completely change the compressors.

Sobeys also faced a shortage of components in North America, including valves and plate heat exchangers for high-pressure CO<sub>2</sub> applications. As a result, the retailer ended up working very closely with system and component manufacturers to fine-tune the nascent CO<sub>2</sub> refrigeration technology.

Today, the systems installed by Sobeys are very stable and reliable, with capacities ranging from 80 to 250 tons of refrigeration. These are manufactured now by three companies for better economies of scale. CSC is no longer operating.

Hugron believes that system manufacturers in Quebec have a completely changed mindset. They are now more interested in manufacturing CO<sub>2</sub> racks than in R507 or R407 racks. Some manufacturers have even gone so far as to stop manufacturing synthetic refrigerant racks completely.

Gradually, initial system costs have come down for Sobeys. In the early days a CO<sub>2</sub> system, compared with a synthetic refrigerant system, would easily cost around 25%-30% higher. The systems now cost the same, and in some cases CO<sub>2</sub> systems are actually cheaper than traditional commercial refrigeration technologies using R507.

Energy efficiency has also improved dramatically. This is very important given that refrigeration systems represents around 50% of a store’s energy costs. Using current CO<sub>2</sub> technology, Sobeys reduced its refrigeration energy costs by about 8% compared with traditional systems.

Is there value to Sobeys in marketing its sustainability achievements? In layman’s terms investing in a CO<sub>2</sub> refrigeration system is the equivalent of removing 3,000 cars from the road every year. To communicate this fact to its customers and raise awareness of the retailer’s green credentials, store openings do feature extra signage highlighting the green technology in-store.

However, with supermarkets and convenience stores already overburdened with signs and advertising, the emphasis in this crowded space remains not on highlighting green credentials, but on selling products.

Refrigeration is a necessary part of running a supermarket but is not the core business. It is the products on sale that must get the most attention. “Highlighting the low prices of our tomatoes compared to those of our competitors remains a priority over highlighting the green technology cooling those tomatoes,” said Hugron @JTL + MC

North Atlantic Ocean

NEWFOUNDLAND AND LABRADOR



QUÉBEC

NOVA SCOTIA

NEW BRUNSWICK

# SOBEYS' CASCADE AND TRANSCRITICAL REFRIGERATION SYSTEMS

» CO<sub>2</sub> transcritical » CO<sub>2</sub> cascade

**QUÉBEC**

- » St-Félix de Valois
- » Coteaux-du-Lac
- » Laval-Ouest
- » Cap-Rouge
- » Cookshire
- » Bromont
- » St-Charles de Drummond
- » Kirkland
- » St-Augustin (Mirabel)
- » Repentigny
- » Dorval
- » St-Rémi de Napierville
- » Granby
- » Disraëli
- » Valleyfield
- » L'Annonciation
- » Mercier
- » Ste-Agathe des Monts
- » St-Donat
- » Pont-Rouge
- » Grenville
- » Delson
- » Val Belair
- » East Angus
- » Masson-Angers
- » Lasarre
- » Gatineau
- » St-Côme
- » Cap-De-La-Madeleine
- » St-Nicephore
- » St-Georges Est
- » St-Sauveur
- » Lachenaie
- » Laval
- » Montreal Millen
- » Bromptonville
- » Terrebonne
- » Amos
- » St-Césaire
- » Vaudreuil-Dorion
- » New Richmond
- » Paspébiac
- » St-Jean-Richelieu
- » Sherbrooke
- » Richelieu
- » Boucherville
- » Chicoutimi
- » Montréal / Fleury
- » Terrebonne
- » Gatineau
- » Magog
- » St-Amable
- » Chandler
- » St-Pie de Bagot
- » Victoriaville
- » Riviere-Du-Loup
- » Ste-Brigitte de Laval
- » Montréal / Centre-ville
- » St-Félicien
- » Ste-Julie
- » Montréal / Centre-ville
- » Boischatel
- » St-Antoine des Laurentides
- » Ste-Thérèse
- » Rimouski
- » Longueuil
- » Ayers Cliff
- » Temiscamigue
- » Montréal / Shamrock
- » Ste-Canut

**BRITISH COLUMBIA**

- » Courtenay
- » Comox

**ALBERTA**

- » Lewis Estates
- » Newcastle
- » Nolan Hill

**SASKATCHEWAN**

- » Stonebridge

**MANITOBA**

- » Kildonan
- » Sage Creek

**ONTARIO**

- » Milton
- » Stratford

**NEWFOUNDLAND**

- » Paradise

# 'OUR MOTIVATION: TO BE MORE GREEN'

Courchesne Larose's reliable NH<sub>3</sub>-CO<sub>2</sub> refrigeration system uses natural refrigerants to save energy, improve safety and be more competitive.

— By Michael Garry and Marc Chasserot



As a major wholesaler of fruits and vegetables, Montreal-based Courchesne Larose Ltd. runs a very "green" business, replete with cucumbers, lettuces, (not-yet-ripe) bananas and other verdant-colored products.

But with its modern distribution center, opened three years ago, the company has transitioned to a different kind of green, the environmental kind, best represented by its all-natural ammonia (NH<sub>3</sub>)-carbon dioxide (CO<sub>2</sub>) refrigeration system, supplied by Carnot Refrigeration.

The NH<sub>3</sub>-CO<sub>2</sub> system, a DX (direct expansion), medium temperature unit, is a significant step

up from the R22-based DX system employed at its former facility. For one thing, the new system eliminates the ozone-layer-depleting and climate-warming R22 (global warming potential of 1,700) in favor of natural refrigerants with no effect on the ozone layer and global warming potentials of just one (CO<sub>2</sub>) and zero (NH<sub>3</sub>).

The Carnot system is also much more efficient than its predecessor, both in terms of electricity consumption and in the use of heat reclaim and hot gas defrost.

"Our motivation was to be more green," said Richard Sevigny, operations manager for

Courchesne Larose for the past 13 years, in a recent interview with *Accelerate America*. "We wanted to be the first to say to our customers that we're green."

Courchesne Larose's customers are food retailers throughout Canada and the east coast of the U.S., many of which are serving an increasingly environment-conscious shopper base and want to work with suppliers that share the same values. "More and more [retailers] care about it," said Sevigny. "They're not all there, but more and more. And if they want to be with a company that's green, they have to come over here."

## CONFINED AMMONIA

Courchesne Larose's warehouse is 100,000 square feet and 40 feet high – 30,000 square feet bigger and 20 feet higher than the old facility. It includes 22 ripening rooms for bananas, a main dock with 19 garage doors, and a banana dock with three garage doors. The temperature in the rooms varies between 34°F and 42°F.

The building, which can handle more than 4.5 million pounds of produce daily, can be expanded to two-and-a-half times its current size.

The NH<sub>3</sub>-CO<sub>2</sub> system confines the ammonia to the mechanical room, using CO<sub>2</sub> to cool medium temperature areas. This drastically reduces the quantity of ammonia used, compared to a conventional ammonia warehouse system, without energy penalty, said Carnot. Moreover, keeping the NH<sub>3</sub> in the machine room increases the safety of the building for employees.

According to Carnot, the system reduces piping and insulation size by more than half compared to a non-CO<sub>2</sub> system, cutting related labor and

material costs by 31.5%. In addition it limits the use of parasismic hangers to support pipes.

Through its first three years of operation, the NH<sub>3</sub>-CO<sub>2</sub> system has been largely problem-free, Sevigny said. "So far, we're lucky. It's better than expected." From a leak perspective, for example, the system is vastly superior to the half-century-old R22 system, which was leak-prone. Sevigny is able to control the system remotely, including from home, which makes his life much easier, he acknowledged.

## FOUR TIMES AS EFFICIENT

Though Sevigny declined to say how much energy the NH<sub>3</sub>-CO<sub>2</sub> system is saving Courchesne Larose, he pointed to a number of features that are controlling energy consumption. For example, though the new facility has triple the storage area of the old building, Courchesne Larose has been able to maintain the same energy costs. This has been possible, according to Carnot, in part because the energy efficiency of the NH<sub>3</sub>-CO<sub>2</sub> system is four times that of the R22 system in the former warehouse.

The NH<sub>3</sub>-CO<sub>2</sub> system also saves energy by reclaiming heat from the discharge gases of the CO<sub>2</sub> compressors and routing it to offices and warehouse space, as well as to domestic or process water heating. And it delivers hot gas for

evaporator defrost, avoiding the need for electric defrost.

Another energy-saving feature is "free cooling," by which the system leverages cold ambient temperatures (not uncommon in Canada) to efficiently enhance the cooling effect. When using CO<sub>2</sub> in direct expansion in cascade with ammonia, the system enters free-cooling mode when the outside temperature is below 8°C (46°F). This mode is maintained for 4,000 hours in the Montreal area.

While in free-cooling mode, the ammonia compressors completely stop. (NH<sub>3</sub> is not needed to cool the CO<sub>2</sub>.) This increases the lifetime of the compressors, the lubrication system and other

components of the ammonia loop, and delivers substantial energy savings.

"We expect that [free cooling] will reduce the total energy (kWh) requirement of the building, compared to a direct NH<sub>3</sub> building," said Carnot in a company document.

Finally, the NH<sub>3</sub>-CO<sub>2</sub> refrigeration system maintains stable temperatures, allowing fruits and vegetables to remain in fresh condition longer. This enables Courchesne Larose to buy at a lower price, giving it a distinct advantage vis-à-vis its competitors. "We can be more aggressive in the marketplace," said Sevigny. **MG + MC**

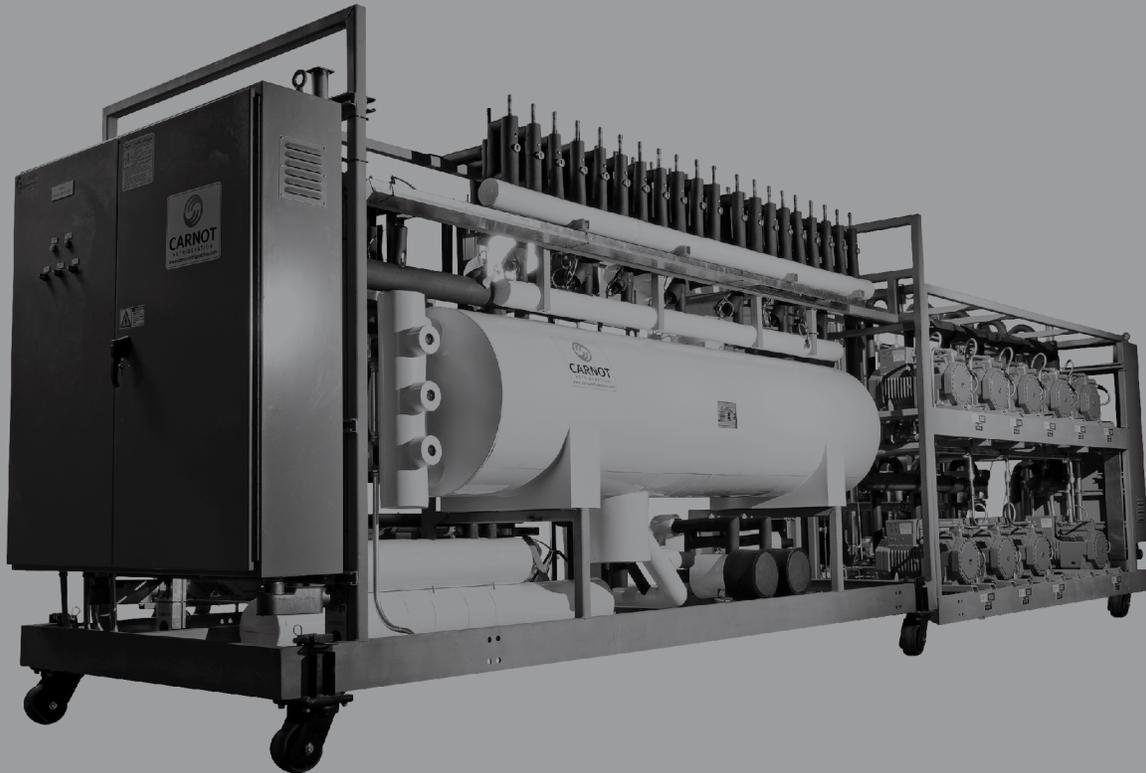


### System Specs

Courchesne Larose's NH<sub>3</sub>-CO<sub>2</sub> refrigeration system at its produce warehouse has the following attributes:

- » Ammonia in the machine room and carbon dioxide in the cooling areas.
- » Medium-temperature compressors for NH<sub>3</sub> and CO<sub>2</sub>
- » Medium-temperature capacity of 1,600 kW
- » Temperature in product rooms varies between 34°F and 42°F.
- » Free cooling.
- » Heat recovery.
- » Hot-gas defrost

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**CARNOT**  
REFRIGERATION

— By James Ranson

# ARE MAJOR CLIMATE ACCORDS ON THE HORIZON?

Preliminary agreements at the Lima Summit and the Montreal Protocol meeting in Paris could lead to breakthroughs in 2015, though barriers remain.

Manuel Pulgar-Vidal, minister of the environment of Peru and president-designate of COP 20 and CMP 10

Are the countries of the world finally headed toward agreements that can slow the rise of global temperatures and prevent the worst effects of climate change?

There were some encouraging signs in 2014. In particular, two major meetings at the end of year – the Montreal Protocol’s Meeting of the Parties that took place in Paris in November and the global climate summit held in Lima, Peru, in December – raised hopes that agreements may come about in 2015 to curb the greenhouse gas emissions that are causing temperatures to rise.

For example, despite some roadblocks, the parties to the Montreal Protocol took steps towards an agreement that would phase down the production and use of HFCs (hydrofluorocarbons), the potent greenhouse gas still widely used in North America as a refrigerant. (See [Accelerate America, Dec. 2014-Jan. 2015 issue, page 30.](#)) Such an agreement,

modeled on the Montreal Protocol’s phasedown of CFC and HCFCs (chlorofluorocarbons and hydrochlorofluorocarbons) would certainly shake up the refrigeration marketplace and potentially boost demand for natural refrigerants.

At the same time, the Lima meeting’s Conference of Parties to the UNFCCC (United Nations Framework Convention on Climate Change) set the stage for ratification of a global accord at a meeting slated for December 2015 in Paris that would commit 196 countries, including the U.S., China and the European Union, to remediation efforts aimed at all greenhouse gases.

The accord struck in Lima essentially put in motion a process by which each nation would design its own plan by March 31 to reduce greenhouse gas emissions. HFCs, currently under the reporting requirements of the Kyoto Protocol, would certainly represent low-hanging fruit in any emissions-reduction plan.

The sum total of those plans would constitute the final agreement that would be formalized in Paris in December and put into effect by 2020.

Also on the HFCs front, the Canadian Environment Minister Leona Aglukkaq announced on Dec. 5 – simultaneous with the Lima conference – that Canada was following through on its commitment to reduce HFCs by publishing a “Notice of Intent to Regulate Hydrofluorocarbons.”

Like the U.S., the Canadian government is looking at prohibiting the use of some high GWP (global warming potential) HFCs, including, R507 and R404A, in certain applications where lower-GWP alternatives are readily available. The targeted applications include commercial and stand-alone refrigeration systems as well as vending machines; only new equipment would be affected.

continued on p.32 →



## SOME DRAWBACKS

By getting both developed and developing countries – rich and poor – to commit to cutting back on greenhouse gas emissions, the Lima Accord represents a landmark in the climate change fight, while also falling short of expectations. For example, it includes no legally binding requirements, and also fails to deliver what scientists believe is necessary to prevent global temperatures from growing by more than 3.6°F beyond pre-industrial levels.

Still, the Lima agreement could lead to the first binding emission-reduction targets since the Kyoto Protocol was signed in 1997.

The world's two biggest emitters, the U.S. and China paved the way for the Lima Accord in November with a joint announcement on their plans to address climate change. President Barack Obama presented an ambitious 2025 target to cut emissions by 26% - 28% as compared to 2005 levels. Meanwhile, Chinese President Xi Jinping said China's CO<sub>2</sub> emissions would peak around 2030, albeit without specifying what they would be.

"Together, the U.S. and China account for over one third of global greenhouse gas

emissions. Today's joint announcement, the culmination of months of bilateral dialogue, highlights the critical role the two countries must play in addressing climate change," the statement said.

Importantly, the U.S. promised to more than double the rate of reduction of its emissions, from 1.2% per year on average during the 2005-2020 period to 2.3%-2.8% between 2020 and 2025. China announced it would start reducing its use of coal within six years, following an EU undertaking to cut its greenhouse-gas contribution by 40% by 2030. All told, this means the nations responsible for more than half the world's carbon dioxide emissions are working to convert their economies to low-carbon ones.

Under the Lima Accord, the remainder of the world's nations will also need to put forward policies outlining just how they will achieve cuts in carbon emissions. These plans, known within the U.N. as the "Intended Nationally Determined Contributions," are dictated by each nation's unique economy and domestic policies. This flexible strategy – in contrast to an all-encompassing mandate – helped secure the willingness of every country to enact some kind

of carbon reduction.

The text contained in the Lima draft is deliberately passive. Countries are "invited" to "consider communicating their undertakings" which "may include, as appropriate" relevant "quantifiable information...time frames and/or periods." A compromise was reached on what kind of information countries must share in their emission-reduction plans as they look to and beyond 2020.

By November 2015, a month prior to the Paris meeting, the UNFCCC secretariat will publish a report on the aggregate effect of the reduction targets.

There remains the fear that, with little threat of action, countries will simply put forward weak plans that amount to little more than tokens. Worse still, nations could submit no plan at all. However, it's hoped the threat of international condemnation – "naming and shaming" – will prevent countries from merely paying lip service to the agreement.

## HELPING THE VULNERABLE

Another major initiative, designed to help vulnerable developing nations reduce their emissions as well as adapt to the impacts of climate change, is the Green Climate Fund, supported by financial donations from developed countries.

The fund is seen as a crucial platform to help bridge the gap between developed and developing nations as the latter strive to invest in low-emission projects. It is also seen as key to achieving a meaningful binding agreement on climate action at the Paris summit.

The Fund has been gaining momentum with 11th-hour contributions from Belgium and Australia, and new contributions from Norway, Peru, Colombia and Austria bringing the total pledged to \$10.2 billion. China, too, delved into its pockets, pledging \$10 million for the South-South Cooperation and agreeing to double it next year.

"Lima has given a new urgency towards fast-tracking adaptation and building resilience across the developing world - not least by strengthening

the link to finance and the development of national adaptation plans," said Manuel Pulgar-Vidal, president of the Conference of Parties in Lima and Peru's Minister of Environment.

Still, as has been the case since the very first mandate in Berlin in 1995, major disagreements rage on between developed and developing countries, as well as between countries willing to shoulder responsibility and those tending to shirk it. The latter category includes countries like India, the world's third biggest emitter and Australia, considered the worst performing industrial country on climate action.

The Lima draft describes this as "the principle of common but differentiated responsibilities and respective capabilities, in light of different national circumstances."

In the U.S., President Obama appears committed to fighting climate change, seeing it as cornerstone of his legacy. Xi Jinping's Chinese government is investigating a cap-and-trade system that would be introduced in 2016 and

force polluters in China to pay for their greenhouse gas emissions. But there remains skepticism that China is interested in cutting pollution only to mitigate domestic unrest as increasingly bad air hastened by coal power production continues to plague the nation's standard of living.

Meanwhile, economic growth remains India's top priority, even if it means investing in the construction of hundreds of new coal-fired power plants to deliver cheap electricity. "We've got what we wanted," said Indian Environment Minister Prakash Javedekar.

And Vladimir Putin's Russia continues to scoff at international opinion, while Australia, the only government to repeal a climate policy, was conspicuous in its silence as other delegates from around the world praised the Lima Accord.

Thus it remains to be seen whether international scrutiny will be sufficient for world leaders to finally push through new global warming laws in Paris next December @JR

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# GREENER CHINA IS TURNING TOWARDS NATURAL REFRIGERANTS



A new study by shecco and the Chinese Association of Refrigeration shows a growing market for naturals in the wake of government regulations

— By Elke Miner and Caixia Mao

As a developing country with a population of 1.3 billion, China has made remarkable progress in becoming the second largest economy in the world – and a major manufacturer and exporter in the global HVAC&R industry.

In fact, its top three manufacturers – Haier, Midea and Gree – have the capacity to supply half the world’s demand for HVAC&R products. In the future, many of those products may include natural refrigerants as China looks for ways to become a greener nation.

China’s rapidly developing economy has put it at the top of the list of the world’s top polluters, and increasing domestic concerns over air pollution have led the government to make a historic move to revamp its environmental law. The new rules are said to be the strictest yet, with a monitoring and retribution system for polluters, and it is expected that this new law will prove an important driver in making business more aware of their environmental impacts.

In the HVAC&R sphere, China has also taken steps to limit greenhouse gas emissions. Recent developments include reversing its former position and agreeing to support a phasedown of HFCs (hydrofluorocarbons) via the Montreal Protocol, as well as striking an accord with President Obama that includes beginning to phase down the use of HFCs.

These government actions, coupled with increased emphasis on energy efficiency and technology development in the HVAC&R industry to maintain China’s competitive edge in the world market, could lead

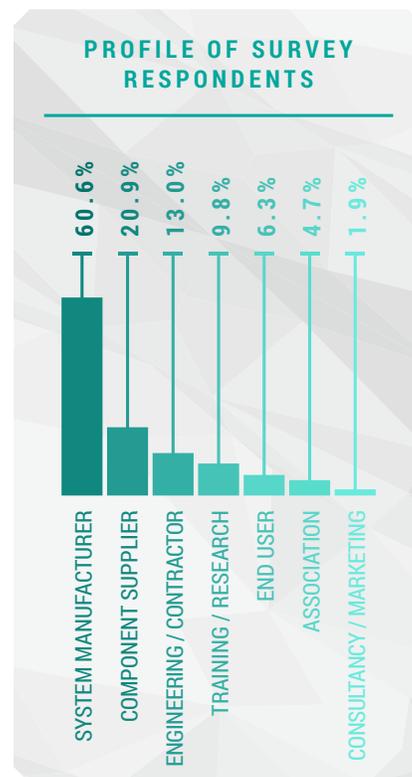
to a much greater use of natural refrigerants in China, both by manufacturers and end users.

Thus far, China has been slow to leave the gate in natural-refrigerant adoption, compared with markets like Europe, Japan and even North America. However, the nation’s delayed start won’t necessarily be indicative of future trends.

To get a clearer picture of the status and potential of natural refrigerants in the growing Chinese economy, market expert shecco, in collaboration with the Chinese Association of Refrigeration (CAR), launched an industry-wide study last summer.

The study, a first-ever comprehensive industry analysis of the Chinese market, will be published in February as “GUIDE China 2015: Natural Refrigerants – Market Trends & Potential in China.” The GUIDE will focus on key application areas in the Chinese market, including commercial, light commercial and industrial refrigeration, CO<sub>2</sub> heat pumps, and R290 in room air conditioning. It will include the results of a survey of suppliers, trainers, contractors, end users, and other stakeholders; and it will also offer exclusive insights from government officials, leading researchers, industry experts and end users active in a variety of application areas of the HVAC&R industry.

Overall, the GUIDE will shed light on the current use of natural refrigerants, expectations for market development, and barriers and challenges facing the Chinese market.



## ON THE RISE

Having collected nearly 1,000 responses, the GUIDEs shecco-CAR survey results suggest that natural refrigerants are indeed on the rise in China.

The survey found that three-quarters of respondents still use HFCs, and more than 60% are still employing ozone-depleting HCFCs (hydrochlorofluorocarbons). However, a sizeable number of respondents indicated their organization already uses or offers solutions using natural refrigerants, including carbon dioxide (30%), ammonia (23%) and hydrocarbons (26%).

Furthermore, of those not yet using or offering systems using natural refrigerants, nearly 50% reported that their organizations would do so in the future, indicating a significantly increased market share on the horizon. In addition, 30% of respondents were unsure whether or not their organization would adopt natural refrigerants, further expanding the potential number of companies employing natural coolants in the future.

For the Chinese market, going natural makes economic sense. The government is already aware that the increased efficiency many natural refrigerant solutions offer is an important way to help the economy continue to grow, but within a more sustainable model. And the government has noted that future technology developments

should focus on safety, high efficiency and reduced carbon emissions.

Moreover, the government is putting increased emphasis on maintaining a competitive edge in the world market by improving energy efficiency and keeping up with technology advancements around the globe. This means that as China's export markets, particularly Europe and North America, adopt natural refrigerants, Chinese industry will follow this trend in production.

For example, respondents to the shecco-CAR study have indicated that CO<sub>2</sub> and hydrocarbons are likely to take a strong share of the Chinese light commercial refrigeration market, largely due to the vast influence of the EU F-Gas Regulation revisions on HFC replacement. In fact, refrigerant replacement offers China a unique opportunity to overtake other nations in the HVAC&R industry, said China's Foreign Economic Cooperation Office of the Ministry of Environmental Protection at the 2014 HVAC&R Industry Development Forum.

According to the results of the shecco-CAR survey, Chinese industry is very receptive to this opportunity and is keen on increasing research and development in natural refrigerants technology. Among those companies indicating a clear plan for future use of refrigerants, nearly 100% reported they intend to increase R&D efforts for natural refrigerants.

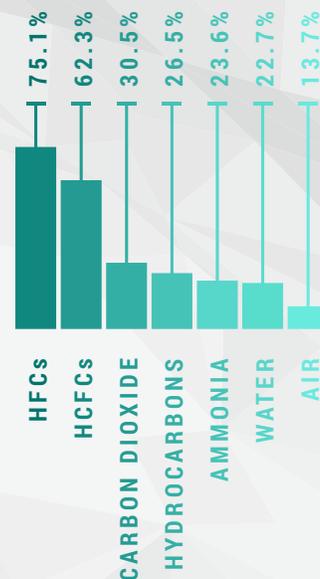
## NEW POLICY DRIVERS

In terms of policy, the turn of the new year will build on earlier moves aimed at HFCs. For example, it will be a pivotal moment for those still using HCFCs, as China aims to phase down HCFCs by 10%, leading to a phase out in 2030. In addition, in April 2014, the Chinese government announced a short-term target to reduce emissions, including HFCs, by 280 million tons of CO<sub>2</sub> equivalent by 2015.

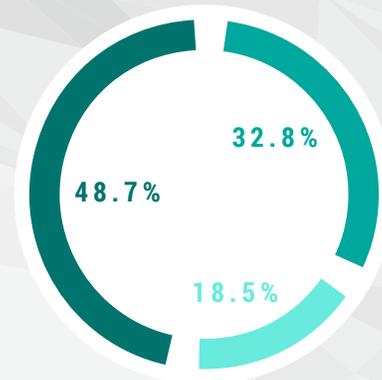
Key industry stakeholders that participated in the survey indicated that global and national HFC regulations and, within China, the introduction of standards allowing for the use of natural refrigerants, are the strongest drivers for the development of natural refrigerant technologies and the growing use of these refrigerants in China.

Already, the industrial refrigeration sector is entering a period of transition, in which increased emphasis is placed on safety and energy efficiency. This is particularly evident in the amplified adoption of CO<sub>2</sub>/NH<sub>3</sub> indirect and cascade systems in place of older systems. And 2015 is expected to be a significant year in room air conditioning as well, likely including the commercialization of R290 (propane) applications @EM + CM

### USE OF NATURAL REFRIGERANTS VS F-GASES IN CHINA TODAY



### FUTURE PLANS FOR NON-NATURAL REFRIGERANTS USERS



Yes, I will use natural refrigerants

Do not know the plan yet

No, I will not use natural refrigerants

# Danfoss



Jonathan Holloway  
Strategic Marketing Director,  
Climate & Energy  
Danfoss North America

## **DANFOSS IS PUSHING THE MARKET TOWARDS NATURAL REFRIGERANTS**

The Danish components maker is engaged in research, training, education and standards development in support of what it sees as a growing phenomenon in North America.

— By Michael Garry and Marc Chasserot

## As North American food retailers assess the prospects for future regulations of refrigerants, they can read the handwriting on the wall: more are on the way.

Given this reality, many merchants are looking for a more “future-proof” refrigeration solution not subject to the vagaries of government oversight. And as their counterparts in Europe have already done in large numbers, some here are turning to natural-refrigerant-based equipment, such as transcritical booster systems incorporating carbon dioxide.

Most of the North American transcritical systems have been deployed in climates that have a significant winter season because these systems typically operate more efficiently in cooler climates. Now the race is on to develop technology that can make transcritical a truly universal refrigeration option for supermarkets, suitable for any climate.

### “THESE TECHNOLOGIES ARE CHANGING THE GAME IN TERMS OF WHERE THE ‘EFFICIENCY EQUATOR’ STANDS”

Danfoss, the venerable Danish manufacturer of controls, valves, compressors and other components, is an eager participant in that contest.

Founded in 1933, Danfoss, based in Nordborg, Denmark, has one of the most far-flung manufacturing and sales operations geared to HVAC&R applications, with factories in 19 countries and sales teams in 49.

In North America, where it has operated since 1958, the company has more than 4,000 employees and generated nearly a quarter of its \$5.3 billion annual sales in 2013. Headquartered in Baltimore, Md., Danfoss North America has bolstered its portfolio with a series of acquisitions over the past 30 years and now has locations throughout the Midwest and South.

But Danfoss is not a company to rest on its laurels. It invested 4.3% of its 2013 annual sales in innovation, and now its research and development is squarely targeting CO<sub>2</sub> refrigeration.

According to Jonathan Holloway, Danfoss’ strategic marketing director, climate & energy, North America, the company is engaged in research on four technologies that can maximize the benefits and overcome the barriers to broad adoption of transcritical systems: parallel compression, ejectors, mechanical subcooling and adiabatic condensers.

“All of [these technologies] are changing the game in terms of where the ‘efficiency equator’ stands,” said Holloway, a former banking executive who has served in marketing roles for Danfoss since 2011, during a recent interview with *Accelerate America* at Danfoss’s Baltimore offices. “We are working with all of [them] to help our customers be ready for field trials so that CO<sub>2</sub> can be expanded in North America.”

With a solid business in traditional HVAC&R technology, why is Danfoss so keen on promoting natural refrigerants? Currently natural-refrigerant-related components represent less than 10% of the company’s North American sales, which is reflective of where the market as a whole stands.

But that’s today. With regulations likely to play a major role, Danfoss sees a robust future for natural refrigerants in North America, starting with transcritical systems. “Based on activities we’ve seen with our customers, we are moving through the early adoption phase [and] scaling up,” said Holloway, who expects the number of U.S. transcritical store installations to surpass 100 in 2016. “I see CO<sub>2</sub> growing in momentum. I don’t see this slowing down.”

It’s not all about business for Danfoss. Environmental considerations have long been a part of its history and infuse its culture. “Danfoss as a company is very concerned about the environment,” said Holloway. Within food retail, for example, “we see [natural refrigerant technology] as the right solution for the environment.” A member of the United Nations Global Compact, Danfoss has announced its intention to generate 25% less carbon equivalent and use 25% more renewable energy by 2025.

continued on p.38 

## → A Big Focus

Traditional supermarkets are not the only retail outlet where CO<sub>2</sub> is catching on, noted Holloway. Following a trend in Japan, downsized, modular systems for smaller merchants such as convenience stores represent “a big focus in the market,” he said. “This is one of the ways the game can change.” But smaller systems require different components – an area where Danfoss can help end users make the necessary adjustments.

Holloway also sees potential for CO<sub>2</sub>, among natural refrigerant options, in refrigerated trucking applications. “There are some CO<sub>2</sub> solutions on the market today that will continue to evolve.”

Danfoss has its eye on other natural refrigerants as well, such as ammonia. The company has long been involved in ammonia refrigeration systems used by industrial warehouses and production plants, but now it is helping develop smaller, lower-charge applications, even packaged systems. “This could change the cost equation, making ammonia systems easier to apply for end users,” said Holloway.

An Albertsons store in Carpinteria, Calif. (originally owned by Supervalu but now owned by Albersons LLC), which employs an ammonia-CO<sub>2</sub> cascade refrigeration system, shows that smaller-scale ammonia systems can work even in retail settings, he noted.

Danfoss is also examining how hydrocarbons such as propane (R290) and isobutane (R600a) can be more widely used. While these refrigerants are highly efficient, and are being adopted in beverage coolers, there remain flammability concerns and charge limits. “These can be addressed with proper insulation, service and system design,” said Holloway. “We have been working in a lab in Baltimore with manufacturers to optimize their systems for hydrocarbon applications.”

Other areas where natural refrigerants will play a role include data centers and ice rinks, Holloway observed. But he sees much less applicability to HVAC, at least in North America. For example, heat pumps using hydrocarbons, which Danfoss is pursuing in Europe, have been held up in the U.S. by regulations.

## The Value of Support

Beyond its R&D efforts, Danfoss has myriad other ways of furthering the adoption of natural refrigerants in North America.

For one, it is heavily invested in training personnel and nurturing their expertise in natural refrigerant applications in order to help customers improve efficiency and design, adapt to regulations, and have successful implementations. “Support is an underplayed point,” said Holloway. “Our engagement with customers and making sure projects are a success are also critical to making sure this momentum continues.”

Danfoss is also helping to educate the marketplace about natural refrigerants through its EnVisioneering Symposia Series, which bring together policy makers, utilities, equipment manufacturers and contractors to discuss the “tough issues,” said Holloway. “Natural refrigerants have risen to a higher area of the agenda the past couple of years.”

Another tactic is to work with utilities on offering incentives in support of natural solutions. How can Danfoss justify incentives for a technology

still relatively uncommon in North America? “To the extent that natural refrigerants are proven as a more efficient solution, I don’t know why they wouldn’t want to support that,” said Holloway.

Danfoss recently took its support of natural refrigerants to the national stage. It was among 22 companies that assembled at the White House last September to make a commitment to slashing emissions of HFCs (hydrofluorocarbons) by using alternative climate-friendly technologies.

In particular, Danfoss announced that, it is forming a stakeholder task force to accelerate the adoption of standards and building codes for next-generation, low-GWP (global warming potential) refrigerants, including natural refrigerants such as hydrocarbons.

“We see the market moving, and we have a role in pushing it that way,” Holloway said **MG + MC**

## DANFOSS QUICK FACTS

- » Founded in 1933 by Mads Clausen
- » Worldwide headquarters: Nordborg, Denmark
- » Ownership: Privately held
- » Opened first US sales office in 1958
- » North American headquarters: Baltimore, Md.
- » 2013 global sales: \$5.33 billion.
- » 2013 North American percentage of sales: 23%
- » 2013 percentage of sales invested in innovation: 4.3%
- » Global employees: 24,000
- » North American employees (including Mexico): 4,030
- » Factories: 64 in 19 countries
- » Top three markets: US, Germany and China



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Rusty Walker  
Senior Trainer  
Hillphoenix Learning Center

## *IT'S NOT ROCKET SCIENCE. IT'S JUST REFRIGERATION*

At Hillphoenix's Learning Center, chief trainer Rusty Walker demystifies natural refrigerants.

— By Michael Garry and Marc Chasserot

Fans of the *Star Wars* film series will recall the Ewok, a small, primitive creature that looks like a teddy bear. As an instructor for refrigeration manufacturer Hillphoenix, Rusty Walker invokes the character as a way of allaying the concerns of his students about new systems using carbon dioxide as a natural refrigerant.

"One of my goals," he said in a recent interview with *Accelerate America*, "is just to be like a little bitty Ewok and just give everybody a big hug and say, 'It's OK, it's just refrigeration! We're not going to kill anybody! It's fantastic!'"

Walker, the senior trainer at the Hillphoenix Learning Center, oversees an educational program that has explained the intricacies of refrigeration installation, maintenance and commissioning to more than 23,000 students – mostly contractors, technicians and engineers, but some end users as well – since its inception in 2006. Much of the training takes place at the Center in Conyers,

Ga., but Walker, who has been in the HVAC&R industry almost 30 years, also travels the country to conduct regional programs. The Center offers a growing online instruction program as well.

"What we found in the refrigeration industry is a huge gap where technicians and engineers are not necessarily trained like they used to be," he said. "It was [Hillphoenix vice president of marketing] Henry Pellerin's vision that we needed to somehow do something about it instead of just complain. So we put the Learning Center together."

Walker also speaks at HVAC&R educational organizations like AHSRAE and RSES and participates in online chat groups like HVAC-Talk.

At the Learning Center, Hillphoenix offers an array of courses at prices ranging from \$59 to \$299 (see [www.hillphoenixlc.com](http://www.hillphoenixlc.com)). Several of the courses address CO<sub>2</sub> refrigeration, including

transcritical, cascade and secondary systems, while others cover a range of conventional DX (direct expansion) technologies as well as basic refrigeration concepts. Attendees can customize their course selection over a one-, two- or three-day period. Courses use manuals written by in-house technical writers Bill Katz and David Moorehead.

Of the Learning Center's 23,000 students, more than half – about 12,000 – have received training in natural-refrigerant systems, particularly equipment using CO<sub>2</sub>. Given the relative newness of natural refrigerants, this may be the area where Walker's training is most needed.

"For years our industry never changed," he said. "But now, with environmental and energy concerns, we have new systems and refrigerants. We have to educate people in the usage and installation of those systems."

## JUST ANOTHER REFRIGERANT

One of Walker's most important tasks as an educator is to address the anxieties and myths that have grown up around the safety of CO<sub>2</sub> technologies. "When people ask if CO<sub>2</sub> is dangerous, my answer is yes, but so is R22, and we've used R22 forever," he said.

One area where CO<sub>2</sub> does differ from other refrigerants is in the higher pressures under which it operates. But Walker pointed out that the higher pressures don't exist in the store, and where they do occur, the system is built to handle them. "So it's not a big deal; it's just another refrigerant."

Walker's teaching style is interactive. He asks questions and waits for answers. "If it's a

discussion and not a lecture, then everybody learns," he said. "A lecture bores me as well."

In the CO<sub>2</sub> sessions, attendees also get "hands-on" experience with the systems. "We have a transcritical rack at the Learning Center and we'll start pulling off the heads of the compressors, open up the coalescent filters and look at the components," he said. "What valves do we shut to pump it down? What are the safeties built in?"

The Learning Center also has an operating transcritical rack at its R&D facility where attendees can see the high pressures and work with the controllers. "Once they play with it, they start understanding this is not that big a

difference [from conventional systems]," Walker said.

He also encourages attendees to rely on their training for DX systems in approaching transcritical technology. "I teach a couple of new things, maybe a new valve," such as the high-pressure control valve and the flash-gas bypass valve, he said. "It's not rocket science; it's just refrigeration."

Some of Walker's students come to realize that CO<sub>2</sub> systems, which have fewer moving parts and use electronic expansion valves, are easier to install and maintain than conventional systems. "That's the fun part for me," he said.

## MANUFACTURER'S RESPONSIBILITY

While CO<sub>2</sub> is the natural refrigerant the Learning Center is most focused on, hydrocarbons are also covered in the context of Hillphoenix's self-contained cases. The Center plans to offer instruction on any natural refrigerants for which there is a market demand.

Walker believes that refrigeration training has become more of a responsibility of the system

manufacturer, because trade schools have moved away from it. That's especially true "if we want to move people to natural refrigerants."

He sees natural refrigerants helping to bring young people who care about the environment into the HVAC&R industry, which has struggled to recruit young technicians. "We need young people. That's a fact."

Walker admits he is "drinking the CO<sub>2</sub> Kool-Aid," but believes his faith is justified. "When we can use a refrigerant that is so efficient and has a better latent heat transfer, I think we all win," he said. "And it's a natural refrigerant that doesn't harm our environment" **MG + MC**

# REFRIGERATE DIFFERENTLY

So says Carnot Refrigeration, which, with Canadian grocer Sobeys, has put CO<sub>2</sub> transcritical refrigeration on the map in North America

— By Michael Garry and Marc Chasserot

Marc-André Lesmerises  
Carnot Refrigeration

When Marc-André Lesmerises fulfilled a dream by co-founding Quebec-based Carnot Refrigeration in 2008, he had the good fortune of immediately striking a deal with the company that would become his biggest customer — Sobeys, Canada's second largest food retailer.

That year, Lesmerises, who had received his degree in mechanical engineering from Quebec University just five years earlier, oversaw the construction of an innovative refrigeration system for Sobeys' dairy distribution center in Trois-Rivières, Quebec. It uses ammonia in the central chiller and glycol as a secondary fluid to maintain a temperature of 39°F. (4°C.) in the refrigerated space. Most of the facility's heating is derived from the chiller's condensers.

The system was a hit, earning Carnot two awards from ASHRAE (the American Society of Heating, Refrigerating and Air-Conditioning Engineers). It was, to paraphrase the movie *Casablanca*, the beginning of a beautiful relationship. Working together, Carnot and Sobeys have helped put transcritical refrigeration, which uses only carbon dioxide, on the map in North America (see [page 26](#)). "The journey started with Sobeys," said Lesmerises in a recent interview with *Accelerate America*.

Today, Carnot's emphasis on natural refrigerants like CO<sub>2</sub> is epitomized by the phrase "refrigerate differently," prominently displayed on its website.

## CHOOSING CO<sub>2</sub>

Following the successful Trois-Rivieres project, Sobeys asked Lesmerises to develop a system that would reduce the refrigerant charge in its stores. He began surveying natural-refrigerant solutions around the world.

Lesmerises initially looked at propane and ammonia applications in Sweden. But he couldn't help noticing the rapid adoption of CO<sub>2</sub> systems in Europe between 2007 and 2009, and decided to pursue that route. "We understood rapidly after we did our first site that CO<sub>2</sub> was the best option for supermarkets," he said.

Since then, Carnot has also designed CO<sub>2</sub> systems for industrial warehouses and ice rinks. In 2011, the company installed an ammonia-CO<sub>2</sub> system in a produce warehouse operated by Courchesne Larose in Montreal. (See story, [page 28](#).)

Lesmerises described the evolution of Carnot's supermarket CO<sub>2</sub> installations at shecco's ATMOsphere America conference last June. Starting with two stores in 2009, they grew to eight in 2010, 11 in 2011, and 45 in 2013.

Carnot's initial CO<sub>2</sub> systems were cascade models, but then in 2010 the company introduced its CO<sub>2</sub>-only transcritical system, which has been the basis for its supermarket business since then. Carnot has become, Lesmerises said, the North American leader in the number of transcritical CO<sub>2</sub> systems installed in supermarkets.

Sobeys overall operates 72 food stores with transcritical systems, which are supplied now by three manufacturers.

In addition to Sobeys, Carnot is working with six other supermarket chain customers on deploying its CO<sub>2</sub> system, including its first U.S. customer,

Hannaford Supermarkets. In 2013, Carnot's transcritical system became the first such system installed in a U.S. supermarket, Hannaford's store in Turner, Maine. (See, "Does CO<sub>2</sub> Refrigeration Deliver?", *Accelerate America*, Nov. 2014.)

"It is good news that there are now more U.S. companies on board with this strategy and I'm confident they will like what they get," he said. After the massive adoption of CO<sub>2</sub> refrigeration in Europe, "it was only a question of time before the U.S. jumped into that."

Carnot's presence in the U.S. adds a new supplier to the mix and thereby mitigates the risk of investing in unconventional refrigeration technology. "U.S. retailers say it's refreshing to have a new serious supplier in the market," he noted.

## OVERCOMING FEAR

The primary obstacle to further adoption of CO<sub>2</sub> systems, Lesmerises believes, is fear of the technology. For example, some end users are apprehensive about the higher pressures inherent in CO<sub>2</sub> systems. Other companies are not persuaded that transcritical systems can run efficiently in warmer climates. Still others may be highly invested in traditional technology and reluctant to try something different that they believe is more expensive.

Lesmerises works diligently to dispel these fears. For example, in regard to high pressures, he points out that cars have high-pressure components and "they are moving anyway."

Lesmerises finds word of mouth between users who have had a positive experience with CO<sub>2</sub> systems and those who are considering these systems to be an effective way of helping the latter get over the hump. "I just think it's a matter of time before enough [end users] have a good experience with us or other suppliers and demonstrate that the fears were maybe exaggerated," he said.

Over the past five years, the total cost of CO<sub>2</sub> systems – first cost, installation and operating cost – has declined to the point where they are now competitive with traditional DX systems using an HFC (hydrofluorocarbon) like R507, said Lesmerises. The first cost alone has dropped as well.

With demand for CO<sub>2</sub> systems in North America expected to grow over the next few years, Carnot is able to manufacture 15 transcritical racks per week, said Lesmerises. Carnot employs 15 engineers, five technicians, up to 30 production employees and five administrators.

But Lesmerises still regards Carnot as a small company that is growing along with the demand for CO<sub>2</sub> systems. "We'll take it one step at a time, which is always the way we do it," he said. "We don't want to rush too fast because you need to deliver the quality and innovation."

To ensure a successful installation, Carnot works on-site with an established network of installers as well as with a customer's own installer. "We follow the process of start-up and installation really closely," he said.

One of the challenges in being among the first to market with CO<sub>2</sub> systems is dealing with snafus that occur with component suppliers. Carnot experienced that with one supplier of low-temperature expansion valves. "When we discovered we needed to replace all the valves, we did it, and the supplier completely supported us in this," said Lesmerises. "For us and our customer, you can judge your supplier by how they help you when you get in trouble." The customer also appreciated that Carnot stepped in to resolve the issue "We didn't just try to run away."

Since that experience, Carnot has made sure that each component is thoroughly vetted before it goes on a system. "We don't test them; we torture them," he said.

In furthering the adoption of natural refrigerants, Lesmerises is driven to fill, not just a market need, but an environmental one as well. "Each morning when I wake up I have no difficulties going to work because I know what I do is good," he said. "I know my two daughters will have a better life in 50 years because I do that @ MG + MC

## MULTIPLE-AWARD WINNER



In its brief, six-year lifetime, Carnot Refrigeration has garnered a number of awards and recognitions:

- » The company's very first project – an ammonia-glycol refrigeration system at Sobeys' dairy distribution center in Trois-Rivières, Quebec – won two awards in 2010 from ASHRAE (the American Society of Heating, Refrigerating and Air-Conditioning Engineers): first place in the industrial facilities or process category, and a technology case studies award.
- » Carnot's transcritical installation at Hannaford Supermarkets' Turner, Maine, store received widespread recognition. In December 2013, nine U.S. Senators and seven members of Congress (all Democrats) wrote a letter to Gina McCarthy, administrator of the Environmental Protection Agency, in which they advocated a shift away from HFCs and cited the store's system as an example of an alternative to HFC technology.
- » In 2013, the EPA's GreenChill Partnership gave the Turner store its highest level of certification, platinum, as well as the "Best of the Best" award as the most outstanding GreenChill certified store. GreenChill is a voluntary program in which food retailers agree to meet goals regarding refrigerant charge and leak rate. In 2014, Carnot became the first Canadian manufacturer to join the program's system manufacturer sector.
- » In 2014, Carnot received an award for a CO<sub>2</sub> transcritical installation in an ice rink from the Quebec Association of Energy Efficiency (AQME). The installation was at the Civic Centre in Dollard-des-Ormeaux, Quebec. (See "CO<sub>2</sub> Scores Goal at Quebec Ice Rink," *Accelerate America*, Dec. 2014-Jan. 2015).

NORTH AMERICAN EDITION

# ACCELERATE

ADVANCING HVAC&R NATURALLY

MAGAZINE

## EDITORIAL CALENDAR 2015\*

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### Issue #3 February (to be published mid Jan)

Special Issue: AHR Expo

Supplement: GUIDE AHR EXPO

Format: Digital + Print of Guide AHR Expo (@ AHR Expo)

Ad submission deadline: January 7

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### Issue #4 March (to be published early March)

Special Issue: Foodservice (NAFEM coverage)

Format: Digital

Ad submission deadline: February 23

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### Issue #5 April (to be published mid April)

Special Issue: Industrial Refrigeration (Food Processing / Food Storage)

Format: Digital + Print (@ IARW)

Ad submission deadline: April 3

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### Issue #6 May (to be published mid May)

Special Issue: Energy Utilities (Programs, Research, Rebates)

Format: Digital

Ad submission deadline: May 4

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### Issue #7 June (to be published mid June)

Special Issue: Ice Rinks + Trade Show Coverage

Format: Digital

Ad submission deadline: June 5

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### Issue #8 July / August (to be published end of July)

Special Issue: ATMOSphere America + Accelerate Awards  
(incl. Person of the Year)

Supplement: ATMOSphere America Summary Report

Format: Digital + Print (@ FMI Energy)

Ad submission deadline: July 17

Format: Digital + Print (@ FMI Energy)

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### Issue #9 September (to be published early Sept)

Special Issue: FMI Energy Conference

Format: Digital + Print (@ FMI Energy)

Ad submission deadline: August 17

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### Issue #10 October (to be published early Oct)

Special Issue: Intermodal / Transport Refrigeration

Format: Digital

Ad submission deadline: September 18

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### Issue #11 November (to be published early Nov)

Special Issue: Training + Servicing (RSES + Expo Coverage)

Format: Digital

Ad submission deadline: October 19

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### Issue #12 December / January (to be published early Dec)

Special Issue: Regulations (US + International Policies, Standards,  
Codes Update)

Format: Digital

Ad submission deadline: November 20

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### Additional topics:

HVAC + Heat Pumps

Wineries

Servers (IT)

Research

Residential

Institutional (Hospitals, Universities, etc)

Government Buildings

Office Buildings

Hotels

Mobile Air Conditioning

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\* Publisher reserves the right to modify the calendar.