

ACCELERATE

ADVANCING HVAC&R NATURALLY

A M E R I C A

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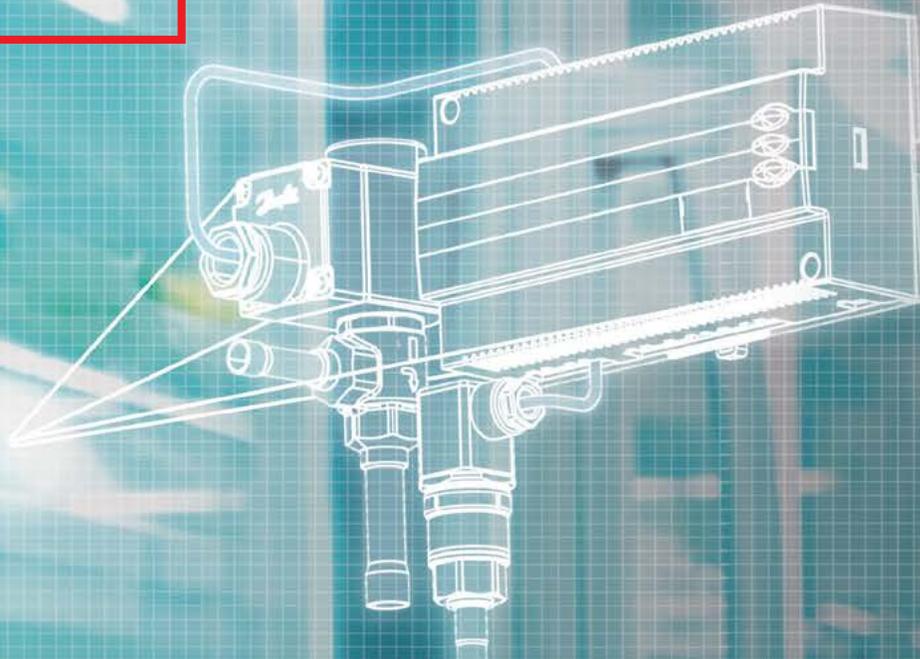
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California Air Resources Board

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**ENGINEERING
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Danfoss

Publisher's note by Marc Chasserot



THE WIDE WORLD OF NATURAL REFRIGERANTS

Ever since *Accelerate America's* founding in November 2014, reader feedback has been essential to the magazine's team, which now has an office in New York City. When we get a chance to talk with our readers about the magazine, we take advantage of it.

The good news is that our readers enjoy the stories and feel of the magazine. We are different, and our readers notice it. That's what we want. We're not strictly a trade magazine, nor are we a lifestyle magazine – we're a crossover of both, and more. We don't want to be put into a neat little box; rather, we want to think outside the box.

It's precisely this type of thinking that creates opportunities for natural refrigerant-based technologies. While many of us have to focus on one segment of HVAC&R, at *Accelerate America* we deliberately choose to look beyond the obvious and into new areas in order to show the broad and diverse applicability of natural refrigerants. This will be a key focus of our second year of publication.

On *Accelerate America's* 2016 editorial calendar (see [back cover](#)), you will see that we will continue to build on our core topics of food service, food retail and industrial refrigeration, where a lot is happening each month, as well as our ongoing coverage of regulations, standards and utilities. However, natural refrigerant-based technologies are also entering new segments, and we want to lead in coverage of these areas, too, especially as more and more of them cross over and reinforce each other, not only in North America but across the globe. We firmly believe that the leaders and innovators in all of these segments can help others, even if it is only to show what can be done.

Thus, we will explore the worlds of ice rinks and data centers as well as transport refrigeration. We will cover mobile air-conditioning, too, as manufacturers look to CO₂ as a solution instead of HFOs. And importantly we will look into HVAC both for residential and commercial buildings, including private offices, hospitals, universities, government, hotels, airports, shopping centers, sports facilities and more. So expect the range of sub-sectors to increase with each issue.

Year two also marks the debut of *Accelerate America's* annual Natural Refrigerants Awards, the first such program in North America. (See [page 12](#)) The awards will be presented this June at ATMOsphere America in Chicago. They will recognize end-user companies in food service, food retail and industrial refrigeration that are leading the wave of natural refrigerant innovation. A person of the year will also be named. We think that this is a big deal – that it is crucial to recognize the leadership and courage of innovators who are showing the way forward to a more sustainable future.

Nominations open January 12, 2016, at <http://acceleratena.com/awards>. Be sure to participate! @MC

VOLUME 2, #11, DECEMBER 2015-JANUARY 2016

ACCELERATE

ADVANCING HVAC&R NATURALLY

A M E R I C A



About Accelerate America

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

<http://acceleratenas.com>



The Wide World of Natural Refrigerants

Publisher's note by Marc Chasserot



Ryan McCarthy & Glenn Gallagher from the California Air Resources Board

Leading by Example

With the help of natural refrigerants, the California Air Resources Board plans to roll back emissions of HFCs in the state by 40% of 2013 levels by 2030, setting a standard for the rest of the U.S. and much of the world.



Predictions for 2016

Editor's note by Michael Garry



Events guide

for January, February and March 2016



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EPA's To-Do List for 2016

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COP21: Bridging the Emissions Gap

Research + Sustainability = Low-Charge Ammonia

Evapco's twin traditions have resulted in Evapcold, a low-charge packaged ammonia unit poised to enter the industrial refrigeration market

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VOLUME 2 ISSUE # 11

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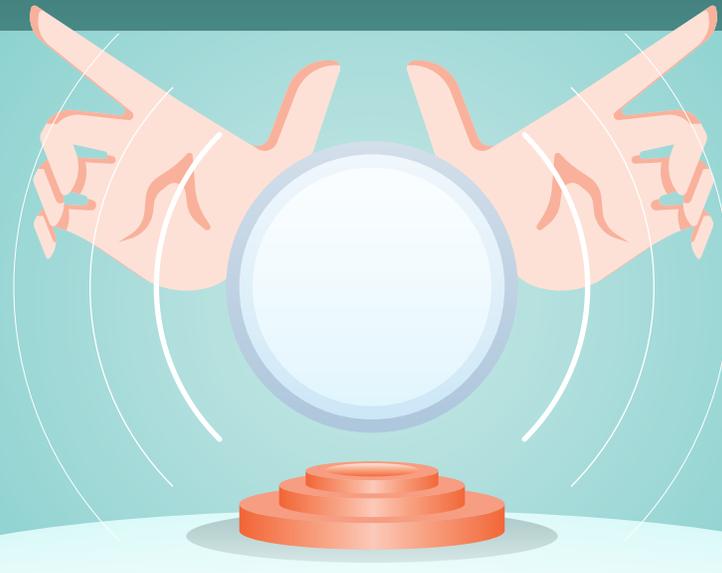
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Editor's note by Michael Garry

PREDICTIONS FOR 2016



How will natural refrigerant-based systems fare in the North American marketplace in 2016?

If past is prologue, then the future looks promising for the further adoption of natural refrigerants in sectors like commercial, light-commercial and industrial refrigeration, as well as many other HVAC&R applications. Plus there are factors emerging now that support market growth in 2016.

In commercial applications (notably food stores), for example, there was an uptick in CO₂ transcritical installations from 12 in 2014 to 52 last year in the U.S., and a rise from 93 to 139 such installations in Canada, according to shecco research.

While those numbers remain modest compared to the adoption of transcritical systems in Europe and Japan, we are starting to see some regulatory changes in North America that should move end users of HVAC&R equipment more rapidly into the natural refrigerants arena. Certainly that is the way it has played out in Europe with the EU's F-Gas Regulations.

This issue of *Accelerate America* is dedicated to understanding some of the key regulatory and standards changes that are impacting the uptake of natural refrigerant solutions in North America. Of course, what may be the most significant developments have just occurred overseas – in Dubai, where the Montreal Protocol at long last started negotiations to phase

down HFCs, and in Paris, where the COP21 meeting recognized the importance of removing short-lived climate pollutants (SLCPs) such as HFCs in order to keep global temperatures from rising more than 2 °C above pre-industrial levels. (See [page 54](#)) If these meetings fulfill their promise, then we are likely to see a greater shift from HFCs to natural refrigerants.

Here in the U.S., there are positive regulatory signs as well. Last year, the Environmental Protection Agency approved more low-GWP hydrocarbon refrigerants and delisted high-GWP refrigerants in some sectors and applications; more such approvals and delistings are on the way this year. (See [page 34](#)) Importantly, the EPA also proposed adding HFCs to its Section 608 refrigerant management rules.

Perhaps the most telling regulatory movement is taking place, as usual, in California, where the California Air Resources Board is getting ready to present its SLCP Reduction Strategy to its governing board for approval. (See cover story, [page 26](#)) The strategy, which includes banning refrigerants with a GWP higher than 150 in new stationary refrigeration by Jan. 1, 2021, aims to cut HFC emissions by 40% of 2013 levels by 2030. This aggressive plan will have a dramatic effect on natural refrigerant adoption in California, and given the state's considerable influence on the EPA, the plan could ultimately go national.

Of course, much may happen to muddy the regulatory waters in 2016 in the U.S. (the presidential election, for one). But it will be fascinating to see whether the overall arc of change favors new environmental technology, natural refrigerants in particular. I think it does.

TECHNOLOGY that evolves consciously

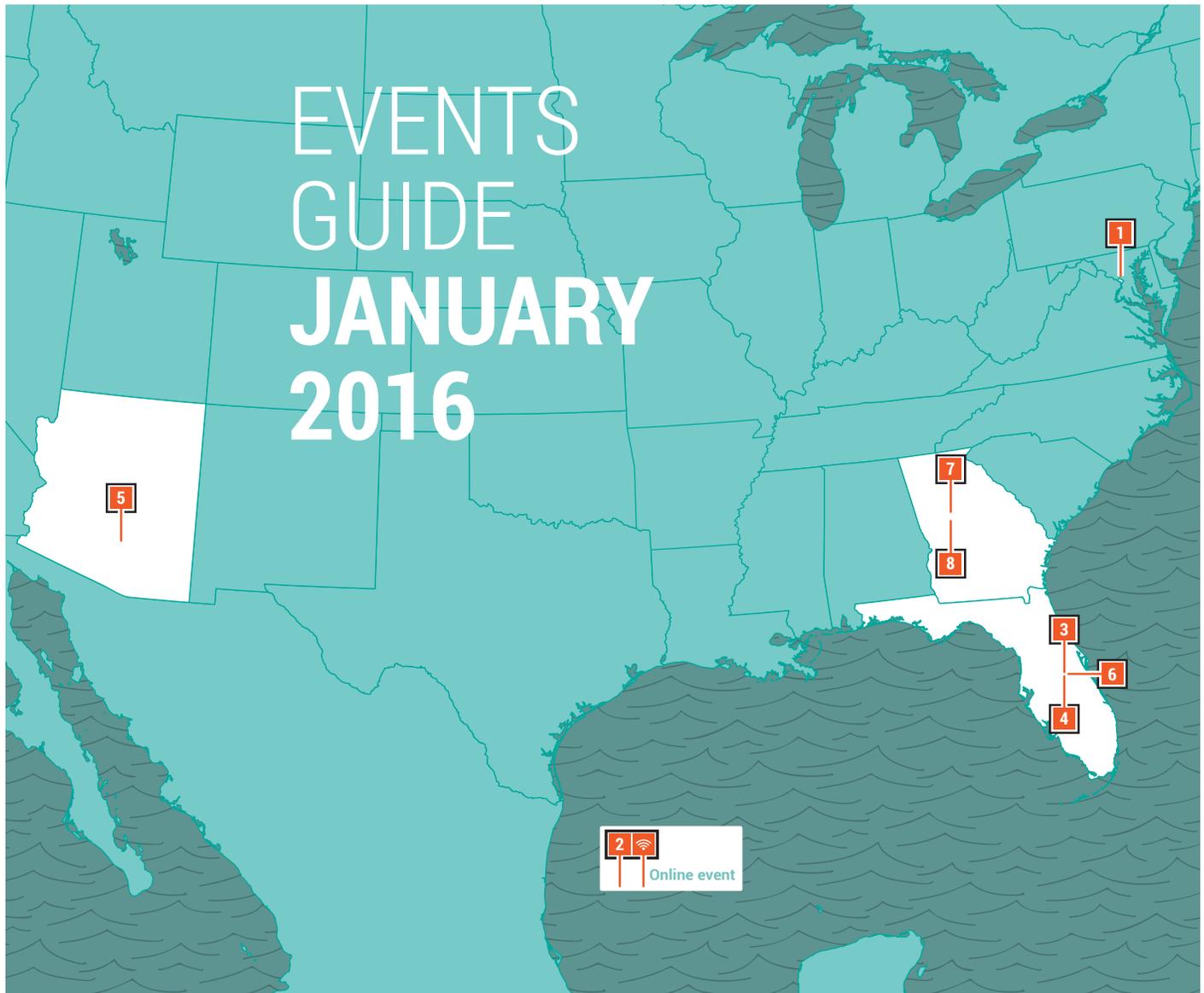
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1 January 11-15, Washington, DC
Building Innovation 2016
<http://www.nibs.org/?page=conference2016>

2 January 19, online, 2pm EST
GreenChill Webinar: Utility Incentives for the Use of Natural Refrigerants
http://epawebconferencing.acms.com/utility_incentives/
twitter: #SAEComVEC / @SAEIntl

3 January 23-27, Orlando, FL
2016 ASHRAE Winter Conference
<https://www.ashrae.org/membership-conferences/conferences/2016-ashrae-winter-conference>
twitter: @ashraenews

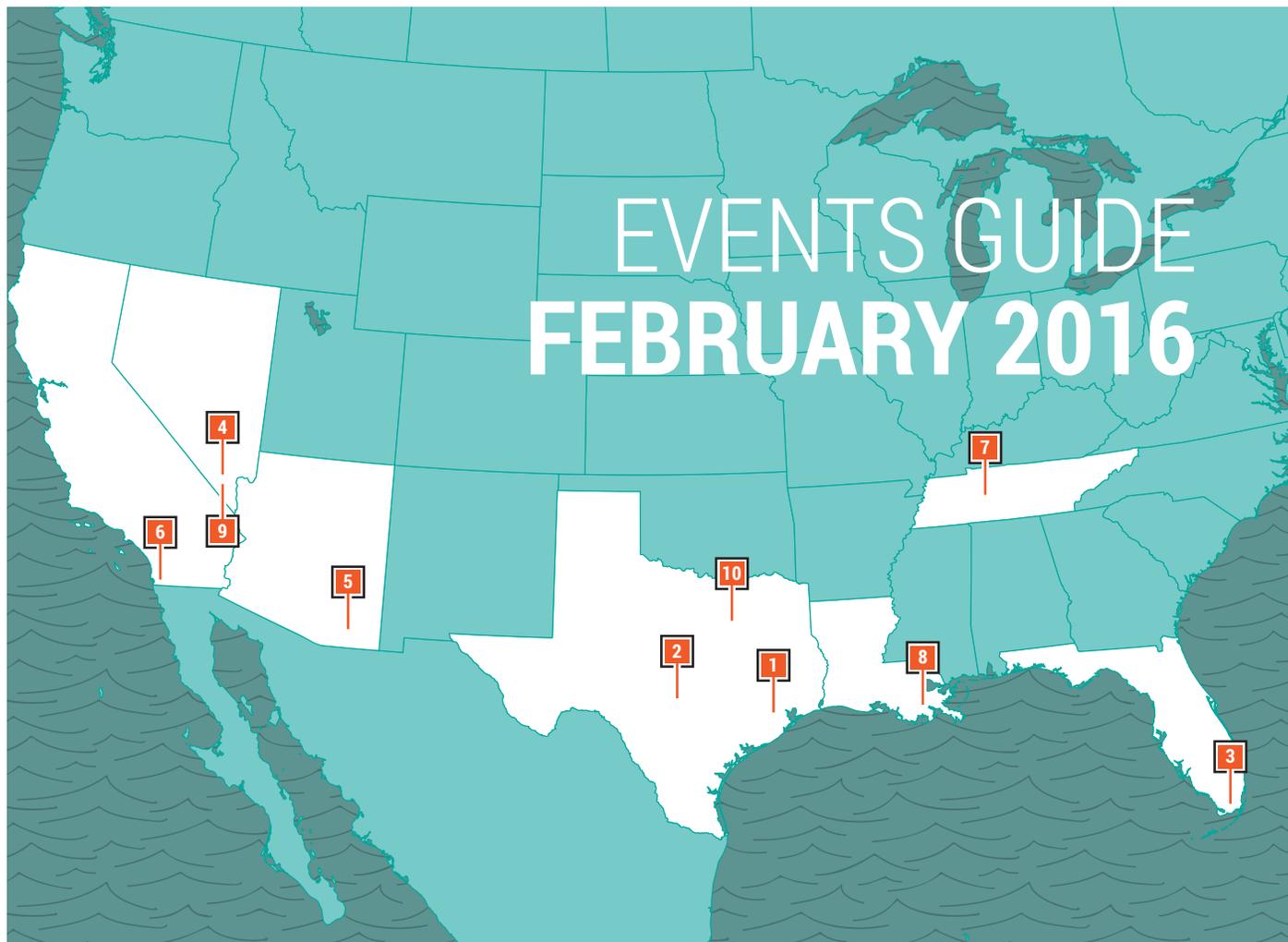
4 January 24-27, Orlando, FL
IAQA 19th Annual Meeting
<http://www.iaqa.org/iaqa2016>
twitter: @IAQAssociation

5 January 24-27, Phoenix, AZ
Dairy Forum 2016
http://www.idfa.org/forms/meeting/Microsite/Dairy_Forum_2016
twitter: @dairyifda

6 January 25-27, Orlando, FL
AHR Expo 2016
<http://www.ahrexpo.com/>
twitter: #HVAC #HVACR / @ahrexpo

7 January 26-28, Atlanta, GA
International Production & Processing Expo
<http://www.ippexpo.org>

8 January 30-February 3, Atlanta, GA
52nd WFLO Institute
<http://www.gcca.org/wflo-institute-cold-chain-education-training/>
twitter: @gccaorg / #wflo



1

February 7-11, Houston, TX
Cooling Technology Institute (CTI) Annual Conference
<http://www.cti.org/meetings.shtml>

2

February 8-12, Austin, TX
Campus Energy 2016
<http://www.ideacampus2016.org/>
 twitter: @districtenergy

3

February 09-11, Miami, FL
MiaGreen Expo & Conference
<http://www.eventsinamerica.com/events/miagreen-2016-expo-conference-8th-edition/ev55db291d59888/#.VnfgXN-rTuQ>

4

February 16-18 Las Vegas, NV
Convenience Distribution Marketplace 2016
<http://www.cdmarketplace.net/>
 twitter: @CDA_01

5

February 17-20 Tucson, AZ
Annual Convention National Turkey Federation
<http://www.eatturkey.com/meetings>
 twitter: @TurkeyGal

6

February 20-24, San Diego, CA
AFFI-CON 2016
<http://www.affi.org/events/affi-con-2016>
 twitter: @FriendsofFrozen

7

February 21-23, Nashville, TN
2016 Annual Meat Conference
<http://www.meatconference.com/>
 twitter: @MeatInstitute

8

February 22-24, New Orleans, LA
Supply Chain Conference
<http://www.gmaonline.org/forms/meeting/Microsite/SupplyChain16>

9

February 28 - March 2, Las Vegas, NV
The NGA Show
<http://www.thengashow.com/>
 twitter: #NGAShow16 @NationalGrocers

10

February 28 - March 2, Dallas, TX
Retail Supply Chain Conference 2016
<http://www.rila.org/events/conferences/supplychain/Pages/default.aspx>
 twitter: #RILAsupplychain @RILAtweets



1 March 6-9, St. Petersburg, FL
36th Annual Conference & Tabletop Display, Refrigerated Foods Association
<http://www.refrigeratedfoods.org/rfa-conference-registration>

2 March 6-8, New York, NY
The International Restaurant & Foodservice Show of New York
<http://www.internationalrestaurantny.com/Content/16.htm>
twitter: @TheFoodShows

3 March 6-8, Boston, MA
Seafood Expo North America/ Seafood Processing North America 2016
<http://www.seafoodexpo.com/north-america/>

4 March 9, Flushing, NY
ABCO EXPO
<http://abcohvacr.com/abco-expo/>

5 March 9-13, Anaheim, CA
Natural Products Expo West
<http://www.expowest.com/ew16/public/enter.aspx>
twitter: #ExpoWest @NatProdExpo

6 March 10-13, Charlotte, NC
ACCA 2016 and the IE3
<https://www.acca.org/events/conference>
twitter: @accausa

7 March 20-23, Orlando, FL
2016 IIAR Industrial Refrigeration Conference & Exhibition
http://www.iiar.org/IIAR/WCM/Events/2016_Conference/2016_Exhibitor_Information/2016_Exhibitor_Information.aspx
twitter: @IIAR2016

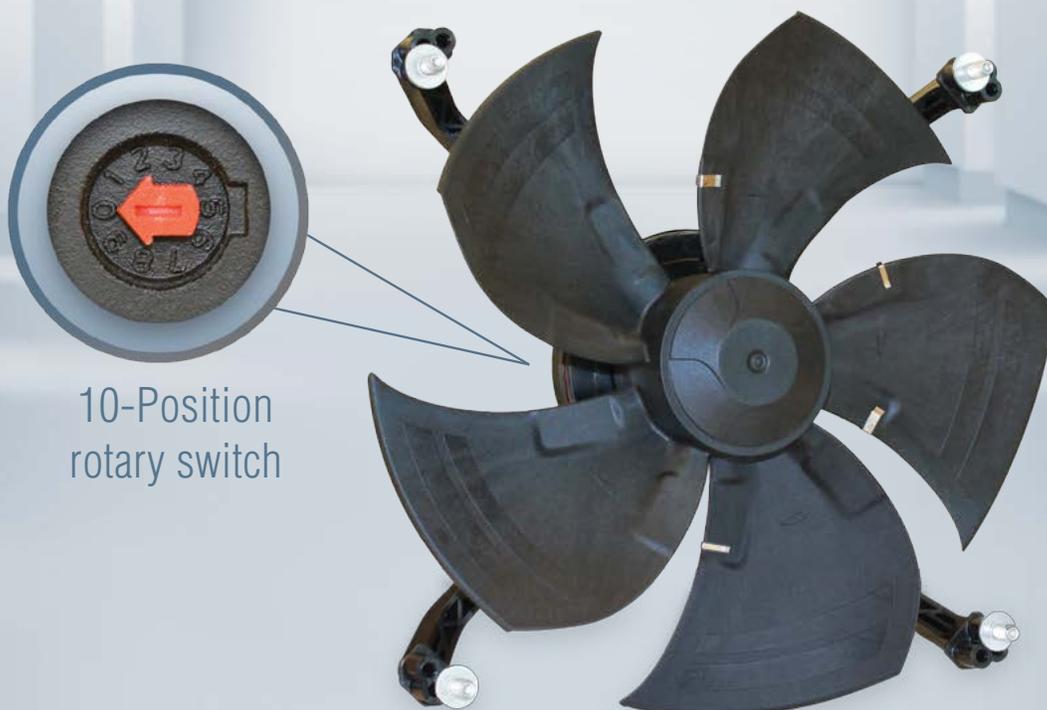
8 March 20-23, Phoenix, AZ
2016 ABA Convention, American Bakers Association
<http://www.americanbakers.org/2016abaconvention/>
twitter: @AmericanBakers / #PowerofBaking

9 March 21-23, Las Vegas, NV
National HVACR Educators and Trainers Conference
<http://www.hvacexcellence.org/nhetc/>

10 March 31 - April 1, St. Petersburg, FL
Ice Cream Technology Conference 2016
<http://www.idfa.org/news-views/headline-news/article/2014/10/29/registration-now-open-for-popular-ice-cream-technology-conference>



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ACCELERATE AMERICA *OPENS* NOMINATING PROCESS FOR NATURAL REFRIGERANTS AWARDS PROGRAM

The awards, to be presented in June at ATMOsphere America, will recognize end-user companies in food retail, food service and industrial refrigeration that are doing the most with natural-refrigerant solutions in North America; a person of the year will also be named

Any questions or comments about the awards program may be sent to michael.garry@shecco.com.

Accelerate America is pleased to begin accepting nominations for its first annual Natural Refrigerants Awards program, which will recognize three end-user companies and one individual for doing the most to drive adoption of natural refrigerants in North America over the past year.

The nominating process opens January 12, 2016 and continues through April 30. Nominations may be submitted at <http://acceleraten.com/awards> by end users, manufacturers, contractors, consultants, academics, policy makers and others involved with HVAC&R applications using natural refrigerants (CO₂, hydrocarbons, ammonia, water and air); end-user companies and individuals may nominate themselves.

Nomination may be submitted in multiple categories by the same company or person, one category per nomination.

From May to June 2016, a panel of experts, assembled by shecco, will review the nominations as well as others not nominated, and select winners. During ATMOsphere America 2016, to be held June 16 and 17 in Chicago, shecco will host a special awards-presentation ceremony honoring the Natural Refrigerants Award winners. The July-August 2016 issue of *Accelerate America* will profile the winning companies and individual.

TWO CATEGORIES

The awards will be presented in two categories: Best in Sector and Person of the Year.

A Best in Sector award will go to one end-user company in each of three sectors – food retail, food service and industrial (cold storage or food processing) – that has been a leader in advancing the adoption of natural refrigerant technologies in the previous 12 months in North America

To be eligible for the sector awards, an end-user company needs

to have completed a natural-refrigerant-system performance study between June 2015 and May 2016. The study can refer to systems installed prior to June 2015.

CRITERIA FOR ASSESSING NOMINATED COMPANIES' SYSTEMS WILL INCLUDE:

- » Energy efficiency
- » Greenhouse gas emissions
- » Reproducibility
- » A business case encompassing the costs of capital, installation, operation, maintenance and training, as well as return on investment

CRITERIA FOR ASSESSING NOMINATED COMPANIES WILL INCLUDE:

- » Commitment to future natural-refrigerant installations
- » Industry leadership
- » Innovation and perseverance

The Person of the Year award will honor a single individual who has done the most to advance the adoption of natural refrigerant technology in North America between June 2015 and May 2016. This award is open to any individual, including end users, manufacturers, contractors policy makers, academics and consultants.

CRITERIA FOR ASSESSING NOMINATED INDIVIDUALS WILL INCLUDE:

- » Impact on development and/or implementation of natural-refrigerant systems
- » Leadership in organization as well as the industry
- » Innovation and perseverance

"This will be someone who has driven the market," said Michael Garry, editor of *Accelerate America*. "It's going to be a difficult one to choose, but we want to single out and honor someone who's really done a special job." 🍀

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SHORT TAKES

— By Blanka Zoldi, James Ranson and Michael Garry

Panasonic Targets C-Stores In North America for CO₂



Panasonic's acquisition of Hussmann for \$1.545 billion last month could advance adoption of natural refrigerant equipment in North America, particularly installations of CO₂ systems in convenience stores.

Panasonic has been promoting its energy-efficient and environmentally-conscious refrigerated and freezer display cases for supermarkets and convenience stores, mainly in Japan, China and other parts of Asia. Tetsuro Homma, president (appliances) at Panasonic, said the company was well-placed to bring its food retail innovations to the U.S. market – including natural refrigerant technology.

“The big business opportunity in the U.S. is convenience stores,” he said. “In Japan, the convenience store market is a very highly industrialized, expanding business model with large capital investment and major development. Going forward, there will be this kind of chance in the U.S. We think we can use our experiences with equipment for small-size stores in Japan.”

Hussmann will serve as the base of Panasonic's food distribution business in North America. Hussmann and Systemes LMP, based in Quebec, will continue their alliance to provide CO₂ transcritical refrigeration systems.

Hussmann's current management team will stay in place to manage the acquired company under Panasonic's guidance. The Hussmann name and brand will continue to be used.

The completion of this acquisition is subject to approval by competition authorities in the United States and other countries. [@MG](#)

ACCA Issues Maintenance Standard For Commercial Refrigeration

The Air Conditioning Contractors of America (ACCA) has released the first nationally recognized standard establishing a minimum maintenance program for commercial refrigeration equipment found in supermarkets, convenience stores, food service and warehouses.

The ANSI-rated standard (ANSI/ACCA 14 QMref - 2015 Quality Maintenance of Commercial Refrigeration Systems) outlines the procedures that contractors should follow when designing, installing, maintaining, repairing, and verifying commercial refrigeration equipment.

The standard covers a range of applications, including beverage dispensers, cascade systems, ice makers, reach-ins, single condensing units and walk-ins.

The standard can be downloaded for free at: www.acca.org/quality. [@JR](#)

EPA Grant to Rutgers Supports NH₃ Training



The U.S. Environmental Protection Agency has awarded \$158,000 to Rutgers University to provide training and technical assistance to food companies in New Jersey that are transitioning from HCFC refrigerant R22 to anhydrous ammonia.

Beginning in June, Rutgers will assist food production, processing, storage and distribution companies in Essex and Hudson counties, which includes the Port Newark area. The grant is part of the approximately \$5 million the EPA awards each year to prevent pollution across the nation.

“With cold storage capacity at Port Newark expected to double over the next ten years, this program has the potential to significantly cut the amount of HCFC used in the Newark area,” said EPA Regional Administrator Judith A. Enck.

In 2013, New Jersey relaxed the requirements for facilities using ammonia, exempting them from having engineers on premises 24 hours per day if they use 5,200 pounds or less of ammonia, among other criteria. Many operators have used R22 to avoid the ammonia 24/7 rule, and thus lack the knowledge and resources to switch to anhydrous ammonia. [@BZ](#)

Danfoss Breaks Ground on Development Center

Component maker Danfoss broke ground last month on a new state-of-the-art development center that will serve as an HVAC&R equipment-testing laboratory, training facility and research and development hub.

The 22,000-square-foot “Engineering Tomorrow Application Development Center” will be based in Tallahassee, Fla., expanding the existing facility that houses the engineering and manufacturing of Danfoss Turboacor oil-free, magnetic-bearing compressors.

“One of the major drivers behind this significant investment is the increasing needs of our customers to comply with the unprecedented number of U.S. EPA and DOE regulations and testing requirements,” said John Galyen, president, Danfoss North America. “We feel it is critical for us to help our industry prepare for the transition ahead to meet low-GWP refrigerant targets and higher energy efficiency levels.” [@ BZ](#)

Second CO₂ Ice Rink Completed in Alaska



Anchorage, Alaska, is now home to the second ice rink in the U.S. using CO₂ as its refrigerant.

The new rink is housed in the Sullivan Arena, home of the Alaska Aces minor-league hockey team. It uses Hillphoenix’s Advansor CO₂ transcritical booster system with heat reclaim, which

replaces a 22-year-old R22 system. A similar Hillphoenix transcritical system was installed last year by Anchorage’s Harry J. McDonald Recreational Center.

The transcritical systems have expected energy savings of 25%-40% and lower maintenance fees, compared to R22 systems. Other arenas have taken notice, with conversions slated at two other Anchorage arenas – Ben Boeke and Dempsey-Anderson – along with several projects planned in the lower 48 states.

“We get a lot more inquiries about this technology than before the Anchorage systems were up and running,” said Tim Henderson, industrial program manager, Hillphoenix. “It’s a slow industry to change, but people are accepting this technology and it’s going to continue to grow in this market.” [@ BZ](#)

Aldi CO₂ Stores Earn GreenChill Platinum



Stores in Webster and West Carthage, N.Y., operated by German supermarket discount chain Aldi, have earned platinum GreenChill certification from the U.S. Environmental Protection Agency’s GreenChill Partnership as a result of their investment in natural refrigerants.

To achieve platinum certification – the highest recognition that GreenChill awards for cutting leak rates and refrigerant charge – the two stores installed Hillphoenix’s Advansor CO₂–only transcritical booster systems.

GreenChill is a voluntary program that aims to reduce the use of environmentally harmful HFCs in commercial refrigeration. More than 11,000 food retail stores in the U.S. are GreenChill partners, but only 12 have been certified as platinum stores.

The Webster and West Carthage Aldi locations are among more than 50 stores that installed Hillphoenix Advansor CO₂ booster systems in 2015. The Aldi stores also installed Hillphoenix energy-efficient closed-door refrigerated cases.

Tom Land, manager of EPA’s GreenChill Partnership, said achieving GreenChill certification is good for the environment and for grocers’ business. “What we’ve seen through our GreenChill program is that consumers want to shop in stores that share their environmental values. By being dedicated to GreenChill standards, these stores demonstrate their interest in maintaining environmentally sustainable operations.” [@ MG](#)

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- CO₂ refrigerant is abundantly available and inexpensive.
- Sustainable technology helps achieve GreenChill certification.

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AHR EXPO OFFERS INSIGHTS INTO NATURAL REFRIGERANTS

The annual event will feature 90 companies marketing natural-refrigerant-related products, along with a slew of educational sessions on naturals, all detailed in shecco's Guide to Natural Refrigerants at the AHR Expo

— By Matthew Cullinen



From January 25-27, more than 60,000 HVAC&R professionals will gather at the Orange County Convention Center in Orlando, Fla., for the 2016 International Air-Conditioning, Heating, Refrigerating Exposition (AHR Expo), where they will be able to check out the latest advances in natural refrigerant technology.

The annual event will feature over 2,000 exhibitors, including 90 companies offering products or services using natural refrigerants. Overall, the Expo will highlight the latest market innovations, with more than 80% of exhibitors expected to introduce new or upgraded products.

Co-sponsored by the American Society of Heating, Refrigerating, & Air-Conditioning Engineers (ASHRAE) and the Air-Conditioning, Heating & Refrigeration Institute (AHRI), the Expo also offers nearly 50 free 1-2 hour seminars offered by endorsing associations and other groups, as well as over 80 new product and technology presentations that each run for 20 minutes.

Natural refrigerant-related sessions include "Hydrocarbon refrigerant safety," "CO₂ measurements that make sense," and "New CO₂ controller built-in data logger." There will also be paid educational programs, including AHSRAE Learning Institute courses, certification exams and PM Live seminars.

A hydrocarbon refrigerants study guide, developed to help technicians navigate the safe maintenance of systems that employ hydrocarbons and other flammable refrigerants, will be available at the event.

To help attendees interested in natural refrigerants and related applications navigate the Expo, market development expert shecco (publisher of *Accelerate America*) is publishing its second annual *Guide to Natural Refrigerants at the 2016 AHR Expo*. The publication compiles information on companies offering products and services for natural refrigerants and highlights natural-refrigerant-related events to be held during the trade show. The *Guide* will be available for free in digital form at acceleratena.com and in print at the AHR Expo at *Accelerate America's* booth (5877) and at the Media Resources Center.

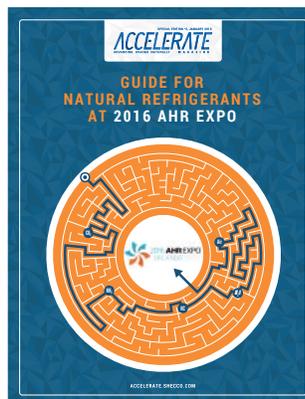
The AHR Expo Innovation Award winners in 10 categories will be recognized at the event on Jan. 27 at 1 pm in Theater A. A single 2016 AHR Expo Product of the Year winner will be announced as well. The winner of the "refrigeration category" is Italian manufacturer Carel Industries for its HEOS Sistema, a high-efficiency water-loop system for commercial refrigeration that reduces total refrigerant charge by up to 80%. The Baltimore Aircoil Company, based in Baltimore, Md., received honorable mention in the refrigeration category for its transcritical CO₂ TrilliumSeries Condenser.

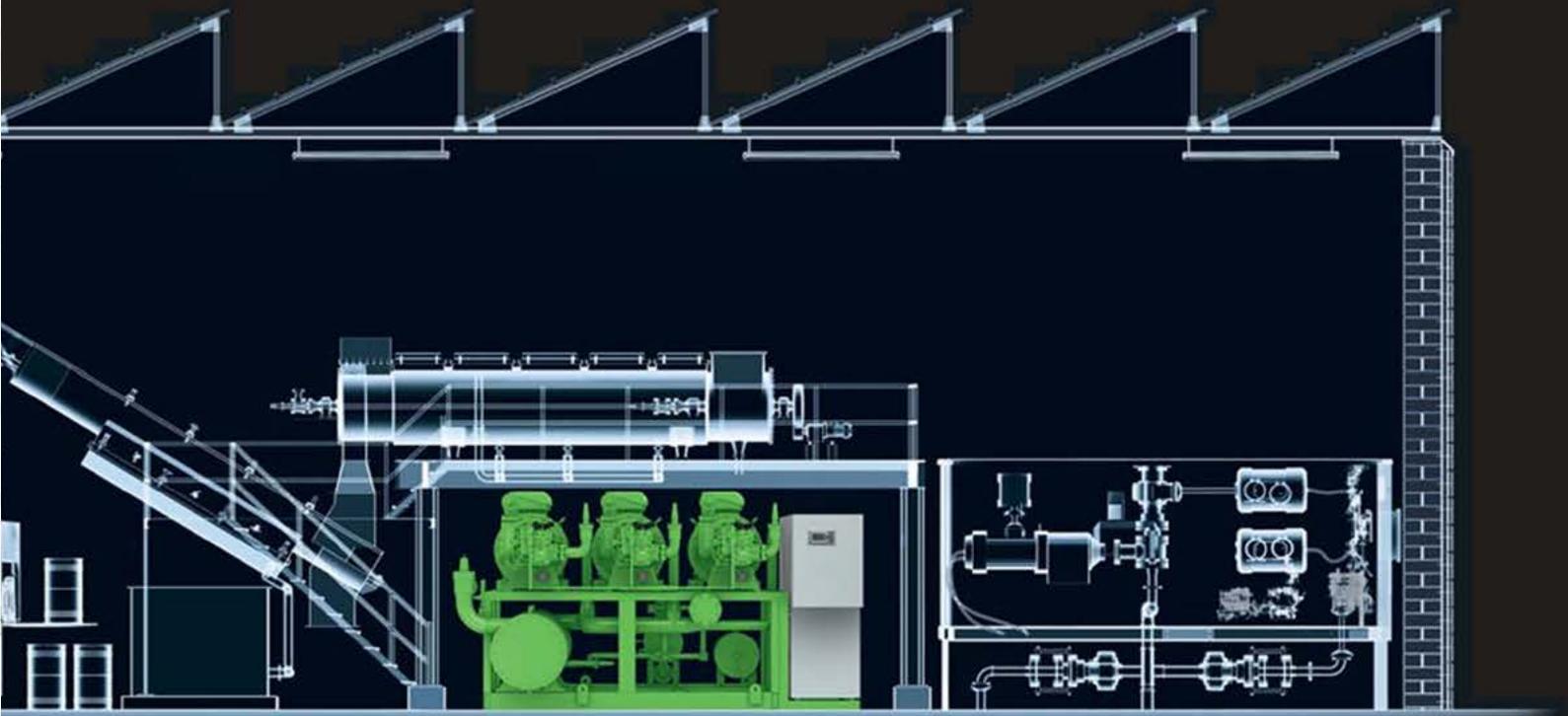
The AHR Expo provides visitors with a clear picture of the HVAC&R market. According to a survey of 2016 AHR Expo exhibitors, 86% are confident about their business prospects in the coming year, with 14% projecting "excellent" results, and 62% anticipating "good" returns. Eighty-one percent of exhibitors expect to see increases in sales, 21% of them predicting 10% growth.

Asked about how much government and/or utility incentives are helping to increase the adoption of energy-efficient products and technologies, 58% of exhibitors said "some," 28% said "very little," and 5% responded "not at all," while only 9% answered "a lot," suggesting there's room for improvement in this area.

The AHR Expo will be held next year in Las Vegas.

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RAJAN ON REGS

Emerson’s regulatory expert Dr. Rajan Rajendran looks at the state of regulations and their impact on the HVAC&R industry, including the natural refrigerants sector

– By Michael Garry



Rajan Rajendran

At Emerson Climate Technologies’ E360 Forum and other educational events, the person who typically leads the discussion on refrigerant and energy regulations is Dr. Rajan Rajendran, Emerson’s vice president, system innovation center and sustainability. Dr. Rajendran has also led the development of Emerson’s new Helix Innovation Center, which opened operationally last month and will have its grand opening this spring.

To get a sense of where the natural refrigerants industry stands with respect to regulatory moves taken – or expected to be taken in 2016 – by the Environmental Protection Agency and the Department of Energy, among others, *Accelerate America* turned to Dr. Rajendran in the following interview, conducted in early December during the Paris climate change talks.

California Environmental Protection Agency Air Resources Board



SNAP, SECTION 608, AND CALIFORNIA

Accelerate America: What’s your overall assessment of the state of regulations and their impact on the HVAC&R industry?

Rajan Rajendran: The Montreal Protocol amendment proposal seems to be moving forward now on a plan to phase down HFCs. Who knows what’s

going to come out of this climate change meeting in Paris this week? Is California going out on its own [with regulations on refrigeration] and doing something the rest of the country is not doing?

When you add all of that to the EPA’s SNAP [Significant New Alternatives Policy] and Section 608 actions, and the ongoing DOE’s efficiency regulations – that’s a lot. It makes the life of a component and equipment manufacturer quite complicated!

AA: What about the end user who has to change to new equipment?

Rajan Rajendran: That is where the burden exists for end users. But when they go and buy

something, they expect whatever it is to meet all the regulatory requirements.

“ [The regulatory environment] makes the life of a component and equipment manufacturer quite complicated!”

AA: If manufacturers are building equipment to meet the EU's low-GWP requirements, would that equipment also satisfy whatever requirements California imposes?

in Europe. Store sizes are smaller, so the equipment is different. In Europe UL is not relevant; they have CE and other standards. Finally, the voltage is different, which means the motors are different. So if California has some special requirements, then I think people have to try to meet them and should not expect a European product to automatically meet these requirements.

AA: What SNAP changes do you expect in 2016?

I expect these will be some new blends of HFCs and HFOs as well as some natural refrigerants in specific applications. And they talked about delisting refrigerants like R134a and R407C in chiller applications. We'll have to wait and see.

AA: Do you see the new SNAP rulings delisting some HFCs (such as R404A and R507A) moving some end users toward natural refrigerant-based equipment?

experimenting with CO₂ and propane stores will continue to do that. All it does is give them certainty in terms of what is permitted and what is not permitted. But there are still lots of synthetic and natural refrigerant options on the table.

Rajan Rajendran: People assume that equipment designed in Europe should work in the U.S. and vice versa. That is so far from reality. The foods and store formats are different

Rajan Rajendran: At a September meeting, the EPA stated it expects some new approvals;

Rajan Rajendran: I don't know if the new SNAP regulations are going to push people to CO₂ and hydrocarbons any more than they already were inclined to do. People who are

In regard to R404A, about 10 years ago, U.S. supermarkets started moving away from R404A toward R407A because R407A does much better than R404A when it comes to harvesting condenser heat. This shift was not about GWP [global warming potential] or because the EPA was going to delist R404A; it was about what can I do to get better efficiency in my system. Today, practically every U.S. supermarket has moved away from R404A. This did not happen in Europe, so when regulatory changes started to happen, the change in GWP required to meet the regulations naturally caused end users to look at CO₂.

AA: What about the impact of EPA's proposed changes to Section 608 of the Clean Air Act, such as adding HFCs to the regulation and lowering the trigger rate for mandatory repairs to a 20% leak rate from 35%?

So if California has some special requirements, then I think people have to try to meet them and should not expect a European product to automatically meet these requirements.

Rajan Rajendran: I think the big thing that's going to happen next year is Section 608.

Regardless of what [synthetic] refrigerant you use, it's going to affect you. I'm a believer that it's not good to leak any

refrigerant, even CO₂. You may ask, what's the problem with leaking CO₂, since it's not a problem for the environment? When you leak refrigerant, your system is no longer efficient. It's actually consuming more energy and you won't be able to maintain temperature. So it's not good to leak 35%, no matter what the refrigerant is. What Section 608 will do is lead to better monitoring, and more awareness of the regulation and the impact of leaks. It will put a lot of pressure on people to manage HFCs. Overall, for the environment, it's a good thing.

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→ **AA:** Will Section 608's focus on HFCs lead to more consideration of natural refrigerants?

Rajan Rajendran: At the end of the day, every one of these end users is going to look at the economics of the choices they make. I know there are people who look at the environment and being green, and ask whether there is a refrigerant I can go to where I'm not going to be affected by EPA regulations. After all that is said and done, they'll look at the economics and total cost of ownership. And if the economics make sense, they'll do it.

Emerson continues to build a portfolio of CO₂ products – valves, controls and compressors. We have released and sampled numerous small horsepower compressors used with propane, but there is more R&D to be done there. For example, the problem with hydrocarbons in reach-in cases is that they are limited to 150g. Many of the cases using R404A or R507A are way too big for hydrocarbons. And using multiple hydrocarbon condensing units would be extremely expensive.

DOE NEGOTIATIONS

AA: Last July, the DOE and the AHRI (Air Conditioning, Heating and Refrigeration Institute) announced a settlement of yearlong litigation that vacates six efficiency standards for walk-in coolers and freezers. The DOE has since negotiated with the industry on new standards, with a targeted completion date of Jan 22, 2016. The DOE has agreed that if negotiations deliver proposed standards by that date, it will not enforce those standards until Jan. 20, 2020. How are those negotiations going?

Rajan Rajendran: We'll have to wait and see what happens. Emerson is a member of AHRI, and we have a person on the ASRAC (Appliance Standards and Rulemaking Federal Advisory Committee) involved in the walk-in negotiations. The ASRAC website (<http://energy.gov/eere/buildings/appliance-standards-and-rulemaking-federal-advisory-committee>) has the latest information on progress.

“I think the big thing that's going to happen next year is Section 608.”

AA: Is the industry moving to a building focus for improving efficiency vs. just a system focus?

Rajan Rajendran: The industry needs to start looking at efficiency in a more inclusive way instead of looking at efficiency

at the component level or subsystem level. The AHRI has started promoting that approach. I don't think it will happen overnight; it will take time.

AA: How would you characterize the coordination between the EPA and DOE rulemaking bodies?

Rajan Rajendran: A lot of people in the industry continue to talk about how poorly the EPA and DOE coordinate their

rulemaking. The DOE comes out with a standard that is R404A-based and then the EPA comes out with a delisting of R404A in that application. So you design a piece of equipment to meet the DOE regulations and then shortly after that, it's going to be obsolete because the EPA won't allow you to produce it. That is a huge challenge for equipment makers.

AA: Has there been an effort to address this issue?

Rajan Rajendran: Every opportunity industry folks get, they tell the agencies how this

lack of coordination between the regulatory departments is a big problem. Industry representatives have made requests that the coordination between the two agencies be more formal when it comes to rulemaking that affects the same product.

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Report on Natural Refrigerants Training in **North America**



2016
**GUIDE TO NATURAL REFRIGERANTS
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– 2016 STATE OF THE INDUSTRY

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→ **GAINING ACCEPTANCE FOR EUROPEAN COMPONENTS**

European supermarkets, which began installing CO₂ transcritical systems a decade ago, have grown to be the global leaders in this refrigeration technology, with more than 5,500 stores using them. By contrast, just 52 supermarkets have or are committed to having transcritical systems, according to shecco research.

One consequence of Europe's dominance is that many transcritical components have been designed to meet just European standards, and not the standards set by UL in the U.S. As a result, U.S. transcritical rack manufacturers like Hillphoenix are unable to obtain components that have been used in Europe, leaving them fewer and more expensive components designed for the U.S. market.

Emerson Climate Technologies is an example of a company that designed components such as filter driers, expansion devices, solenoid valves and pressure controls for the European market, and is now trying to get them approved by UL for the U.S. market.

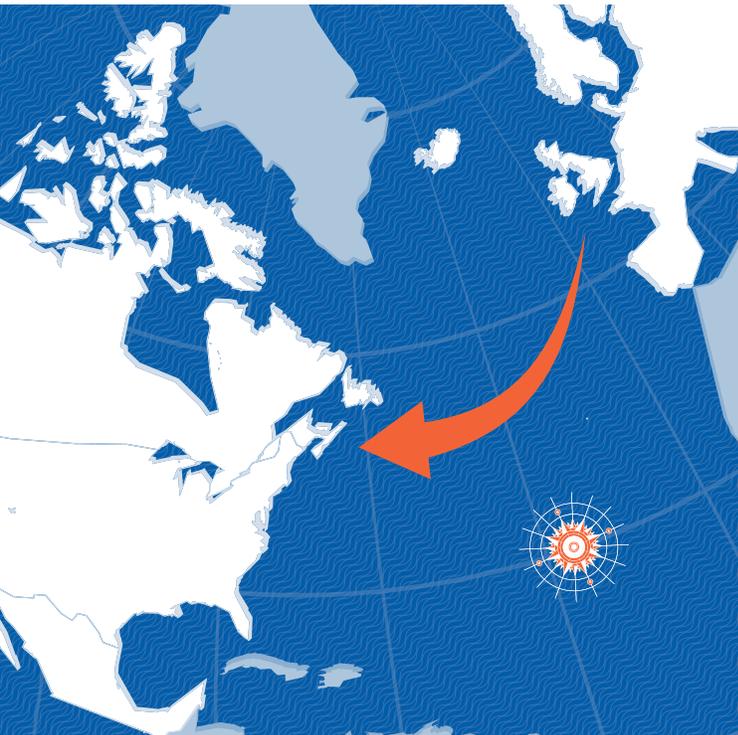
“We're still working through the process. It takes time.”

Due to variations between UL and European safety and operational standards, if a component designed for the European market meets European safety and operational standards but falls short of meeting UL standards, the manufacturer has to decide whether to redesign it to pass muster with UL. “Then the question is, is the business case strong enough?” said Andre Patenaude, director, CO₂ business development, Emerson Climate Technologies. “How many units will sell in the U.S.?”

Some of Emerson's European-designed components have met UL requirements, while others are still being evaluated. None have failed to date. “We're still working through the process,” said Patenaude. “It takes time.”

In addition to meeting UL standards, Emerson now designs many of its components and compressors to meet IEC (International Electrotechnical Commission) standards, and thus be marketable anywhere in the world.

Another way for European-designed products to make their way into the U.S. market would be for UL to accept the European standards. “But UL won't do that because the EN (European Standard) has less stringent requirements than UL and IEC, which UL harmonizes with,” said Greg Relue, regulatory agency manager for Emerson Climate Technologies. “And the IEC has not accepted European lobbying.” **MG**



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LEADING BY EXAMPLE

With the help of natural refrigerants, the California Air Resources Board plans to roll back emissions of HFCs in the state by 40% of 2013 levels by 2030, setting a standard for the rest of the U.S. and much of the world

— by Michael Garry

 California, the most populous state in the U.S. with more than 39 million people, has the world's eighth largest economy. Due in part to its reliance on cars, the state emitted more greenhouse gas (11 metric tons) per capita in 2012 than every other leading world economy except the U.S. itself (18.6 metric tons), according to the World Resources Institute.

But California, known as the Golden State, is also among the world's most aggressive economies when it comes to crafting policy to reduce greenhouse gas emissions. In 2006, the state passed its landmark California Global Warming Solutions Act, AB 32, which calls for greenhouse gas emissions to be cut to 1990 levels by 2020.

One of the key agencies responsible for formulating and executing AB 32's emission-reduction rules is the California Air Resources Board (CARB). California is the only state that is permitted to have such a regulatory agency, because it came into being before the passage of the federal Clean Air Act of 1970.

CARB is on track to meet or exceed AB 32's 2020 emissions-reduction goal, and has added a new one: cutting 1990-level emissions by 40% by 2030 – the same target set by the European Union. The state's ultimate goal is getting emissions to 80% below the 1990 level by 2050, which is the reduction the state believes will be needed to keep temperatures from rising more than 2 °C above pre-industrial levels; that is the warming threshold at which scientists expect major climate disruptions such as super droughts and rising sea levels.

Photography by Talia Herman



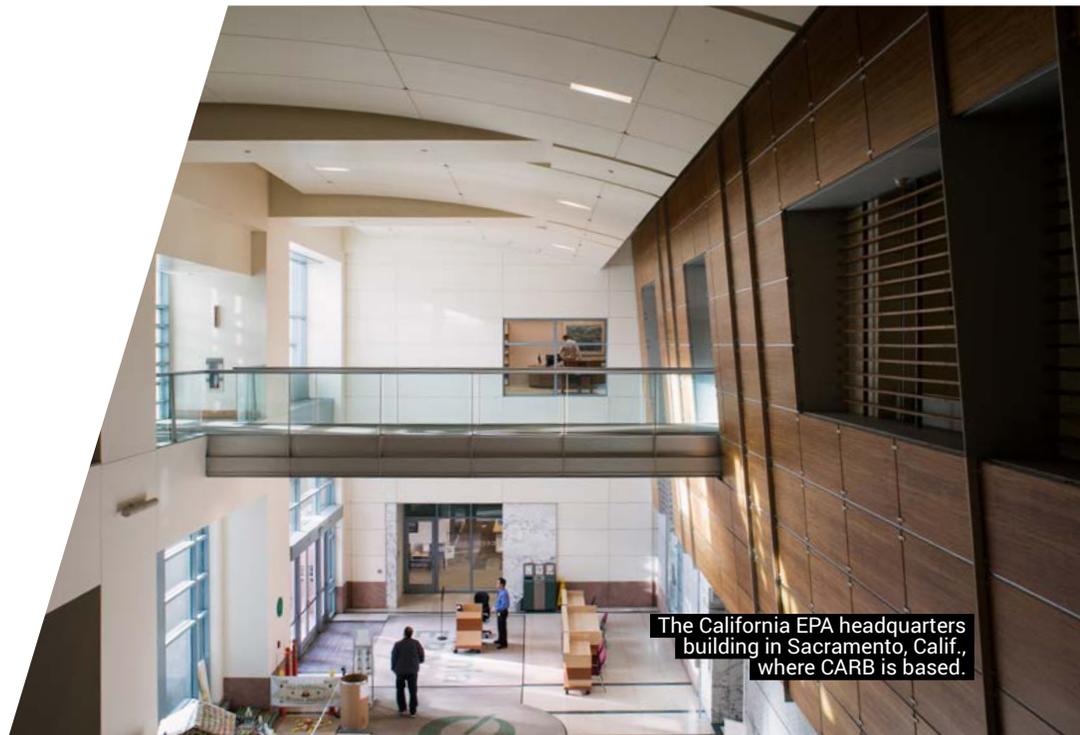
Glenn Gallagher (left)
and Ryan McCarthy of CARB

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→ The impact of California's environmental innovation has often extended well beyond its borders. Since its inception in 1967, CARB has developed air quality projects and regulations that are adopted at the U.S. national level and are "often used as the basis for other countries' air quality programs as well," said Glenn Gallagher, air pollution specialist at CARB (see story, page 31). "We expect California's climate change programs will continue to provide models for development of regulations nationally and for other states."

California's strategies for meeting its emission-reduction goals include a cap-and-trade plan, a low-carbon fuel standard and advanced clean-car standards. But the state is also addressing the contribution to global warming made by short-term climate pollutants (SLCPs) such as methane, black carbon (soot) and HFCs. SLCPs remain in the atmosphere from a few days to a few decades (compared to CO₂, which persists for a century or more) and, in the case of HFCs, have a global warming potential (GWP) far greater than that of CO₂.

HFCs (aka f-gases) are currently about 4%



The California EPA headquarters building in Sacramento, Calif., where CARB is based.

of all greenhouse gas emissions in California, but they are considered the fastest growing greenhouse gases, and that percentage will double in the next decade without reduction measures in place. A study by Guus J.M. Velders of the Netherlands' National Institute for Public Health and the Environment concluded that HFCs would account for 9% to 19% of all global greenhouse gas emissions by 2050 if steps were not taken to reduce them in the near future.

California has already taken steps to curb HFC emissions and is poised to do much more. Pursuant to AB 32, in Sept. 2014 California Governor Jerry Brown, who has spearheaded California's environmental efforts, signed Senate Bill (SB) 605, which calls upon CARB to complete a comprehensive plan to reduce SLCP emissions by Jan. 1, 2016. The plan includes taking an inventory of sources of SLCP emissions, identifying research needs, consulting with SLCP experts, and identifying existing and potential control measures to reduce these emissions. Among those control measures: refrigeration and HVAC equipment that use low-GWP gases like natural refrigerants in place of HFCs.

The SLCP plan is meant to work relatively quickly to reduce HFC emissions in the next few decades, complementing efforts in California and globally to rein in fossil fuel emissions. In fact, California's overarching goal of reducing greenhouse gas emissions by 40% below 1990 levels by 2030 "can't be accomplished if f-gases are not included," said Gallagher.

Governor Brown has identified SLCP emission reductions as one of "six pillars" needed to meet California's greenhouse gas reduction goals. (See chart, this page.) "What the science is saying is that CO₂ reduction alone doesn't get you there," said Ryan McCarthy, who has served as science and technology policy advisor to CARB chair Mary Nichols since 2011. "We need SLCP reductions to get us there and provide lots of [environmental] benefits in the near term."

CARB allows end users to meet California's standards in the way they deem best, and it does not endorse any specific products such as natural refrigerant systems. However, Gallagher acknowledged that natural refrigerants are "a logical choice" for meeting CARB's

low-GWP requirements for refrigeration equipment. One of those requirements sets a GWP limit of 150 for refrigerants in new equipment sometime in the next four to five years; all natural refrigerants (notably CO₂, hydrocarbons and ammonia) are well below that limit. A strong GWP limit on refrigerants, noted Gallagher, cuts 95% of their contribution to global warming.

Gallagher hopes that the effectiveness of low-GWP systems will lead to their adoption nationally. "We think now is the time to go forward with low-GWP options."

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Coming Full Circle

Glenn Gallagher started studying the environmental effects of synthetic refrigerants more than 20 years ago at an environmental consulting firm. Back then the focus was on eliminating ozone-depleting substances (ODS) like CFCs, and he wrote ODS management plans.

Since joining the California Air Resources Board (CARB) in 2007 as air pollution specialist, Gallagher has been working on f-gas reduction strategies largely aimed at HFCs. After studying the sources of HFCs in California, he developed an inventory that is being used in CARB's Short-Lived Climate Pollutants (SLCP) Reduction Strategy. And based on the technical feasibility of HFC reduction methods, "I make recommendations that will end up in the SCLP and climate change scoping plans," he said.

Gallagher tracks all f-gases, including ODS, though ODS "has been taken care of by the Montreal Protocol." He'd like the Montreal Protocol to target HFCs for a similar global phasedown, as it began doing in Dubai in November.

When he was an environmental consultant in the 1980s, he recalls presciently writing that while HFCs would make a good replacement to CFCs, their high GWP may ultimately lead them to be replaced as well. "So I've come full circle," he said, adding, "I hope this next round of substitutes will be the end of it for many, many years."

→ Timeline for action

The idea that reducing SLCP emissions would help California meet its greenhouse gas emissions goals originated in the 2014 Climate Change Scoping Plan, an update to the original 2008 plan established by AB 32; it is being updated again in 2016.

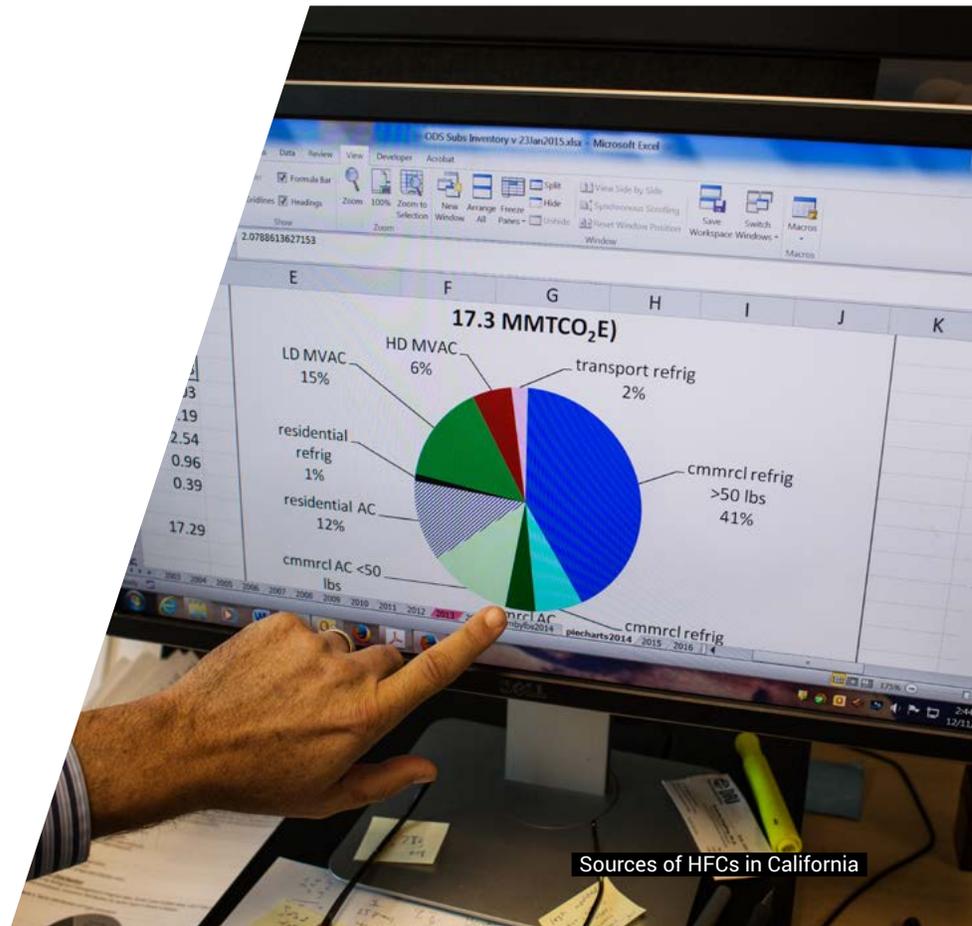
In 2014 CARB released a booklet detailing existing measures used in SLCP emission reduction, and then embarked on a collaborative process with other state and local agencies to develop a formal SLCP Reduction Strategy, as required by SB605.

In May 2015, CARB issued a Concept Paper to initiate discussion on the strategy. SLCPs represent “a new way to look at the [climate change] problem,” said McCarthy, who is part of a group responsible for overseeing the creation of the SLCP Reduction Strategy. “So we tried to lay out the science and be pretty specific about emissions in California – where they come from and the opportunities to reduce them.”

After collecting stakeholder comments on the paper at a public meeting, CARB released a Draft SLCP Reduction Strategy in Sept. 2015, for which it solicited additional comments. Since then, CARB has been going through the hundreds of comments it has received and answering stakeholder questions about what the strategy will contain as well as the potential cost of the reduction efforts. “We expect the SLCP Reduction Strategy will be completed in early February 2016,” slightly past the original January deadline, said Gallagher.

“We’re taking the time to do this right, including a detailed economic and environmental analysis of the proposed measures in the plan,” said McCarthy.

The strategy will then be presented to the governing



Sources of HFCs in California

board at CARB in March, and again over the summer. The governing board is made up of 12 members appointed by the governor, including scientific experts and representatives of regional pollution control agencies.

“If the board doesn’t like [the SLCP strategy], they can direct us to go do something else,” McCarthy said. “But if we say we’re going to develop regulations to ban high-GWP refrigerants in new equipment by some time frame, we expect to do that.”

During the comment period CARB welcomed input from proponents of natural refrigerant technology showing the cost effectiveness and energy efficiencies of these systems. “We do informal stakeholder meetings every week and get a lot of great information from [refrigeration] OEMs and end users and HVAC people,” said Gallagher. “And every time, we learn that low-GWP refrigeration and air conditioning is much more cost effective and feasible than anybody would have thought of just a year ago. It’s a very promising trend.”



Ryan McCarthy



Glenn Gallagher

However, McCarthy cautioned that because the application of low-GWP technology is still fairly new, “the cost numbers are all over the map and we don’t really trust them.” Consequently CARB is still investigating the costs and benefits of these systems.

“Anything we recommend is going to be feasible,” added Gallagher. “So if you are a food retailer and purchase the low-GWP equipment, it will be cost effective and have an ROI within the life of the equipment or less than five years.”

To validate the technical feasibility and cost effectiveness of low-GWP commercial refrigeration equipment, CARB has sponsored research under the direction of Dr. Ed Cheng of San Francisco State University and Doug Scott of VaCom Technologies. They are looking at several natural refrigerant technologies, including hybrid cascade systems and transcritical CO₂. “The energy efficiency question of transcritical CO₂ [in high ambient climates] is of great interest in California, because we have 16 different climate zones, all the way from cool alpine

to scorching desert,” said Gallagher. CARB hopes to have research results by early 2017.

“The low-GWP refrigeration technologies are getting better at such a fast pace that it has been difficult to keep up with all the recent developments,” added Gallagher. “For example, when we first started the research project, we did not even know that low-charge ammonia refrigeration was available.”

Once the full board approves the SLCP strategy after the summer of 2016, “we would start a separate rule-making process” that would ultimately give the measures in the plan regulatory effect, said Gallagher. Even then, the plan could still be modified if, for example, an international agreement to phase down HFCs comes out of the Montreal Protocol in 2016.

Gallagher estimated that the adoption of regulations would take two years, followed by another “adjustment” year, making Sept. 2019 the soonest the regulations would take effect. During the rule-making process, CARB would develop another detailed cost/benefit and technical feasibility analysis. “We have to be deliberate as a governmental body and take stakeholders’ comments and needs seriously,” he said. “The benefits [of the regulations] will have to be pretty significant, which we know they are.”

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Working with the EPA

Formed in 1967, three years before the creation of the U.S. Environmental Protection Agency, the California Air Resources Board (CARB) has maintained a long collaboration with the EPA that continues to this day.

For refrigerant emissions programs, CARB has “an informal but very close relationship with U.S. EPA’s Stratospheric Protection Division that works on ODS and refrigerants,” noted Glenn Gallagher, CARB’s air pollution specialist. “We are constantly sharing refrigerant usage and emissions data between our two agencies.”

Recently, the EPA, in proposing improvements to Section 608 of the Clean Air Act, used CARB data on refrigerant usage and emissions collected since 2011 under CARB’s Refrigerant Management Program. “With our encouragement, they borrowed heavily from [the program],” said Gallagher.

In addition, the EPA is planning to adopt California’s low-GWP rules for aerosol propellants and its requirement for self-sealing valves in refrigerant cans used for motor vehicle air conditioning.

“We hope that any measures we require here in California will soon be adopted nationally,” said Gallagher.

Fixing Leaks, Destroying CFCs

The California Air Resources Board's efforts to curb HFC emissions did not start with the Short-Lived Climate Pollutants strategy.

In January 2011, the agency launched its Refrigerant Management Program aimed at leak reduction of high-GWP refrigerants, including HFCs and HCFCs.

The Refrigerant Management Program requires facilities with refrigeration systems that have more than 50 pounds of high-GWP refrigerant to conduct and report periodic leak inspections, promptly repair leaks, and keep service records on site.

"We've seen a real reduction in refrigerant emissions since our Refrigerant Management Program began," said Glenn Gallagher, air pollution specialist for CARB. "We can't take all the credit, because we know that high refrigerant prices have really made operators pay more attention to refrigerant leaks. Still, we have made a difference with our outreach to more than 20,000 businesses in California and ongoing efforts to educate operators, technicians, and the public on best [leak] management practices."

The U.S. Environmental Protection Agency's GreenChill program for supermarkets also deserves credit for raising awareness among store operators about the importance of good refrigerant management programs, he added.

Under its cap-and-trade system, California has also been able to help eliminate used CFC refrigerants – ozone-depleting substances that have been phased out of production – by offering carbon offset credits for their destruction. "The ODS destruction program has been a very successful part of our greenhouse gas compliance offset program, with more than 10 million offset credits earned, with each offset credit equal to 1 metric ton of CO₂-equivalent emissions," said Gallagher.

The ODS destruction offset program is competing against the high value of reusable CFC refrigerant. Even so, only the state's forest protocol has been more successful, with 20 million offset credits earned.

California's plan to double energy efficiency in buildings is indirectly helping to drive the market for low-GWP refrigerant systems that use natural refrigerants, which can be more efficient than traditional systems. California utilities are beginning to make incentives for these systems available. (See "[Southern California Edison Takes on Natural Refrigerants](#)," *Accelerate America*, June 2015.)

→ Low-GWP requirements

Because HFCs refrigerants are not meant to be emitted during normal use – in contrast to CO₂ produced from burning fossil fuels – they were not included in California's cap-and-trade program. CARB thus sought other methods to reduce HFC emissions under AB 32, and came up with a Refrigerant Management Program for commercial refrigeration (see story, [this page](#)), low-GWP requirements for consumer products such as aerosol dusters, and the self-sealing valve requirements for small cans of motor vehicle refrigerant (preventing leftover refrigerant from being emitted). "However," said Gallagher, "even with these measures in place, they just slowed down the increase in HFC emissions, so we knew we needed additional measures," giving rise to the SLCP Reduction Strategy.

The main elements of CARB's SLCP Reduction Strategy to date – most of which are likely to remain (perhaps with some tweaks) in the final plan submitted to CARB's governing board – consist of GWP caps for new stationary refrigeration and air conditioning equipment; a ban on the sale of refrigerants with a GWP of 2,500 or greater; an HFC phase-down plan; and an incentive program for using low-GWP refrigerants in new and retrofit applications. In a number of cases, these proposals parallel the European Union's F-gas Regulations.

These moves together are designed to slash emissions of HFCs by 40% of 2013 levels by 2030. "That's a huge decrease," said Gallagher. But to meet the reduction target, "the exact details of any prohibition or ban and when it'll take effect may have to be more stringent or less stringent" said McCarthy. "That will also be dependent on the technologies available."

The ban on sales of refrigerants with very high (more than 2,500) GWPs, scheduled for Jan. 1, 2020, is in line with the U.S. EPA's plan to delist refrigerants like R404A and R507A under the SNAP (Significant New Alternatives Policy) program. (See "[EPA Announces Final Rule for Delisting of HFCs](#)," *Accelerate America*, [July/August 2015](#).) But the GWP caps in new equipment go much further.

For example, CARB has proposed a ban on refrigerants with a GWP of 150 or greater in new stationary refrigeration (all sectors – commercial, industrial and residential) starting Jan. 1, 2021;

and a ban on refrigerants with a GWP of 750 or greater in new stationary air conditioning (all sectors) starting Jan. 1, 2022. Gallagher underscored that the GWP caps would apply only to new equipment. “We don’t expect anyone to change a perfectly good refrigeration system they just purchased a year ago.”

Gallagher noted that for California to meet its greenhouse gas reduction goals, CARB would prefer to require refrigerants with a GWP of less than 150 for stationary air-conditioning at the small commercial building level and at the residential level. “So we are looking for more innovation from the equipment manufacturers.”

CARB intends to put forward an HFC production and import phase down in its final SLCP strategy, though the progress made at the Montreal Protocol’s Dubai meeting in November could lead to a global HFC phase down initiative in 2016, which would supersede CARB’s plan. “The Dubai meeting was very promising, but we are going to keep working on our own California phase down of HFCs until we see a real phase-down schedule emerge next year from more Montreal Protocol meetings,” said Gallagher. If a global commitment can’t be made, he added, CARB would ultimately



partner with the EU, Canada, Australia and Japan on their HFC phase downs in addition to pursuing its own plan.

CARB has also analyzed a potential fee on HFCs that would apply to new production in the state or to the first importer of HFCs. While fees remain a possibility, they “are always problematic from a political point of view, and we’re hoping we can get HFC reductions from a phase down or sector specific high-GWP bans without resorting to a fee,” Gallagher said

Seeking incentive money

CARB’s financial incentives, which have not yet been finalized, would apply to new commercial refrigeration systems using low-GWP refrigerants in new or existing stores. “We are doing our best to secure funding for pilot projects where retail food stores can receive a grant that pays for the incremental cost of putting in a low-GWP refrigeration system, such as a hydrocarbon system, transcritical CO₂, ammonia-CO₂ hybrid system, or an HFC-CO₂ hybrid system,” said Gallagher. “By subsidizing the additional higher cost that can occur with the purchase of the low-GWP refrigeration, we hope to increase the number of stores using low-GWP, which will in turn show that low-GWP refrigeration works, and is cost-effective.”

It’s important for retail end users to make decisions about low-GWP systems as soon as possible, given the time it takes to turn over systems throughout an entire chain of stores. “Anything we do will take 10 or 20 years to see really good results,” Gallagher said.

McCarthy pointed out that CARB does not control incentive funding; the state legislature does. “We think that a fairly reasonable investment could go a long way,” he said.

While supporting the use of natural refrigerants, CARB does not take a position on which type of refrigerant end users should use, other than that it meets performance requirements and is allowed by the EPA’s SNAP program, leaving the door open to low-GWP

HFOs or HFO-HFC blends. HFOs, Gallagher said, could have a role in refrigerant retrofits, which are not generally amenable to natural refrigerants. However, he pointed out that HFO-HFC blends “aren’t yet below the GWP threshold we would like to see” in new systems.

In regard to the potential long-term environmental effects of HFOs, such as the generation of trifluoroacetic acid (TFA), McCarthy said CARB “doesn’t want unintended consequences and we’ll rely on the best-available science to understand what these may or may not be.” Added Gallagher. “We are looking into the TFA-accumulation issue, but we defer to the U.S. EPA’s SNAP program and we’re relying on the EPA to thoroughly vet any replacement refrigerants. The science is not resolved on the TFA issue – it’s an ongoing process.”

As CARB moves on with the process of understanding climate science and formulating its SLCP plans, the overarching intent of its regulatory initiatives remains to curb greenhouse gas emissions in the context of a growing economy. “That might be one of CARB’s real ongoing successes,” Gallagher said. “To again and again show that environmental regulations can protect human health and the environment in a cost-effective manner that does not harm businesses.” @MG

EPA'S TO-DO LIST FOR 2016

The agency's Drusilla Hufford discusses upcoming actions under the SNAP program, a new federal acquisition amendment, and other plans for the new year

– By Michael Garry

The U.S. Environmental Protection Agency, which plays a major role in regulating refrigerants, had a busy year in 2015 expanding the list of allowable refrigerants while prohibiting a number of high-GWP HFCs under its SNAP (Significant New Alternatives Policy) program. The agency's partnership with supermarkets in the GreenChill program also grew.

To find out what may be coming in 2016 from the agency, *Accelerate America* conducted the following interview with Drusilla Hufford, director of EPA's Stratospheric Protection Division.



Accelerate America: The Dubai meeting of the Montreal Protocol led to the formation of a contact group to begin negotiating an HFC phase-down amendment. What does the EPA expect will be accomplished in 2016?

the Montreal Protocol will stem the growth in HFC use and avoid an increase that could erode the gains we have made in other climate protection efforts. We are encouraged by the decision in Dubai, but recognize there is a tremendous amount of work ahead, and active leadership will be needed by all parties.

AA: How would an HFC phase-down amendment to the Montreal Protocol shape EPA policy in the U.S. towards HFCs? How might this affect the use of natural refrigerants (CO₂, hydrocarbons and ammonia)?

identifying and approving climate-friendly chemicals while prohibiting certain uses of the most harmful chemical alternatives.

Drusilla Hufford: At the 27th Meeting of the Parties (MOP-27) to the Montreal Protocol in Dubai in November, Parties reached an important agreement on a pathway to an HFC amendment in 2016.

A phase down of HFCs under

Drusilla Hufford: EPA is already taking action under the SNAP program, consistent with the President's Climate Action Plan, to encourage private sector investment in low-emissions technology by

“The U.S. is playing a leading role internationally and domestically to reduce HFC use and emissions.”

AA: EPA is proposing to amend the Federal Acquisition Regulations to promote alternatives to high-GWP HFCs. How much of a role will natural refrigerants play as an alternative?

for use by executive agencies in acquiring goods and services. On May 11, 2015, DoD, GSA, and NASA proposed to amend the FAR (FAR Case 2014-026) to implement executive branch policy in the President's Climate Action Plan to procure, when feasible, alternatives to high-GWP HFCs.

This would allow agencies to better meet the GHG emission-reduction goals and reporting requirements of the Executive Order (EO) 13693 of March 25, 2015, "Planning for Sustainability in the Next Decade." A final rule is currently being drafted, addressing public comments, and is expected to be published in 2016.

AA: Would EPA make incentives available to the private sector to spur the adoption of natural refrigerant systems, as California is considering?

Drusilla Hufford: The Department of Defense (DoD), General Services Administration (GSA), and the National Aeronautics and Space Administration (NASA) jointly issue the Federal Acquisition Regulation (FAR)

for use by executive agencies in acquiring goods and services.

On May 11, 2015, DoD, GSA, and NASA proposed to amend the FAR (FAR Case 2014-026) to implement executive branch policy in the President's Climate Action Plan to procure, when feasible, alternatives to high-GWP HFCs.

Drusilla Hufford: EPA's SNAP program is technology neutral and does not favor non-fluorinated or fluorinated alternatives.

continued on p.38 →

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→ **AA: What sector-specific workshops on new technologies, policies and standards regarding refrigerants will be coming in 2016?**

as sector-specific workshops, as we consider further potential actions addressing HFCs. EPA announced it would continue to work with the Alliance for Responsible Atmospheric Policy and other interested governments, international agencies, private sector organizations, and civil society to organize a series of sector-specific workshops that would provide opportunities to share information on technologies, policies, and standards. The first workshop, concerning the food cold chain – or bringing food from farm to market – was held in Montreal in November 2015. Future workshops are under discussion.

AA: How has the EPA GreenChill program promoted the use of natural refrigerant alternatives?

instead provides opportunities for sharing information about a range of environmentally-friendly alternatives, both fluorinated and non-fluorinated, and advanced refrigeration technologies through webinars and social media.

AA: Can you provide any details on impending SNAP rules that will declare additional refrigerants acceptable or unacceptable in various end uses?

included various refrigeration and air conditioning end uses. EPA announced continued actions under SNAP through a new rulemaking during the first half of 2016 that would propose to add to the SNAP list additional low-GWP alternatives and propose to

Drusilla Hufford: EPA will continue the important dialogue and engagement with stakeholders, through broad stakeholder meetings as well

Drusilla Hufford: EPA's GreenChill program does not promote a single refrigerant or technology approach, but

Drusilla Hufford: At our September SNAP stakeholder meeting, EPA outlined potential listings it was considering in its next regulatory action, and these

“The SNAP July final rule is estimated to result in avoided HFC emissions of 54-64 million tons of CO₂ equivalent in 2025.”

change the status of higher-GWP substances where safer options are available. EPA is also taking action to improve refrigerant management practices in the U.S. by applying the same rules to both ozone-depleting and HFC refrigerants through a proposed rule. [See story, [page 40](#)]

[Editor's note: At the September meeting EPA also said it is considering safer alternatives for chillers, refrigerated food processing and dispensing, household refrigerators and freezers, and cold storage warehouses. EPA is also seeking stakeholder input for refrigeration and air conditioning end uses for flammable and highly flammable refrigerants. And EPA is considering later transition dates than those announced in its July 20 delisting rule.]

AA: The EPA has said there will be no across-the-board GWP cutoffs or prohibitions of HFCs as a whole or in any one sector. Yet the EU F-gas regulations now in effect prohibit the sale of domestic refrigerators containing HFCs with GWPs greater than 150. California is considering similar regulations. Shouldn't the U.S. play a comparably leading role in eliminating HFCs?

Drusilla Hufford: The U.S. is playing a leading role internationally and domestically to reduce HFC use and emissions. Over the past year, EPA's SNAP program has completed four separate actions that both expand the list of climate-friendly alternatives and prohibit the use of certain high-GWP HFCs in uses such

as motor vehicle air conditioning and retail food refrigeration. The SNAP July final rule is estimated to result in avoided HFC emissions of 54-64 million tons of CO₂ equivalent in 2025. At our September SNAP stakeholder meeting, EPA outlined potential listings it was considering in its next regulatory action.

@ MG

continued on p.40 →

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EPA Targets HFCs in Section 608 Proposal

– By Matthew Cullinen

→ Since 1993, many end users of commercial refrigeration systems, notably food retailers, have been obligated to adhere to the maintenance, leak management and related regulations contained in Section 608 of the Clean Air Act of 1990, also known as the National Recycling and Emission Reduction Program.

Section 608 applies to systems using ozone-depleting substances (CFCs and HCFCs) targeted for phase out under the Montreal Protocol agreement. However, given the attention paid to the global-warming properties of HFC refrigerants (the

The proposed rule would lower the “trigger” leak rate requiring repairs from 35% to 20%.

primary replacement for CFCs and HCFCs) the Environmental Protection Agency is now aiming – in a proposed rule change published November 9 in the Federal Register – to extend Section 608’s reach to HFCs in appliances with 50 or more pounds of the refrigerant.

The proposed rule would also go much further in policing refrigerant leaks, lowering the annual “trigger” leak rate threshold – the minimum rate compelling repairs – from 35% to 20% for refrigeration systems containing 50 or more pounds of refrigerant, and from 15% to 10% for comfort cooling systems.

Stricter regulations on HFCs – along with the cost of compliance and the penalties for non-compliance – could lead more end users to consider EPA-allowed alternative refrigerants, including natural refrigerants.

The EPA estimates that the environmental benefits resulting from the proposed rule changes would be substantial: an annual reduction in GHG emissions of 7.5 million tons of CO₂-equivalent per year – the same as taking 1.6 million cars off the road. Overall, regulated industries would save \$52 million per year in reduced refrigerant purchases, while incurring an annual compliance cost of \$63 million, resulting in a net annual cost of \$11 million.

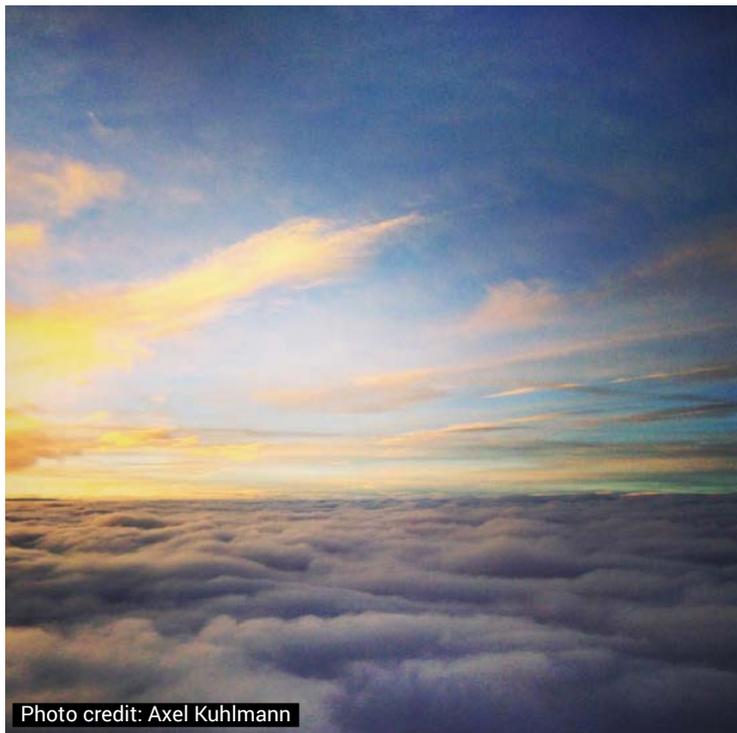


Photo credit: Axel Kuhlmann

The proposed changes to Section 608 come at a time of heightened focus on HFCs. Most recently, the parties to the Montreal Protocol, with U.S. support, have agreed to expand the scope of the treaty from ozone depleting gases to HFCs (see [“Breakthrough in Dubai,” *Accelerate America*, November 2015](#)). And this past summer, the EPA issued its final rule delisting a number of high-GWP HFCs in various applications (see [“EPA Announces Final Rule for Delisting of HFCs,” *Accelerate America*, July-August 2015](#)). Both of these actions are pursuant to the Obama Administration’s Climate Action Plan, which directs the U.S. to address HFC emissions.

In addition to regulating HFCs and lowering the trigger rate for leak repairs, the proposed rule calls for a number of other changes to Section 608:

- » **A two-year leak limit for appliances.** If an appliance leaks more than 75% of its full charge in two consecutive years, it would have to be retired or mothballed.
- » **Inspection and repair of all identified leaks within 30 days.**
- » **Initial and follow-up verification test for all affected appliances.**
- » **Regular leak inspections (quarterly for systems with 500 or more pounds of refrigerant) or the installation of automatic leak detection equipment.**
- » **Expanded recordkeeping requirements.**

While only 8% percent of appliances have annual leak rates that exceed 75%, these systems contribute 38% of refrigerant-related GHG emissions, according to the California Air Resources Board.

The EPA finished receiving comments on the proposed rule changes on Jan. 8 **MC**

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Lowell Randel, GCCA,
at the IIAR Conference in 2015.

WILL EPA AND OSHA EASE UP ON LOW-CHARGE AMMONIA?

Industry looks for federal agencies to recognize reduced risk of low-charge systems in upcoming changes to RMP and PSM regulations

— By Matthew Cullinen



As the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) begin the process of developing new rules for industrial refrigeration, industry observers wonder how these rules will impact ammonia refrigeration systems, large and small.

Both agencies stipulate a 10,000-pound threshold for ammonia used in industrial facilities, above which facilities must adhere to the EPA's Risk Management Plan (RMP) and OSHA's Process Safety Management (PSM) program. Following the massive ammonia nitrate explosion in 2013 in West, Texas, the Obama Administration has increased enforcement of these safety rules, including an EPA alert in February 2015. The alert, entitled "Anhydrous Ammonia at Refrigeration Facilities Under Scrutiny by the EPA," couldn't have sent a clearer message – the EPA is tightening rules and stepping up enforcement.

To alleviate their regulatory burden, end users are beginning to consider transitioning to low-charge ammonia systems that use less than 10,000 pounds of the refrigerant. Some facilities are also looking for alternatives to HFC-based refrigeration, which could include low-charge ammonia. Yet the regulatory rules as currently constituted don't necessarily support the lower-charge systems.

"Whether or not you build a system that has 10,000 lbs. or 1,000 lbs. of ammonia in it, you still need to comply with the same codes," said Kurt Liebendorfer, vice president of Evapco, a Taneytown, Md.-based maker of low-charge ammonia systems. (See story, [page 58](#).)

But the new rules have the potential to significantly encourage the uptake of low-charge systems. "When you use low-

charge ammonia, the risk is significantly reduced, but now the regulations need to catch up," said Liebendorfer. If they do, "it would really be the first time standards and regulation would actually bring down costs in the industry, instead of increasing them," he added.

Lowell Randel, vice president for government and legal affairs from the Global Cold Chain Alliance (GCCA), agreed with Liebendorfer that "there are some inherent safety improvements when you reduce the charge." The question is, will regulators recognize this and create a tiered system of requirements for protecting life and property?

In any event, the general trend is towards natural refrigerants and low-charge systems. "You've got a move away from HFCs toward naturals, and that trend is going to continue," Randel said. "At the same time you've got potentially more regulatory burdens placed on 10,000 lbs. of ammonia and up, and it's definitely driving interest in low-charge."

Low-charge ammonia technology has the potential to be used beyond traditional industrial settings. "We have found that there are a lot of people looking for an alternative to expensive synthetic refrigerants within the light industrial market, particularly in conditions where ambient temperatures are high," said Eric Smith, vice president, International Institute of Ammonia Refrigeration (IIAR). "The new chapter on packaged equipment [in the IIAR-2 standard] will enable ammonia to be more readily used in commercial and light industrial applications." (See story, [page 44](#))

Other issues will need to be addressed over time in the new rules, added Smith. "We remain very concerned that requirements for third-party audits are too strict."

continued on p.44



→ FEEDBACK FROM SMALL BUSINESSES

In drafting potential changes to RMP requirements for industrial refrigeration, the EPA is working with the Small Business Administration (SBA) and “getting some feedback from the small business community,” Randel said. IIAR experts have formed a working group to advise the EPA on this process, which will conclude with a report to the EPA administrator and a proposed rule published in the federal register.

The EPA and OSHA are also referring to the IIAR’s recent update of its IIAR-2 standard.

Randel expects to see the EPA’s proposed rule in March or April of 2016, followed by a comment period “with IIAR and others very active in providing input on whether these proposed changes make sense.”



Eric Smith, IIAR

These changes are also being fast-tracked by strong political forces. “Because this is a high priority for the administration, they will work very hard to have a final rule before the end of 2016, the conclusion of the Obama administration,” Randel said. “But hitting those deadlines will be challenging.”

OSHA is also beginning the process of revising their PSM requirements, but this will likely take longer – beyond 2016. The agency is interested in the portion of the revised IIAR-2 standard that addresses low-charge packaged systems.

One of the big questions is whether OSHA will make changes to the threshold quantities in their rules that require an end-user to comply with PSM or other safety procedures. But Randel doesn’t anticipate a change to the 10,000-lbs. threshold, long one of the most influential guidelines.

“All of the threshold quantities are on the table, but I would be surprised to see major changes to the ammonia threshold,” he said. “I get asked this question a lot, and I ask this question a lot.” @MC

IIAR-2 Addresses Low-Charge Ammonia

The International Institute of Ammonia Refrigeration (IIAR) released updates to its IIAR-2 operational and safety standard for ammonia refrigeration last month in the December 2015 issue of its *Condenser* magazine.

For the first time, the standard, established in 1974, addresses ammonia equipment outside of the machine room in industrial setting, including small low-charge ammonia packaged systems.

IIAR-2 has traditionally been written as a standard for safety and design but the new iteration also serves as a code (what to do) as well as a standard (how to do it).

Some of the other major changes to the standard include:

- › Standards for outdoor installation.
- › Clarification of relief piping terminations.
- › A chapter on ammonia detection and alarms.
- › Definitions of combustible material, trained operators and public access.
- › Clarifications on seismic bracing and on text for signage, labels and pipe marking.
- › An increase of the minimum pressure for low-side vessels to 250 PSIG from 150 PSIG.
- › A decrease in detection-level trigger for emergency ventilation systems to 150 ppm from 1,000 ppm.

On March 20, 2016, IIAR will host an education program on the newly revised IIAR-2 at the IIAR Industrial Refrigeration Conference & Exhibition in Orlando, Fla. @MC



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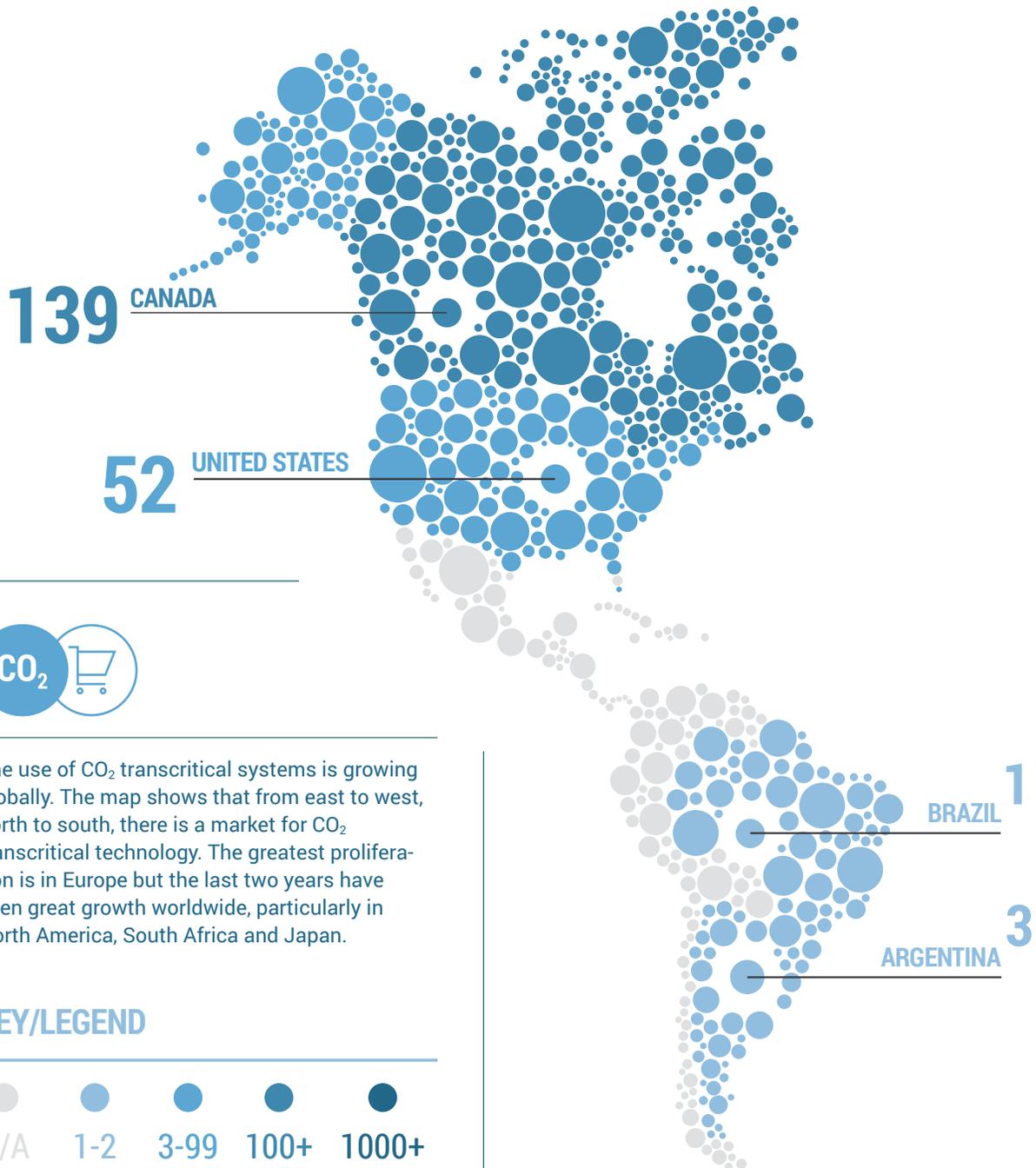
CANADA : 139

Canada leads the charge in North America, benefiting from CO₂ transcritical's excellent efficiency in low-ambient temperatures. Sobeys is the most proactive supermarket in installing CO₂ systems. The food retailer's transition was accelerated in Quebec - where 63 of its installations are located - by subsidies provided by Quebec's OPTER program.



UNITED STATES : 52

The United States has improved its usage of CO₂ transcritical in supermarkets with an increase from two installations in 2013 to 52 in 2015. While the United States may be behind in the total number of transcritical stores, it is at the forefront of technological advancements with innovative CO₂ installations in warm-ambient climates.



The use of CO₂ transcritical systems is growing globally. The map shows that from east to west, north to south, there is a market for CO₂ transcritical technology. The greatest proliferation is in Europe but the last two years have seen great growth worldwide, particularly in North America, South Africa and Japan.

KEY/LEGEND

- N/A
- 1-2
- 3-99
- 100+
- 1000+



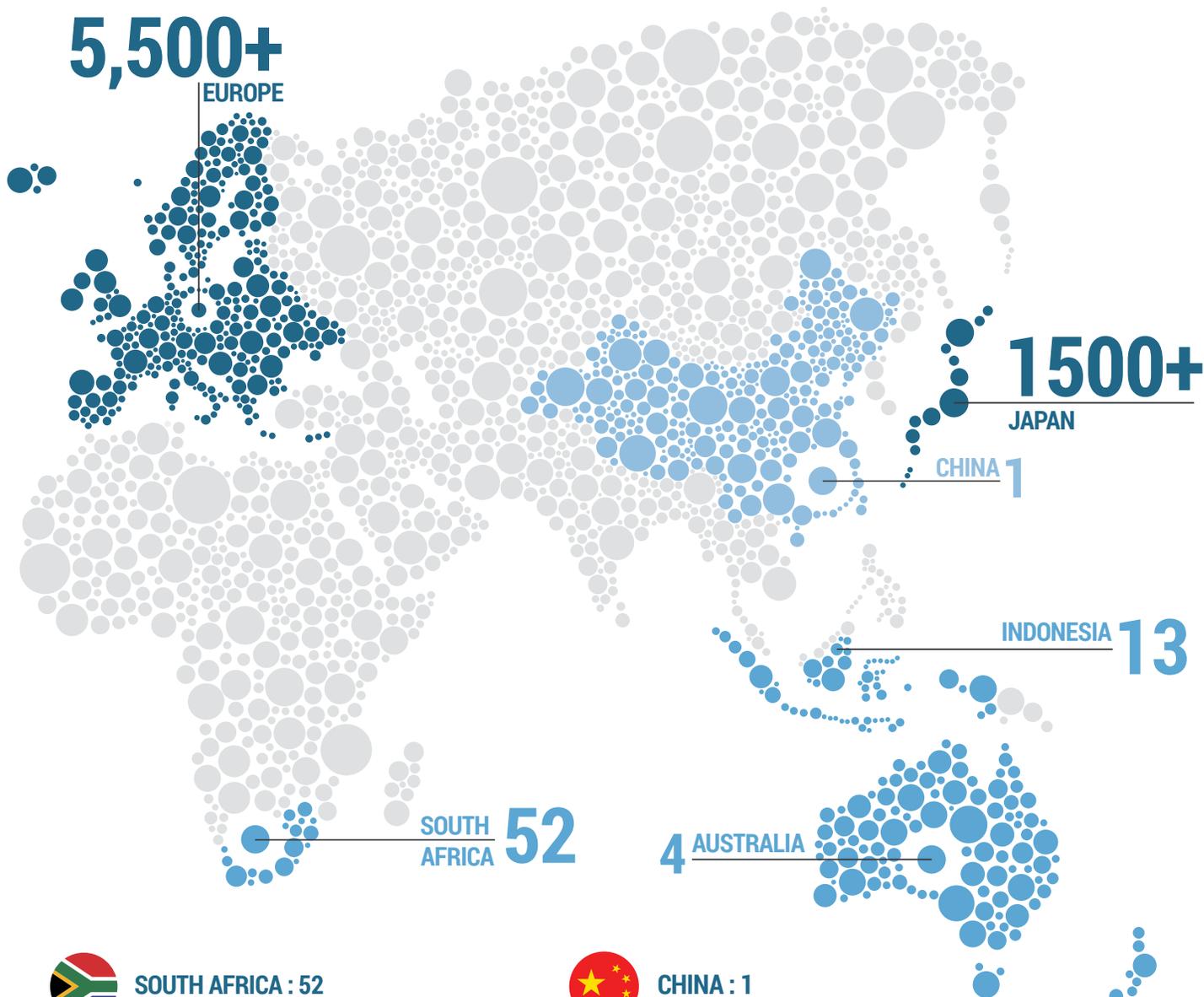
EUROPE : 5,500+

Europe is the world leader in terms of CO₂ adoption in commercial refrigeration, with over 5,500 supermarkets using CO₂ transcritical systems, an increase from 2,885 in 2013 and 1,330 in 2011, and continual growth is expected. Starting in 2016, more than 6,000 CO₂ transcritical systems will be added to the European market each year.



JAPAN : 1,500+

Japan's CO₂ commercial refrigeration sector has exploded in the last year with over 1,500 systems in 2015 compared to 190 in March 2014. This growth is engendered by the commitments of two leading retailers, Lawson and AEON. AEON plans to retrofit its 3,500 stores gradually with CO₂ systems.



SOUTH AFRICA : 52

South Africa has seen growing adoption of CO₂ transcritical systems with retailers Woolworths and Makro using the systems in their supermarkets. As the market for CO₂ technology grows globally, system suppliers in South Africa are confident that this market will continue to implement the technology.



CHINA : 1

China's commercial refrigeration sector is still in its infancy, with eight stores using CO₂, including one CO₂ transcritical store. There is, however, an expectation that this will accelerate soon with international supermarkets such as Carrefour looking to increase adoption of CO₂ technology in China.

9 NEW ZEALAND

SAVE ON'S PROPANE CASES BREAK THE MOLD IN JAPAN

Countering concerns about flammability, the convenience store chain is pioneering the use of propane plug-in low-temperature cases – including one in Japan's first all-natural-refrigerant c-store

— By Yukari Sahashi



Yoshiaki Kenjo,
Store Construction Manager at Save On

Unlike in Europe, where hydrocarbons have been a standard in stand-alone light commercial equipment for some time, refrigeration systems using propane (R290) have not usually been welcomed in Japan.

This is because Japanese system manufacturers are still quite apprehensive about propane's flammability. Safety issues, including how to handle accidents, and who bears responsibility, have been genuine concerns.

But one Japanese convenience store chain — Save On, headquartered in Gunma Prefecture — decided to depart from convention in 2014, becoming the first retailer to install flat glass-covered, low-temperature cases using plug-in propane (R290) refrigeration (from AHT Cooling Systems).

Moreover, in February 2015, after installing R290 cases in 30 stores, the chain opened the first convenience store in Japan with all-natural-refrigerant cases; these include one AHT R290 plug-in unit, and other cases (open, reach-in and walk-in) remotely refrigerated by two Panasonic CO₂ outdoor condensing units. (Other stores with natural refrigerants have at least one HFC plug-in case.) The all-natural-refrigerant store, located in Isesaki City, has been drawing considerable media attention in Japan.

"The fact that propane is widely used in Europe provided a good indication of its safety as we made our decision," said Yoshiaki Kenjo, store construction manager at Save On. "The approved charge limit for propane is 150g, which our systems adhere to. Within this limit, we believe its safety is guaranteed."

The store's MANHATTAN R290 showcases are sourced through REI-TECH, the distributor for AHT Cooling Systems in the Japanese market.

PUSHING TOWARD WIDER ADOPTION

Save On, established in 1984, operates over 600 franchised convenience stores in the Kanto and Tohoku regions. (There are more than 53,000 convenience stores across Japan.) The chain plans to increase the number of stores with the propane system by 20-30 per year. "The only way is for Save On to stick with the new refrigerant and push for wider adoption at more of our stores so that we can prove its safety based on our own experience," said Kenjo.

Save On is also looking at CO₂ as a refrigerant option for more stores. "Moving forward, our ultimate goal is to achieve a 100% adoption with R290 showcases, but we are also interested in CO₂ systems, Kenjo said. "Combining these two, we aim

to go all natural at 10% of our new stores within the next five years."

In opening a new store with an all-natural refrigerant solution, Save On did incur extra initial costs, which were balanced by funding from the Japanese Ministry of Environment. "The initial costs did increase, and to be honest, yes, it would have been difficult if the funding was not available," said Kenjo. Even with the funding, the initial costs were roughly 50% higher. But Save On expects to reduce electricity consumption and achieve a return on investment in no less than seven years. In one comparison to conventional cases using R404A, the chain found that the R290 case cut power consumption by 77%.

Save On's decision will bring to light the energy and cost advantages associated with R290 systems, not only for the chain's stores, but for the convenience store industry in Japan. The chain is ready to share safety and practicality advantages and help address lingering concerns about R290's flammability.

With its commitment to natural refrigerants, Save On is becoming a business that is highly valued by its community for being more environmentally responsible. **YS**

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DELHAIZE TAPS CO₂ AS 'REFRIGERANT OF THE FUTURE'

The Belgium-based food retailer is on a mission to install as many natural refrigerant systems as possible across its global store network, which includes U.S. chains Food Lion and Hannaford Supermarkets

— By James Ranson

In late November *Accelerate Europe* (a new sister publication of *Accelerate America*) took a tour of Delhaize Group's refurbished Chazal store in Schaerbeek, Brussels.

Georgios Patkos, former director of the technical department for Brussels-based Delhaize, lent his technical insights, with his successor David Schalenbourg on hand to provide a window into the company's sustainable future.

Schalenbourg noted that, in Belgium alone, reducing energy consumption and refrigerant leaks, and retrofitting equipment with low-GWP refrigerants like CO₂, have led to a 38% reduction in greenhouse gas emissions, using 2008 as a baseline.

As part of its efforts to communicate its sustainability initiatives to its consumers, suppliers, and other



Delhaize's Chazal store in Brussels, Belgium

stakeholders, Delhaize publishes progress on its targets annually and attends events like shecco's ATMOsphere series on natural refrigerants. The company also engages with the Consumer Goods Forum's Refrigeration Working Group via workshops with other retailers, manufacturers, and refrigeration suppliers to discuss how the market can lower the climate impact of refrigeration systems.

Delhaize does not disclose specific targets on how many natural refrigerant systems it aims to install in the future. The simple message, though, is: the more, the merrier.



“We don’t have specific targets for number of stores with CO₂ refrigeration,” Schalenbourg says. “In Belgium, we plan to have three to four installations yearly. Currently, outside Belgium, we have 12 hybrid CO₂ systems operating in Greece, 770 plug-ins with R290 in Romania, and [three] CO₂ transcritical systems in the U.S.” The U.S. installations include one Food Lion store in Southport, N.C., and two Hannaford stores, in Turner, Maine, and North Berwick, Maine.

Food Lion and Hannaford are still evaluating their transcritical systems. (See [“Taking the Next Step,” Accelerate America, September 2015](#), and [“Food Retail Panel Discussion: Learning From Experience,” Accelerate America, July-August, 2015](#).)

An architect by trade, Schalenbourg had a spring in his step as *Accelerate Europe* followed him and Patkos around the newly refurbished Chazal store, which had undergone 10 months of renovation.

Central to the store’s refurbishment was the installation of Carrier’s CO₂OLtec transcritical CO₂ booster refrigeration system, which has been running since July 2015, replacing an HFC system.

The refurbishment also extended the floor space, raised the ceilings and implemented a new self-scan system.

But arguably the biggest adjustment was Carrier’s CO₂OLtec technology, which includes three low-temperature and four medium-temperature compressors (cooling capacity 200kW) and reclaimed heat used for hot water.

Three-year search

Headquartered in Anderlecht, Brussels, Belgium, the Delhaize Group was founded in Charleroi, Belgium in 1867 and now operates over 3,400 stores across seven countries.

Delhaize’s primary operations are in Belgium via numerous formats, including convenience store chain Proxy Delhaize. In addition to the U.S., the company has a presence in Luxembourg, Greece, Romania, Serbia and Indonesia.

In 2006 Delhaize commenced the search for a new environmentally friendly refrigerant — a “refrigerant of the future.” During a three-year process, the company tested several technologies, with an eye toward impending EU f-gas regulations, and finally opted for CO₂ transcritical in new installations (though hydrocarbons are used in some applications).

“Today CO₂ is still the refrigerant that answers best to all environmental and energy criteria,” said Patkos. “What is more, the technology and its components are becoming more affordable and the total cost of installations has decreased considerably over the last few years. The



David Schalenbourg,
Delhaize

continued on p.52 →

→ implementation of the f-gas regulations wasn't an accelerating element, but rather a confirmation that we took the right options at the right time."

For existing stores, Schalenbourg said Delhaize's goal is to retrofit all installations containing HFCs R404A and R507, with lower-GWP alternatives like CO₂ and hydrocarbons. Using its R404A systems as a comparison, Patkos said data collected typically confirmed a 5% drop in energy consumption a month after conversion to CO₂, and a further 6.5% reduction after 10 months.

All of the company's refrigerated warehouses utilize natural fluids ammonia and CO₂, while some of its transport fleet uses Thermo King's CO₂ Cryotech systems to keep food fresh during transportation.

An area Delhaize is looking to improve, Patkos said, is its in-store bottle coolers, few of which operate with natural refrigerants. Delhaize has invited bids for "cooling equipment with a special attention to plug-ins functioning with natural refrigerants."

U.S. and Global Reach



Refrigerated cases at Delhaize's Chazal store in Brussels, Belgium.



Carrier's CO₂OLtec transcritical CO₂ system at Delhaize's Chazal store in Brussels, Belgium

Delhaize (through its Food Lion and Hannaford stores) is among a number of companies in the U.S. testing transcritical CO₂ systems; others include Kroger, Ahold USA, Aldi and Whole Food Markets. And for the first time, Food Lion is testing a transcritical CO₂ system in a high ambient climate (Southport, N.C.).

For a global company, piloting transcritical CO₂ technology in warm temperatures is vital, said Schalenbourg. "Warm temperatures may pose a challenge for CO₂ installations, but that idea is being tested."

Patkos acknowledged that Delhaize faces a greater challenge implementing natural refrigerant systems in other regions the company services, such as Greece, Serbia, Romania and Indonesia. He cited the availability of trained technicians as a key barrier in those other countries.

"We do take different approaches in our different countries, tailored to local regulations, availability of equipment, availability of contractors," Patkos said. "Installing and maintaining natural refrigerant-based systems is now possible in Belgium, and it is starting to be more possible in the US, but it is not yet easy to do in our other countries of operation."

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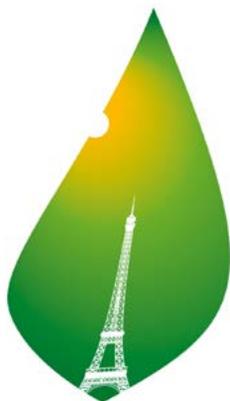


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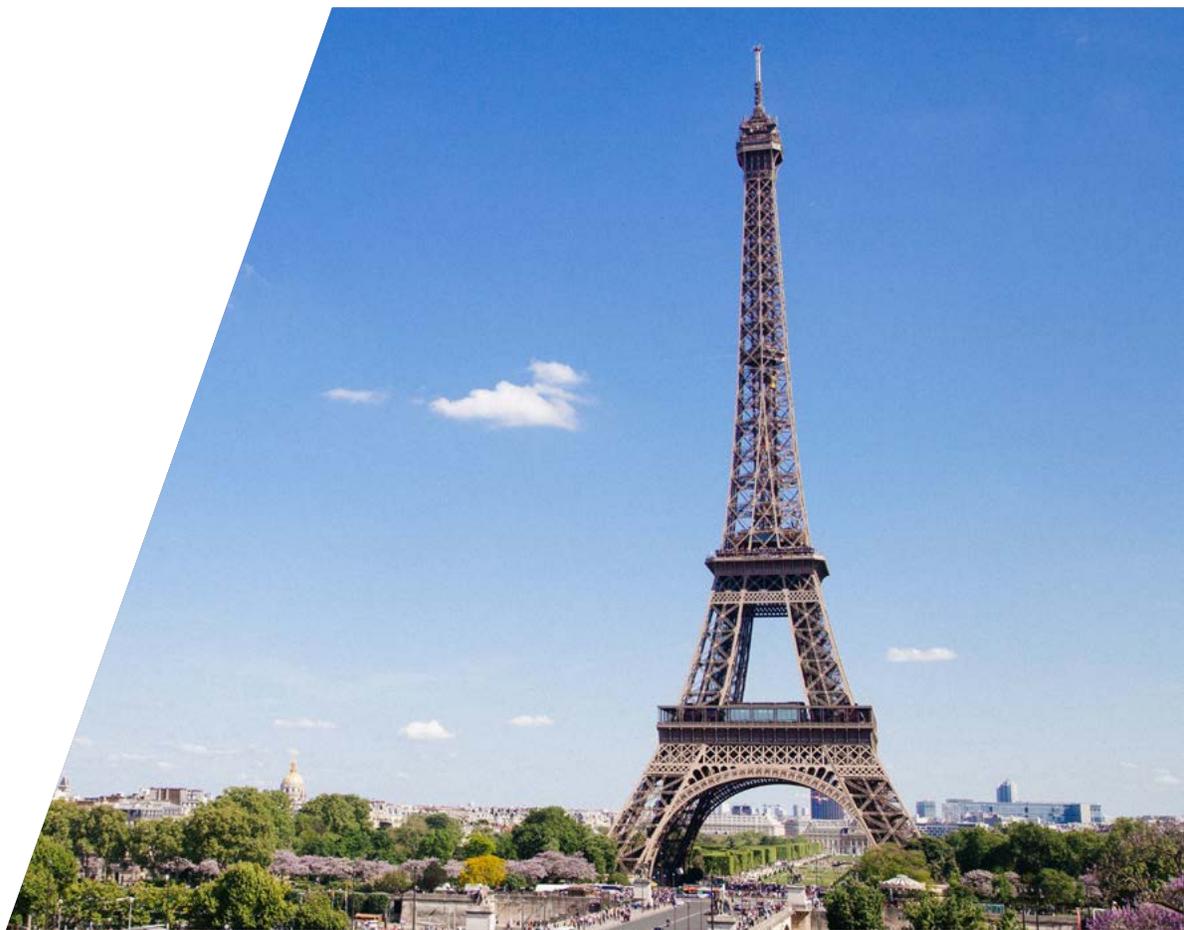


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COP21: *BRIDGING THE EMISSIONS GAP*



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PARIS 2015
UN CLIMATE CHANGE CONFERENCE



To achieve the Paris accord's goal of limiting global warming to less than 2° C, governments, companies and NGOs are targeting reductions of short-lived climate pollutants, including HFCs

— By Klara Skacanova and Michael Garry

The world governments that met in Paris from Nov. 30 through Dec. 11 agreed to work together to head off the devastating effects of unbridled climate change – a widely heralded accord that U.S. Secretary of State John Kerry called “a victory for all of the planet and future generations.”



But many government and industry leaders pointed out that, to effectively address climate change, the reduction of short-lived climate pollutants (SLCPs) would need to take place alongside efforts to rein in fossil fuel emissions.

The Paris meeting – officially called the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) – set the goal of keeping average global temperatures from rising more than 2 °C above pre-industrial levels; that is the warming threshold at which scientists expect major climate disruptions such as super droughts and rising sea levels. The agreement also encouraged countries to pursue a more aggressive goal – a maximum increase of 1.5 °C, which would meet the demands of developing countries that are most severely affected by climate change.

The Paris agreement is built upon country-specific climate targets, submitted this year by 187 governments accounting for over 90% of global emissions. These “Intended Nationally Determined Contributions,” or INDCs, contain public commitments and strategies for reducing greenhouse gases. The U.S., for example, plans to slash greenhouse gas emissions by 26%-28% of 2005 levels by 2025. The Paris agreement includes a regular review of the INDCs and submission of increasingly ambitious targets every five years.

However, according to an analysis by the Climate Action Tracker, the submitted INDCs will only cap global warming at 2.7 °C, far short of the two degree goal, not to mention the more ambitious target of 1.5 °C. Moreover, the commitments carry no weight legally, putting the success of the global agreement at risk.

But this “emissions gap” could be bridged by a global effort to address emissions from SLCPs, which primarily include methane, black carbon and hydrofluorocarbons (HFCs).

GETTING STARTED IN DUBAI

A month before the Paris meeting, the 27th Meeting of the Parties (MOP) to the Montreal Protocol in Dubai resulted in a long-awaited consensus to work within the Montreal Protocol on a phase down of HFCs in 2016. This effort would build on the Montreal Protocol’s widely recognized success in phasing down ozone-depleting CFCs and HCFCs. ([See “Breakthrough in Dubai,” *Accelerate America*, November 2015.](#)) A global deal to phase down HFCs would prevent 100 gigatons of CO₂-equivalent emissions by 2050, according to the North American amendment proposal (not including the effect of energy efficiency improvements).

The negotiations to phase down HFCs under the Montreal Protocol will be spread over four key meetings during 2016, beginning in April. The outcome could have a major impact on the adoption of natural refrigerants in place of HFCs.

The momentum that started in Dubai continued in Paris. On Dec. 4, the Climate and Clean Air Coalition (CCAC) and the UN Environment Program (UNEP) held a Focus Day on Short-Lived Climate Pollutants that brought together policymakers, academia, representatives of the business community and multilateral institutions to discuss measures to address SLCPs.

According to reporting by the International Institute for Sustainable Development (IISD), Ibrahim Thiaw, deputy executive director of UNEP, opened the Focus Day meeting by noting that addressing

continued on p.56 →

→ SLCPs is critical to “bending the emissions curve” and keeping global temperatures from rising more than 2° C. UNEP reported a scientific estimate that actions on SLCPs could slow warming by as much as 0.6 °C by 2050. A phase down of just HFCs under the Montreal Protocol would avoid 0.5 °C by 2100, according to a 2013 study in *Atmospheric Chemistry and Physics* called “The role of HFCs in mitigating 21st century climate change.”

Nobel laureate Mario Molina of the Mario Molina Center for Energy and Environment – who is credited for linking CFCs with ozone depletion – said at the meeting that both CO₂ emissions and SLCPs must be addressed in order to ensure a smaller temperature rise.

Both the U.S. and China include HFC reductions in their INDCs. The U.S. has begun delisting high-GWP HFCs through the Environmental Protection Agency’s SNAP program, and has enlisted commitments from the private sector to reduce HFC usage. (California intends to cut HFC emissions by 40% of 2013 levels by 2030; see story, [page 26](#).)

Private industry is expected to contribute to SLCP reduction. On SLCP Focus Day, food and beverage companies reported on steps they are taking to phase out HFCs from their operations. Coca-Cola, for example, is in the process of replacing HFCs with CO₂ refrigerant in its coolers and vending machines worldwide, while Unilever is working to reduce emissions from its global refrigeration systems.

OTHER ANNOUNCEMENTS MADE ON SLCP FOCUS DAY INCLUDE:

- » The Global Food Cold Chain Council committed to reduce the use and emissions of HFCs, enhance energy efficiency and avoid food loss in the cold chain.
- » The Global Refrigerant Management Initiative committed to achieve a 30% to 50% reduction in HFC emissions from refrigerant servicing within 10 years.
- » The Global Green Freight Action Plan pledged to double the number of green freight programs.



“Sustained reductions [of SLCPs] can help slow the rate of near-term warming, globally and in sensitive regions, such as the Arctic.”

CCAC STEPS UP SLCP WORK

Four days after the SLCP Focus Day, more SLCP announcements were made. On Dec. 8, the CCAC Paris Communiqué, endorsed by 49 ministers, 16 intergovernmental organizations and 44 NGOs, resolved to “prioritize, develop and implement measures that lead to the delivery of SLCP reductions at scale in the near- to medium-term, aiming to achieve significant climate, health and numerous other benefits.” The CCAC also launched a five-year strategic plan to address SLCPs.

To support this work, countries committed \$12 million to the CCAC’s trust fund and hundreds of millions of dollars to reduce SLCPs worldwide.

Several North American political figures weighed in on the CCAC’s announcements. “Sustained reductions [of SLCPs] can help slow the rate of near-term warming, globally and in sensitive regions, such as the Arctic,” said Catherine McKenna, Canada’s minister of environment and climate change. “As a northern country with a vast Arctic territory, this is extremely important to Canada.” Canada, she added, is committing \$35 million dollars over five years to address SLCPs, including \$10 million to the CCAC trust fund.

Gina McCarthy, administrator of the U.S. Environmental Protection Agency, pointed out the “opportunity to leverage the full strength and political leadership of the CCAC to help deliver a global HFC phasedown. I know we can collaborate together with other countries to get the job done.”

“Reducing SLCPs is a winner for everyone, said Jerry Brown, Governor of California.” It is important that we don’t lose sight of how important, how beneficial, and how immediate action in this area is. So let’s get on with it.” @KS+MG



Shaping Refrigeration Systems for Tomorrow

NewTon

A renovation including NewTon installation results in an approximate 40% reduction in yearly power consumption and stable production of high-quality frozen bread dough at the Kobeya Baking Co., Ltd.

Renovation back story

Rising temperature countermeasures and full phase-out of CFC

The Chiba branch is located in the central part of the Boso Peninsula (operations began in 1996). The branch realized renovations were needed when warming trends began in 2005. "Rising outside temperatures in summertime affects the production of frozen bread dough, and it became difficult to ensure the proper temperatures in the facilities compared with the past. Also, because we had decided to completely phase-out CFC by 2020, we decided to systematically update the facilities as soon as possible." (Nakajima, manager)

Kobeya Baking Co., Ltd.
Manger,
Frozen Production Dept.,
Fresh Headquarters
Mr. Yuji Nakajima



"Renovations can be difficult to carry out without interrupting production, and the advantages of NewTon's Factory Packaged System made the transition smooth. We are thankful that they were very careful not to allow any contamination, and that the construction was quick."

(Mr. Masauchi)

The highly quiet operation of the NewTon system is apparent, solving problems of noise affecting residents in the area.

"Machine vibration is minimal, and it is so quiet that you can't tell if it's operating unless you open the door to the machine case." (Mr. Masauchi)



Residential area right next to NewTon



Kobeya Baking Co., Ltd.
Frozen Production Dept.,
Fresh Headquarters
Section Chief,
Production Technology
Mr. Shinichi Masauchi

Kobeya Baking Co., Ltd. Chiba Branch

Kobeya Baking Co., Ltd. (established 1918) is a pioneer that was the first in Japan to succeed in baking bread using yeast cells. They produce and sell bread, cake, frozen dough, and operate bakeries and restaurants.

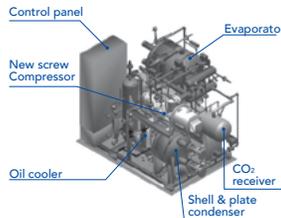
They operate on the concept of "Fresh & Pure" and "Healthy is Tasty", with no additives in their yeast foods and emulsifiers. Based on the business mission of "Pioneering the Future of Food Culture", the Chiba branch focuses on frozen foods, producing and supplying high-quality frozen bread dough for delivery across Japan.

Selection Factor

Excellent freezing performance and natural refrigerant system

"The NewTon system was selected for its high heat efficiency, excellent freezing performance, and its natural ammonia / CO₂ refrigerant that fits our corporate philosophy." (Nakajima, manager)

In particular, the NewTon system's cooling speed and fine-tuned temperature control is ideal for accurate temperature control required in the process of producing bread dough that has been proofed and then frozen.



Results after installation

Excellent freezing performance and natural refrigerant system

"The three main differences from previous models are energy efficiency, cooling speed, and operating time." (Masauchi)

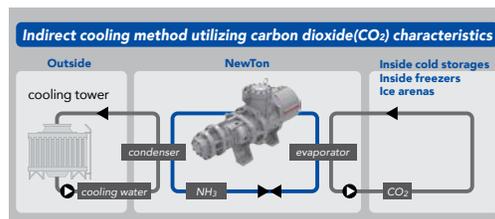
Compared with the previous year, energy efficiency averages 30% or more, and up to 40% depending on the month for reduced power consumption.

The combination of the NewTon system and spiral freezer with air defrost function, which was updated at the same time, results in 21 hours of continuous operation, increased from the previous 16, thereby improving productivity. These changes have resulted in savings of approximately 4 million yen in maintenance costs.



The NewTon system's superiority

High level of safety and quiet operation



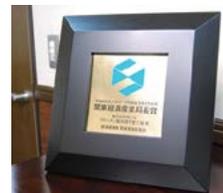
To maintain safety, a small charge of Ammonia is confined to the refrigeration cabinet, reducing the risks of leaking out of the equipment. Even if it does leak out, it can be processed in a removal apparatus.

The next step

Considering installation in other branches

Installation of the NewTon system at the Chiba branch was highly praised as a way to save electricity, resulting in Kobeya winning the Business with Excellent Energy Management Award and the Kanto Bureau of Economy, Trade, and Industry Director's Award. There are now plans to switch to LED lighting within the branch.

"Every effort we made was to deliver our best-tasting bread to as many customers as possible. We plan on installing the NewTon system in one more of our two production lines. We are currently considering installing the NewTon system in our Osaka and Hyogo branches as well." (Mr. Nakajima, manager)



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RESEARCH + SUSTAINABILITY = LOW-CHARGE AMMONIA

Evapco's twin traditions have resulted in Evapcold, a low-charge packaged ammonia unit poised to enter the industrial refrigeration market

— By Matthew Cullinen



about to turn 40 next year, HVAC&R manufacturer Evapco has built its business on a commitment to research and development (R&D) as well as sustainability.

Evapco pioneered the use of stainless-steel ammonia evaporator tubes, and has made significant advances in air-cooled condenser heat exchangers, among other innovations, paving the way for new standards in the industrial refrigeration industry. As a result, the company has no less than 45 U.S. and 92 foreign patents to its name. "There is a lot of enthusiasm among employees for R&D, which helps drive it forward," noted Kurt Liebendorfer, vice president of Evapco.

The employee-owned company, based in Taneytown, Md., has become a global enterprise that operates 20 manufacturing plants in 10 countries, along with a sales network of over 173 offices in 51 countries. It now manufactures a host of equipment for the HVAC&R industry, spanning industrial refrigeration, industrial processing, commercial HVAC and power generation. Its products range from evaporative condensers and evaporators to cooling towers and closed-circuit coolers.



Evapcold low-charge ammonia unit at Evapco's R&D center in Taneytown, Md. The unit will be used by Western Gateway Storage.

Evapco also has a long heritage of sustainability. Beginning with a focus on the efficient treatment and management of water for wet cooling systems, sustainability is now embedded within Evapco's business model. Its global sustainability directive puts the company at the forefront of introducing products that eliminate chemicals from the environment, reduce greenhouse gases, and save water. "We put the leaf on the Evapco logo six years ago because sustainability is something that each employee values," said Liebendorfer.

The dual focus on innovation and sustainability has yielded Evapcold, a complete family of self-contained low-charge ammonia refrigeration units (over 250 models) specifically designed for cold storage applications. "Over the last 10 years Evapco has devoted a lot of its money to R&D, and Evapcold was born out of this philosophy," said Liebendorfer, who is leading Evapcold's market introduction.

Evapcold is not the only low-charge ammonia system on the market; other providers include



Azane and NEXTCOLD. In addition, companies like M&M Refrigeration offer ammonia-CO₂ systems that significantly cut ammonia charge.

Evapcold units hold a charge of 2.5-5 lbs. of ammonia per ton of cooling capacity, about one tenth that of a traditional system, in a pumped liquid ammonia refrigeration system. Cooling capacities of units range from 10 TR to 100 TR, accommodating temperatures from -20 °F to 55 °F. A 100,000-square-foot cold storage warehouse with 300 tons of refrigeration load would require four or five Evapcold units.

In a first for Evapco, all refrigeration equipment — compressors, condensers, evaporators, vessels, piping, controls, valves — are contained in the Evapcold unit, typically installed on a rooftop, above refrigeration loads. (Water-cooled units are connected via piping to a cooling tower or fluid cooler.) Air fans located at the bottom of the unit blow refrigerated air through ductwork into the refrigerated space below. The units are manufactured in Greenup, Ill.

The initial cost of the Evapcold units and their energy efficiency are comparable to those of a traditional ammonia system, said Liebendorfer.

Along with its low charge, Evapcold offers significant advantages when compared to a traditional ammonia refrigeration system. For one thing, low-charge systems can greatly improve safety and reduce regulatory burden. Moreover, they are pre-packaged, speeding time to installation compared to a standard system with a central machinery room that pipes liquid ammonia refrigerant to remote evaporators in the cooling areas.

“ We put the leaf on the Evapco logo six years ago because sustainability is something that each employee values.”

Other characteristics of the Evapcold system include:

- » Half of the 250 models use air-cooled condensing (not common in ammonia systems), the rest water-cooled.
- » An efficient hot-gas defrost method allows units to continue to provide refrigeration while in defrost mode.
- » Evaporator performance is guaranteed and rated in accordance with AHRI standard 420.
- » Personnel access to evaporators is separate from access to the machine room in the unit, which improves operator safety.
- » Insulated “super floor” under the machine room eliminates the need for a roofer to provide insulation.
- » A two-year warranty is offered on all rotating equipment, valves and all electrical components.
- » Product documentation includes all operating procedures and maintenance procedures.

Customers are starting to take notice. “There is a lot of excitement, a lot of expectations for Evapcold,” said Liebendorfer. “The people we show this to are like ‘wow, this is neat.’” Evapcold’s first end user is Western Gateway Storage, a Utah-based cold storage operator. (See story, [page 62](#).)

continued on p.60 →

→ Liebendorfer believes that new applications should open up for low-charge ammonia. “The large market potential for us is jumping from the industrial to the commercial market. It’s a market opportunity of hundreds of millions of dollars.” Over time, he added, manufacturers will prove to regulators like OSHA and the EPA that low-charge ammonia systems are safe enough for these applications.

CHALLENGES AHEAD

Despite the excitement, there are still significant challenges that must be overcome before low-charge ammonia reaches its full potential. For example, while there is a significant opportunity for cost reductions and safety improvements with low-charge ammonia systems, for now those prospects are hindered by a one-size-fits-all approach to regulation.

“We must comply with the codes as they are now regardless of the quantity of ammonia,” said Liebendorfer. “The first generation of Evapcold was built for that purpose.” But, he noted, the systems could be far less expensive if end users didn’t have to comply with the same codes as a system that has far higher levels of ammonia in it.

“The large market potential for us is jumping from the industrial to the commercial market.”



Kurt Liebendorfer, Evapco (left), and David Bornemeier, Western Gateway Storage

A case in point: machinery-room code requirements. An industrial site with an ammonia cooling system must house it in a machinery room with a wall that can withstand a fire for one hour if it is adjacent to an occupied space. This requirement “is very sensible for a system with 10,000 to 20,000 lbs. of ammonia in it, but is it really necessary for a system that only has 1% to 2% of that amount?” Liebendorfer asked.

What is the ammonia charge limit needed to prevent any risk? “I don’t think there is only one,” he said. “There is a potential to develop several tiered limits. At the top end it’s about alleviating what the EPA requires for off-site [environmental risk]; for the low-end it’s about some of the regulations protecting personnel.”

Another challenge that needs to be overcome is building awareness and understanding of low-charge systems among contractors. “These technologies are disruptive to the industry,” Liebendorfer said. “Increasing uptake will ultimately require a sustained effort to help contractors understand where these technologies are a good fit.”

Even with potential changes in regulation, cost could still pose a challenge. “As a new technology, the costs are higher than they will be a year or two from now,” Liebendorfer said. As Evapco produces more units, the costs will likely come down, acting as a catalyst for change. He believes Evapcold “will be very successful over time and during this evolution end users will enjoy the superior life-cycle cost and safety benefits of the Evapcold product.” @MC

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WESTERN GATEWAY: FIRST TO USE EVAPCOLD

 I love feeling the cold air!" said David Bornemeier

Bornemeier, president of Western Gateway Storage, had just had his first experience with the Evapcold low-charge-ammonia cooling system his company bought for its new, state-of-the-art cold storage facility in Ogden, UT.

In mid-December Bornemeier, his wife, Becky, and their three children, as well as representatives from his contractor, Jack Gage Refrigeration, visited Evapco's R&D center at its headquarters in Taneytown, Md., to see the Evapcold packaged unit in operation. It is one of two low-charge units that will be delivered to Western Gateway's 30,000-square-foot cold storage facility in February 2016, and installed by the contractor, to provide cooling for a -10 °F freezer (and go colder if necessary). The Bornemeiers' three children – Sydney, 7, Jacob, 9, and Spencer, 11 – "turned the last bolt" on the system before it started up on Evapco's performance test stand.

Each Evapcold unit – which is 42-feet, 7-inches long, 10-feet, 10-inches wide and nine-feet, seven-inches high – contains 290 lbs. of ammonia, and can provide 70 TR of cooling (4.1 lbs./TR), for a total of 140 TR, though the facility's cooling load is 100 TR. (The extra TR is spare capacity.) The units are sized to allow one to be down temporarily for maintenance. In addition, a separate stick-built ammonia system using two Evapco ceiling-hung evaporators cools a 35 °F dock with a 20 TR cooling load.

Both Bornemeier and Jack Gage, owner of Jack Gage Refrigeration, believe that Evapcold provides significant advantages over a traditional centralized ammonia refrigeration system. But it took a while for them to reach this conclusion – eight different designs to be specific. "We have a far superior refrigeration design now in comparison to the systems we had considered before," Bornemeier said. "I feel like we have the Ferrari of the heat transfer industry."



From left: Kurt Liebendorfer, Evapco; the Bornemeier family: Becky, Sydney, Spencer, Jacob and David; and Jack Gage, Jack Gage Refrigeration

Top among the advantages cited by Bornemeier and Gage was the reduced time it takes to install a packaged system. According to Gage, a custom-built central system typically takes 4,000 hours to install, while he is anticipating only 300 hours for the roof-mounted Evapcold system. That is partly because Western Gateway has been able to build its new cold storage facility at the same time the packaged refrigeration system was being built, whereas a customized system would have to wait until the facility was ready for it.

Packaged units also reduce liability for the contractor, while being easier to operate for the end user. To that end, Evapco provides a single manual for operations and maintenance procedures. And if anything goes wrong, the end user can consult with just one supplier. The fact that Evapco has single-source responsibility for complete system design, factory assembly, operation and safety is highly important to Western Gateway.

Maintenance is also expected to be less than with a traditional system. "The [packaged] equipment is smaller, and there are fewer parts, so we expect maintenance costs to be lower," said Gage. Additionally, the packaged system can go on the roof, saving valuable floor space. Western Gateway was also attracted by the notion that packaged low-charge ammonia systems are safer, and will reduce its regulatory burden; a centralized, stick-built system would have had thousands of pounds of ammonia piped throughout the facility; now the ammonia is contained in two sites.

THE OWNER-CONTRACTOR RELATIONSHIP

Careful upfront planning between Western Gateway and Jack Gage Refrigeration has been an essential part of the plan to implement the

low-charge system. "The owner-contractor relationship is right in the middle of the design decision," said Kurt Liebendorfer, Evapco's vice president. "You have to make these decisions early in the concept of the building." For example, a packaged system on the roof requires structural reinforcement to be factored into the design. "So the sooner you can get your architect, engineer, and refrigeration suppliers together the better," he added.

Western Gateway was also attracted to Evapco because of its customer service and shared commitment to certain values. For example, some Evapco employees are the second-generation of their family to work at the company. "I like that Evapco is family oriented, and they take care of their employees, and they extend their arms out further and take care of their customers," said Western Gateway's CEO Becky Bornemeier. "That's how we run our business." A sense of pride in American manufacturing also had an influence on the decision by Western Gateway to go with Evapco.

Both Evapco and Western Gateway also embrace innovation, which drives what they see as a long-lasting partnership. "I feel like we've made something that we can duplicate," said Becky Bornemeier. "Our business is keeping things safe, clean and cold. We've found the right contractors and suppliers to make this and future buildings state of the art, and help us take care of our customers."

Before the nearly daylong visit was over, Bill Bartley, president and CEO of Evapco, stopped in to say hello. He handed the Bornemeiers his card and told them they can call him anytime day or night if they have a problem with their system. **MC**

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Issue #11

Dec. 2015/Jan. 2016

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Focus: The impact of regulations, standard and codes.

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Supplement to Issue #11

GUIDE to Natural Refrigerants at AHR Expo, Orlando

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Distribution at AHR Expo Orlando, Jan. 25-27

Issue #12

February 2016

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Focus: Food service (light commercial) refrigeration. Includes coverage of AHR Expo.

Ad submission deadline: Feb. 5

Issue #13

March 2016

Publication date: Mar. 15

Focus: Industrial refrigeration including food processing, wineries and breweries.

Distribution at IAR Industrial Refrigeration Conference & Exhibition, March 20-23

Ad submission deadline: Mar. 4

Issue #14

April 2016

Publication date: Apr. 12

Focus: Industrial refrigeration including cold storage and seafood. Includes coverage of IAR Industrial Refrigeration Conference and Seafood Expo.

Distribution at IARW-WFLO Convention, April 17-19

Ad submission deadline: Apr. 1

Issue #15

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Focus: Commercial and industrial HVAC.

Ad submission deadline: Apr. 29

Supplement to Issue #15

GUIDE to Natural Refrigerant Contractors in North America

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Print distribution to commercial and industrial end users.

Ad submission deadline: Apr. 29

Issue #16

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Focus: Utilities & incentives.

Distribution at ATMosphere America (June 16-17), FMI Connect and Global Cold Chain Expo (June 20-23)

Ad submission deadline: May 27

Issue #17

July-August 2016

Publication date: Jul. 19

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

Ad submission deadline: Jul. 8

Issue #18

September 2016

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Focus: Food Retail.

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

Ad submission deadline: Aug. 26

Supplement to Issue #18

GUIDE to Natural Refrigerants Training in North America

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Print distribution to commercial and industrial end users.

Ad submission deadline: Aug. 26

Issue #19

October 2016

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

Ad submission deadline: Sep. 30

Issue #20

Nov. - Dec. 2016

Publication date: Nov. 15

Focus: Regulations and Standards.

Ad submission deadline: Nov. 4

Additional Topics:

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