

ACCELERATE

ADVANCING HVAC&R NATURALLY

MAGAZINE

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AMBROSETTI**

Coca-Cola

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TOMORROW

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Editor's note
by Michael Garry

SPLIT DECISION

In this issue, we delve into how natural refrigerants are being used in the foodservice industry by major companies like Coca-Cola, McDonald's and Red Bull.

Perhaps the most striking thing about the foodservice industry is the divergent paths being taken by Coke, with the selection of carbon dioxide as its natural refrigerant of choice, and many other foodservice companies, such as Red Bull, which prefer hydrocarbons.

There is nothing wrong with having competing gases and technologies under the natural refrigerant umbrella. The main point is that they are all climate-friendly, with GWPs (global warming potentials) close to zero – a far cry from elevated GWPs of synthetic fluorinated refrigerants. Moreover, whether you're talking about CO₂, hydrocarbons or ammonia (as well as air and water on a smaller scale), naturals are generally more energy efficient than their synthetic counterparts, helping not only the environment but companies' bottom line.

Moreover, it's understandable that different applications lend themselves to different natural refrigerants. For example, industrial applications lean toward ammonia, while supermarkets favor CO₂, though in both industries end users are exploring alternatives.

What's different about the foodservice industry is that major industry players have come to a radically different decision about which refrigerant is best suited for pretty much the same application – low-horsepower, light-commercial refrigeration units like beverage coolers and vending machines. Coke insists that CO₂ is the best solution for its mammoth global footprint, even if it's not as easy to implement as a hydrocarbon solution. The company dismisses what it calls the “myths” about CO₂, such as that it can't be used in warmer climates. Moreover, Coke believes CO₂ is safer than hydrocarbons, which are A3 (flammable) refrigerants.

Addressing the safety issue, hydrocarbon advocates point to the long history of safe usage in Europe, as well as to the tiny quantities (up to 5.3 ounces) allowed in commercial applications – far less than propane refill tanks that populate the typical Wal-Mart.

At the NAFEM (foodservice equipment) Show in Anaheim last month, most of the suppliers I visited were touting hydrocarbon equipment, especially True Manufacturing, which devoted

much of its booth to demonstrating the energy benefits of its propane equipment.

It is this efficiency advantage that is driving the development of both hydrocarbon and CO₂ systems in the U.S., as OEMs scramble to comply with the efficiency requirements the Department of Energy has put in place for 2017. But because hydrocarbons are an easier refrigerant to implement, they appear to be the more popular choice in the U.S. so far. This could lead to a virtuous cycle in which greater production of hydrocarbon units helps lower the price of the technology, which in turn drives further adoption.

Ultimately these refrigerants will rise or fall on their merits. In evaluating them, McDonald's has come up with a useful four-part criteria: Is there an existing service infrastructure? Is there improved energy efficiency compared with legacy units? Are first costs roughly comparable to those of conventional equipment? Is there regulatory support?

May the best refrigerant win **MG**

NORTH AMERICAN EDITION ISSUE #4, MARCH 2015

ACCELERATE

ADVANCING HVAC&R NATURALLY

ABOUT ACCELERATE AMERICA

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

<http://accelerate.shecco.com>



Split decision

Editor's note by Michael Garry



Tomas Ambrosetti from Coca-Cola

Coke's quest to reinvent refrigeration



The wind at our back

Editor's note by Jana Topley Lira



Clearing the cost hurdle



Events planner

The events in March, April and May 2015



What's on the menu in foodservice?

'I'll have natural
refrigerants with that
equipment, please'



ISSUE #4

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Red Bull charges toward
sustainable cooling

Is propane a good
refrigerant for
supermarkets?



Preparing for
the inevitable



EPA approves
more uses of
hydrocarbons



Short takes



AHR Expo
signals growth
of natural
refrigerants



NAFEM's coming out party
for hydrocarbons



ATMOsphere Asia finds
dynamic market for
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Editor's note
by Janaina Topley Lira



THE WIND AT OUR BACK

The legislative landscape around the world continues to evolve in an ever more natural -refrigerant-friendly direction.

This spring revised F-Gas laws will enter into force in Japan and the European Union, putting pressure on end users to find low GWP (global-warming potential) alternatives.

In the U.S. the Environmental Protection Agency signed a final rule listing additional applications for hydrocarbon refrigerants R290, R600a, and R441A) as acceptable under the Significant New Alternatives Policy (SNAP) Program. The EPA also has its eye on delisting HFCs in certain applications while the Department of Energy has released its 2017 energy requirements, which favor natural refrigerants. In industrial applications, the phaseout of R22 is forcing building owners to replace the HCFC refrigerant with a climate friendly alternative.

Across nearly all HVAC&R sectors end users can no longer avoid the switch to energy efficient, low-GWP natural refrigerants. This message was clear in the U.S. at the AHR Expo and the NAFEM Show, and in Japan at the Supermarket Tradeshow and ATMOSphere Asia 2015.

Each of these events, which provided a showcase of some of the most cutting-edge refrigeration technology, featured more natural refrigerant solutions than ever before. It was clear that companies are preparing for wider market uptake.

For example, technologies such as adiabatic cooling, parallel compression and ejectors, which will bring CO₂ transcritical technology to any region of the world, were popular topics. For hydrocarbons, propane foodservice refrigerators and bottle coolers, which are more energy efficient than HFC models, are

winning over the U.S. To replace R22, lower-charge ammonia units and CO₂/ammonia cascade systems are being installed around the world, from Japan to New Zealand.

New technologies are also being transferred from one region of the world to another. While until now both Japanese supermarket and convenience store brands have relied on package-type 2 – 20 horsepower CO₂ systems, the very first rack-type CO₂ booster systems, more common in Canada and Europe, have now been introduced in Japan. In the U.S. on the other hand, companies like Sanden and Emerson Climate Technologies are planning to introduce CO₂ compressors for smaller retail formats like convenience stores, previously more common in Japan.

Of course, differences between world markets remain, and will continue for the near future. The positive trend for hydrocarbons in the U.S. has yet to be matched in Japan, where Red Bull has been unable to find component suppliers to enable them to bring their R290 ECO-Cooler to the market, while the level of investment in CO₂ transcritical systems in the Japan has not yet been matched in the US.

Nevertheless the trend in 2015 is clear: legislative change and technological innovation and sharing are like a strong wind pushing the market for natural refrigerants forward. **JTL**



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OUR CONTRIBUTORS.



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Marc holds degrees (incl. two Masters) in Economics, Politics, and Marketing. He has studied at the London School of Economics, INSEAD Singapore, Sciences Po Paris, and the College of Europe. He has specialized in natural refrigerants since 2003. He is an active member of ASHRAE. He founded the leading industry platforms R744.com, hydrocarbons21.com, ammonia21.com and R718.com. Since 2007 Marc is co-founder and Managing Director of shecco, an independent market development company specializing in bringing natural refrigerants "faster to market."

Michael Garry



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Michael Garry is a business journalist with a 30-year track record. Most recently, he led the coverage of sustainability, technology and logistics at Supermarket News for more than 11 years. He is well known among retailers, suppliers, technology vendors and trade groups throughout the North American food retailing and consumer goods industries. A Phi Beta Kappa graduate of M.I.T. with a degree in political science, he has written his first book, "Game of My Life – New York Mets," in which 25 baseball players recall their most memorable game.

Janaina Topley Lira



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A multi-lingual communications manager, Janaina holds a Masters Degree in Environmental Technology from Imperial College London and has a broad understanding of the environment arena, with specialist knowledge of climate change related issues. Prior to joining shecco she worked in research, policy analysis, and events organisation in the NGO sector. Now managing shecco's media and publications department, Janaina develops and delivers marketing and communications campaigns to promote climate friendly HVAC&R technologies.

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Keilly is the owner of KW Refrigerant Management Strategy, a consulting firm specializing in refrigerant management strategy for supermarket owners, service contractors and equipment manufacturers. Previously, she launched the EPA's GreenChill Partnership in 2007 and single-handedly ran the program until she left the agency in 2013. The partnership helps supermarkets transition to environmentally friendlier refrigerants, eliminate leaks, and adopt green refrigeration technologies and best environmental practices. During her tenure, the partnership grew to over 8,500 supermarkets, over 20% of the supermarket industry. Partner companies reduced their annual corporate-wide refrigerant emissions rates to 12.5%, half of the nation's average of 25%. She received a Law Degree and a Master's in Environmental Policy from Vermont Law School.

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Before joining the world of media and publications, Elke taught political science in the U.S. and worked in business development and market consulting. Originally from the state of Georgia, she has plenty of southern sass, and, naturally, loves her music - from rockabilly to indie pop. Elke holds a master's degree in political science with a concentration in European Union economic and social policy.



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Having worked as a journalist, editor and producer for five years in Australia, James felt the time had come to trade the Land Down Under for the Belgian capital. With a degree in communications, other than the written word, he also likes all manner of sports, anything sweet, and has an unhealthy attachment to his bicycle.





CLEARING THE COST HURDLE

— By Kelly Witman

Utility incentives represent a great way for U.S. companies to afford propane-based self-contained refrigeration equipment – and get demand rolling

Those who look to natural refrigerants as the ultimate solution to the cycle of never-ending refrigerant phaseouts have been discussing for several years the hurdles that need to be overcome to accelerate their adoption in the U.S.

Above all, the biggest hurdle is cost. As is usual with technology that has recently come on the scene in the U.S., the cost of natural refrigerant equipment is higher than that of typical HFC equipment.

This is to be expected. The commercial refrigeration industry has had decades to fine tune conventional equipment and drive out inefficiencies. Competition among conventional

equipment manufacturers who sell very similar products has kept prices low, and these manufacturers have been able to take advantage of the economies of scale that come with large sales volumes.

Eventually natural refrigerant equipment will get to that point also. In the meantime, the industry is in a catch-22: few are willing to purchase equipment that uses naturals until the price comes down, but manufacturers cannot bring the price down until more people purchase this equipment.

Greater demand in the U.S. would spark a virtuous cycle of events. For example, many of the components for natural equipment are now imported from Europe or Japan, but with increased demand in the U.S., component manufacturers could set up operations here. More customers would also encourage more manufacturers to enter the market, and these companies would compete with each other for business and look for ways to reduce prices.

Other hurdles to natural refrigerants would also be solved with greater volume, including the need for technician training, the lack of real data from stores that allow for equipment improvements, and the shortage of longer-term data on installation and maintenance costs.

If there were enough work on natural refrigerant systems for large numbers of technicians, service companies would invest in training, because they would get a return on their investment. And with greater experience with natural refrigerants across a broader base of end users, supermarkets would share data with each other and work with manufacturers to further improve products. The very fact of more units in use would generate robust data on all facets of the lifecycle cost equation.

So how can we spike demand for natural systems and thereby solve our catch-22?

HELP FROM UTILITIES

An attempt to answer this question took place on January 8th at an industry workshop in Berkeley, California. Sponsored by Hillphoenix, Emerson Climate Technologies and AHT Cooling Systems USA, the meeting brought together supermarket refrigeration executives, utility representatives, equipment manufacturers, and others to discuss ways to boost demand for equipment that uses natural refrigerants and saves energy.

Though the improved energy efficiency of natural refrigerant systems may not be the only – or even the main – reason supermarkets choose these refrigerants, the fact is that most natural

refrigerant equipment brings significant energy savings vs. conventional equipment, which makes them of interest to utilities. Bringing utilities into the equation is a “key stepping stone in the investment and hard work that is going to be required to make natural refrigerants mainstream,” according to Mitch Knapke, Director at Emerson Climate Technologies, one of the sponsors of the workshop.

The day-long workshop tried to “surface some good ideas of how and where to get traction with utility incentive programs,” said Harrison Horning, director of equipment purchasing, maintenance and energy, for Delhaize America.

The most obvious opportunity for utility incentives lies with hydrocarbon self-contained units, which can cost about 20% more than their HFC counterparts. Data from AHT Cooling Systems USA (see chart on [page 11](#)) show energy efficiency gains of more than 45% for their new hydrocarbon cases vs. their own new HFC cases. (Incentives for self-contained units using carbon dioxide will be considered in a future article.)

Based on those numbers, an average supermarket with 12 self-contained hydrocarbon units saves about 20,000 kWh annually per store. Multiplying the 20,000 kWh per store by

the wall next to each other in an independent lab to measure their energy consumption?

If those numbers still aren't good enough, there will soon be another source: the Department of Energy. By January 1, 2016, all manufacturers of self-contained commercial refrigeration units must measure, certify, and file with the DoE the daily energy consumption in kilowatt-hours per day of each model they sell. The DoE mandates that manufacturers use the "uniform test method for the measurement of energy consumption of commercial refrigerators, freezers, and refrigerator-freezers." Utilities can easily use those numbers as the basis for their incentive calculations.

the 37,459 supermarkets in the US (according to the Food Marketing Institute) results in a rough, back-of-the-napkin potential savings for supermarkets of 771,130,974 kWh per year. In fact, the savings would likely be higher than that, because the older HFC units that would be switched out likely use more energy than a new HFC unit. Of course, this quick analysis assumes that all 12 cases in an average store are 4-5 foot self-contained spot cases.

Taking the analysis one step further, if the average kWh price for electricity is a flat ten cents, U.S. supermarkets would save over \$77,000,000 per year in electricity costs. That sounds like a lot. And it is, though in total our nation's supermarkets spend about \$8-\$10 billion per year on electricity.

The premise at the start of the workshop was that prescriptive incentives for new self-contained hydrocarbon units are as close to a no-brainer as you can get in supermarket refrigeration. It should be as easy as comparing the annual electricity usage of a new hydrocarbon unit with the annual electricity usage of the same new unit that uses an HFC refrigerant. In other words, the hydrocarbon unit is compared to what the supermarket would have bought if the hydrocarbon unit did not exist. Just as with a washing machine or a home refrigerator, the annual energy use of self-contained refrigeration units is tested and listed in the equipment's spec sheets. If utilities don't trust manufacturers' energy usage data, wouldn't it be as easy as plugging both units into

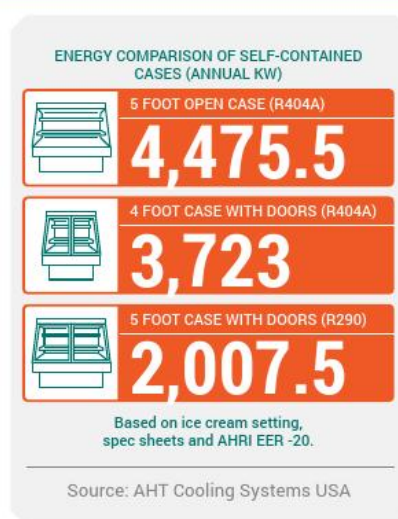
Replacing old self-contained units with new ones is slightly more complex. Does one measure the actual electricity usage of the existing unit first and use that consumption number as the basis for the prescriptive incentive? What about the ancient HFC unit that everyone admits shouldn't even be used anymore? Is it fair or desirable to use that as a baseline for an incentive? Or does one just assume that every existing HFC unit in stores uses an average amount of electricity and base the incentive on that? Or for simplicity's sake, how about taking the energy usage of a new HFC unit as the baseline, regardless of how much electricity the old HFC unit consumes?

GETTING STARTED

Utilities, supermarkets, and equipment manufacturers could spend a very long time evaluating all of those options to determine the perfect methodology. Or they could decide to not let the perfect interfere with the good and pick the most conservative option for utilities and go with that. Supermarkets might not receive as much of an incentive as they would with one of the other options, but at least they'd get more than they are currently receiving - nothing. And they'd start getting something a lot sooner than if utilities spend a very long time figuring out the perfect solution to all of these questions.

Derek Gosselin, product manager for systems at Hillphoenix, perhaps stated it best when he said, "The most important thing is to just get started."

As with other utility incentives, the role of this incentive is to stimulate sales of new energy-efficient equipment while it is still more expensive, allowing manufacturers to achieve



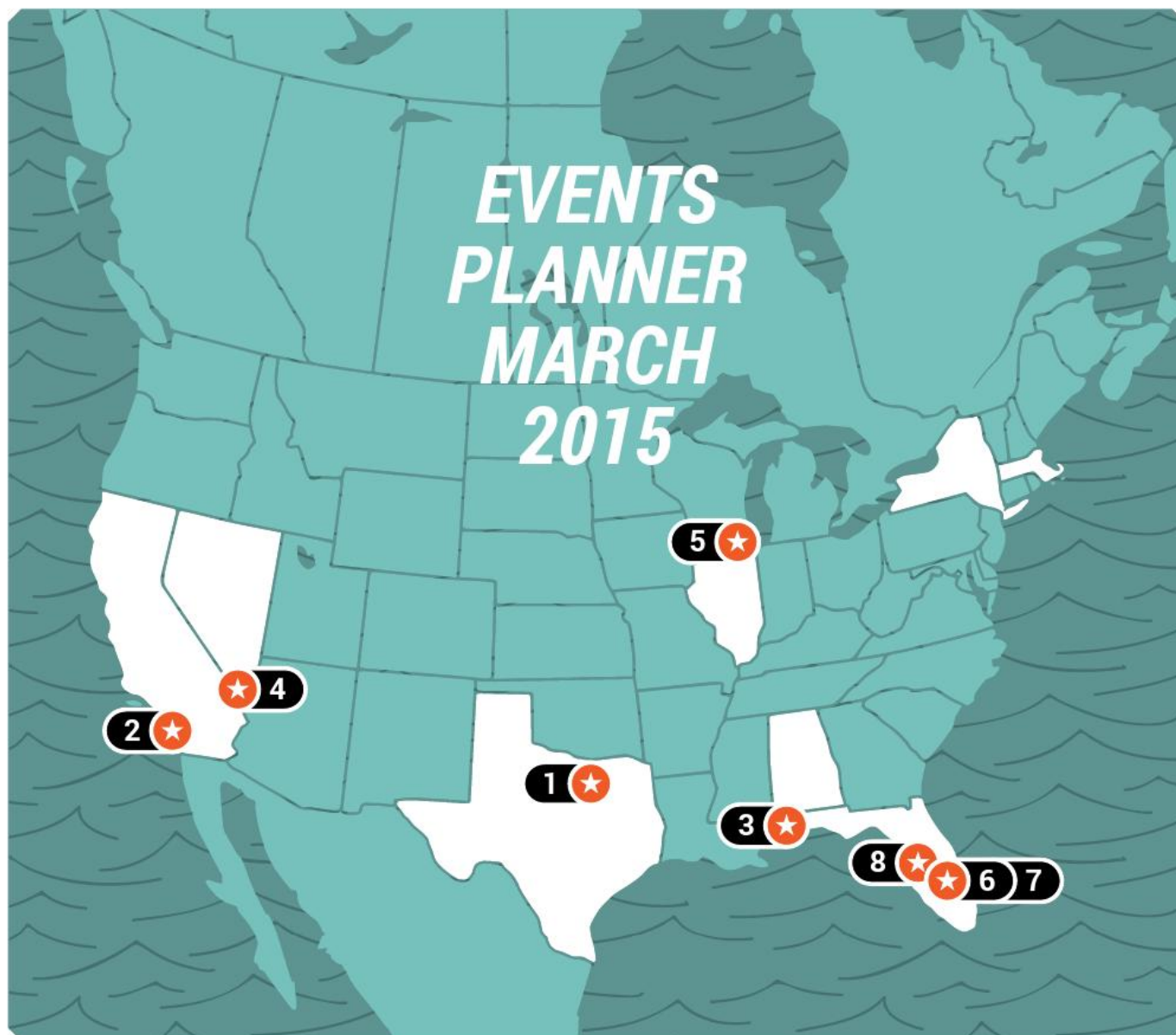
the economies of scale that come with larger volumes. Once the market demand is high enough to justify manufacturing components and cases in the US, the cost of hydrocarbon

self-contained units will automatically come down. And once the price comes down to levels that are comparable to those of conventional self-contained cases, utility incentives won't be necessary anymore.

The ideas discussed in the workshop are already bearing fruit, with innovative utility companies in California hoping to have a prescriptive rebates program in place by mid-summer 2015 for hydrocarbon self-contained units, according to Howell Feig, sales director for AHT Cooling Systems USA.

"The opportunity for prescriptive incentives/rebates for natural refrigerant solutions is in the very near future," noted Leigha Joyal, energy analyst at Hillphoenix.

Next month: Part II of Utility Incentives for Natural Refrigerants: Custom Incentives for Commercial Systems **KW**



1

March 16-19 — Grapevine, TX

ACCA Conference & IE3 Expo<http://www.acca.org/education/conference/>

twitter: @accausa / #acca15

2

March 22-25 — San Diego, CA

2015 IAR Industrial Refrigeration Conference & Exhibitionhttp://www.iar.org/iar/WCM/Events/Annual_Conference/WCM/Events/2015_Conference/2015%20Program/2015_IAR_Conference_Information.aspx?hkey=294e9a3c-1d8e-4c95-9afd-837dcfa7b43c

3

March 22 - 26 - Point Clear, AL

45th Annual Food & Beverage Environmental Conference<http://environ-council.affi.org/index.asp?sid=65>

4

March 24-26 Las Vegas, NV

GLOBALSHOP 2015<http://www.globalshop.org/>

twitter: @GLOBALSHOPSHOW / #WELOVERETAIL

5

March 25-26 - Rosemont, IL

Milk Procurement Workshop/ International Dairy Foods Associationhttp://www.idfa.org/forms/meeting/Microsite/milk_procurement_2015,0

twitter: @dairyidfa

6

March 29 - April 1 - Orlando, FL

2015 ABA Convention, American Bakers Association<http://americanbakers.org/2015abaconvention/>

twitter: @AmericanBakers / #ABACon

7

March 30 - April 2 Orlando, FL

SUSTPACK 2015/ Sustainable Packaging Coalition<http://www.sustainability-in-packaging.com>

twitter: @SustPack / #SustPack15

8

March 31 - April 1 - St. Petersburg, FL

Ice Cream Technology Conference 2015http://www.idfa.org/forms/meeting/Microsite/Ice_Cream_Tech_2015

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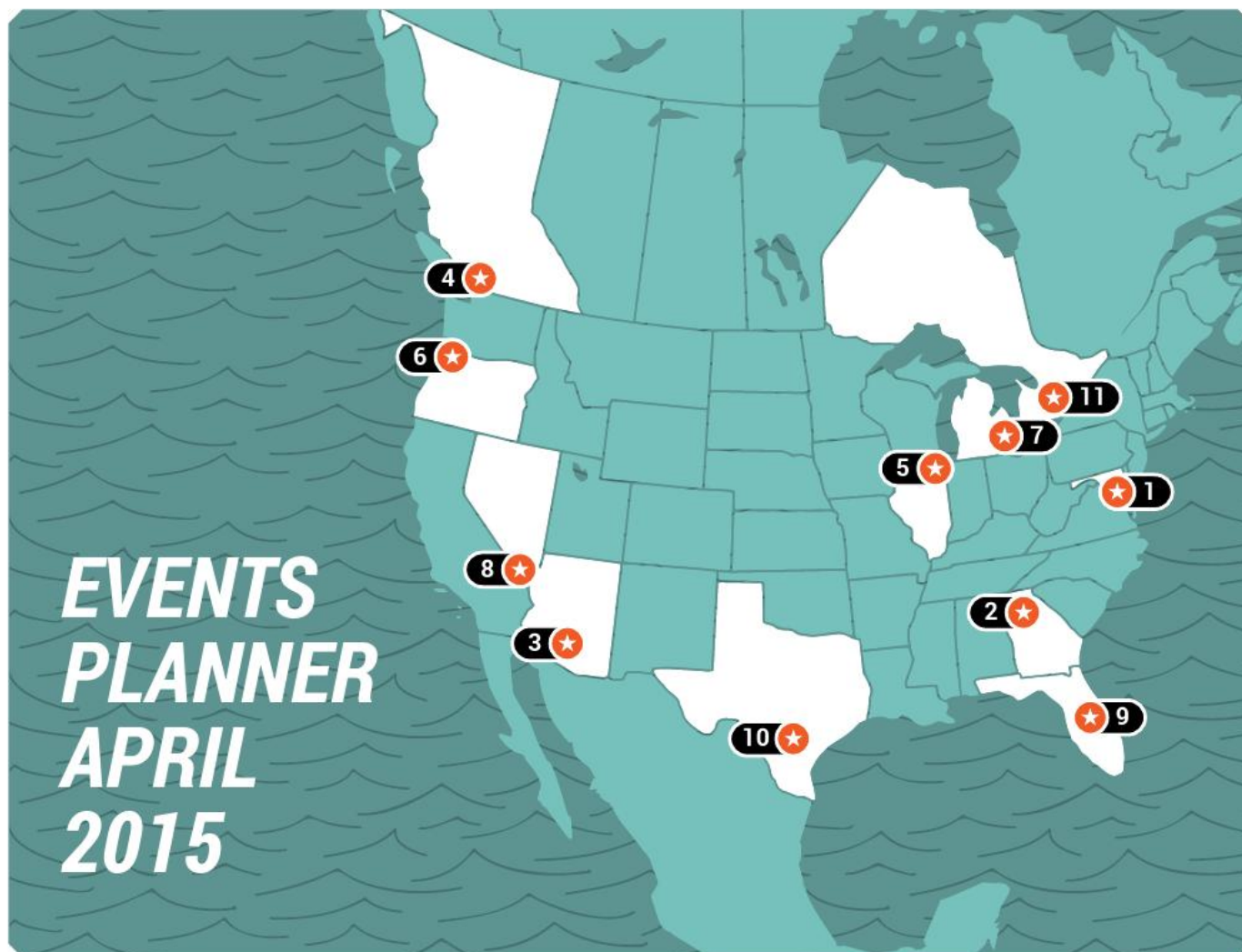
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April 12 - 15 - Washington, DC
GMA Science Forum 2015
<http://www.gmaonline.org/forms/meeting/Microsite/scienceforum15>
 twitter : @GroceryMakers

2

April 13 - 15 - Atlanta, GA
National Logistics & Distribution Conference
<http://nldcinfo.com/>
 twitter : @NLDCinfo / #NLDCinfo

3

April 13 - 15 - Tempe, AZ
NFRA Executive Conference
<http://nfraexecutiveconference.org/>
 twitter : @EasyHomeMeals

4

April 13 - 14 - Vancouver, BC
Grocery & Specialty Food West 2015
<http://www.cfig.ca/page.asp?id=43>
 twitter : @CFIGFCEI

5

April 14 - 15 - Chicago, IL
9th Annual American Food Technology & Innovation Summit
<http://www.thefoodsummit.com/>
 twitter : @FoodInnoNetwork

6

April 14 - 17 - Portland, OR
Craft Brewers Conference
<http://www.craftbrewersconference.com/>
 twitter : @BrewersAssoc / #craftbeer

7

April 21-23 - Detroit, MI
SAE 2015 World Congress & Exhibition
<http://www.sae.org/congress/>
 twitter : @SAEIntl

8

April 22 - 24 - Las Vegas, NV
2015 NAMA OneShow
<http://www.namaoneshow.org/>
 twitter : @NAMAvening / #NAMAOneShow15

9

April 25-29 - Orlando, FL
124th IARW-WFLO Convention & Expo
<http://www.gcca.org/124th-iarw-wflo-convention-expo/>
 twitter : @gccorg / #IARW

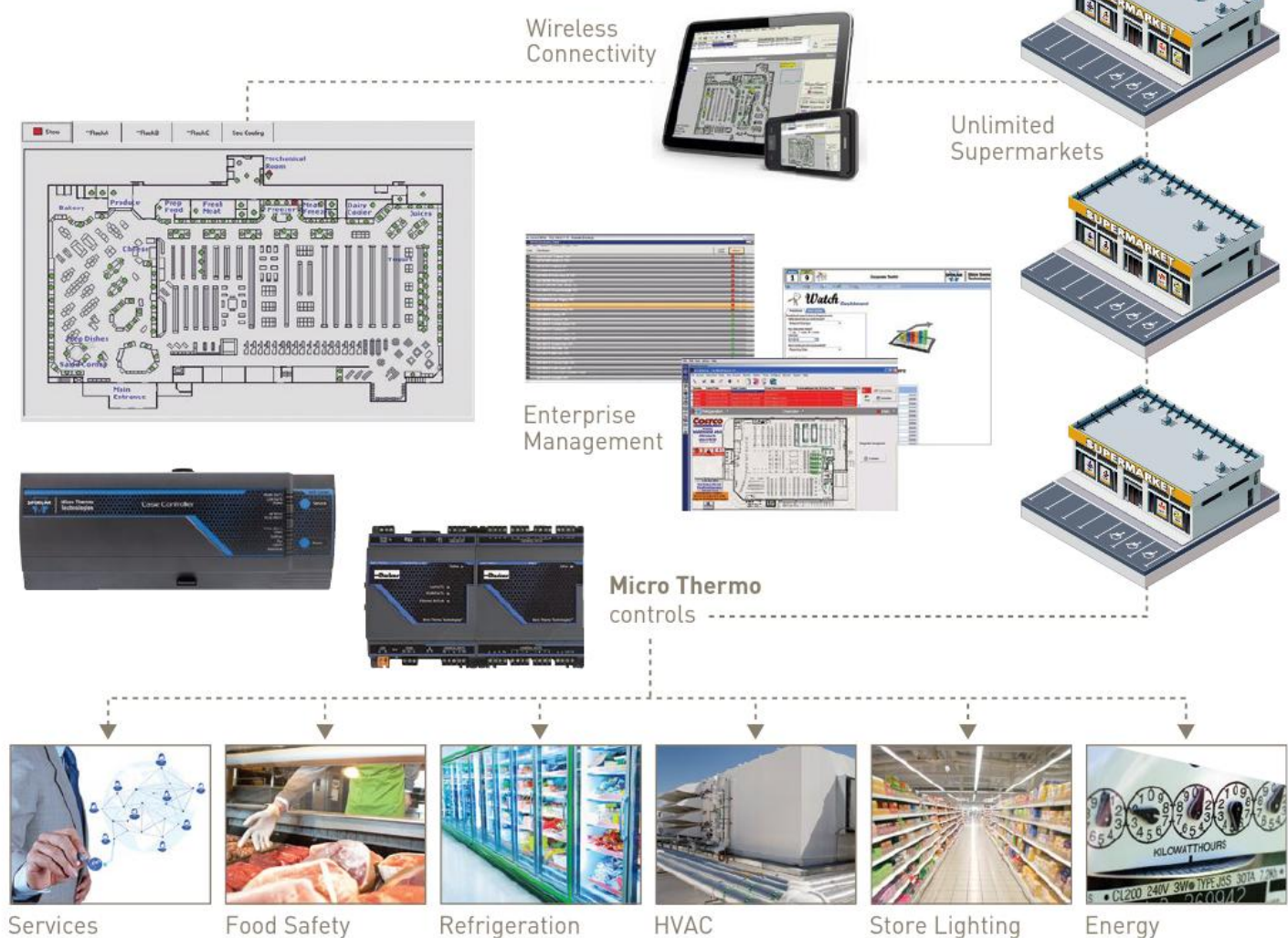
10

April 26-29 - San Antonio, TX
BuildPoint 2015
<http://www.buildpointevent.com/>
 twitter : @BuildPointEvent / #bp2014event

11

April 28 - 30 - Toronto, ON
SIAL Canada
<http://www.sialcanada.com/sial/en/index.sn>
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EVENTS PLANNER MAY 2015



1

May 11-13 – Monterey, CA

**PMA Tech Knowledge,
Produce Marketing Association**<http://www.pma.com/events/tech-knowledge/program/educational-sessions>

2

May 16-19 – Chicago, IL

NRA Show 2015www.show.restaurant.org

3

May 26-28 – Boston, MA

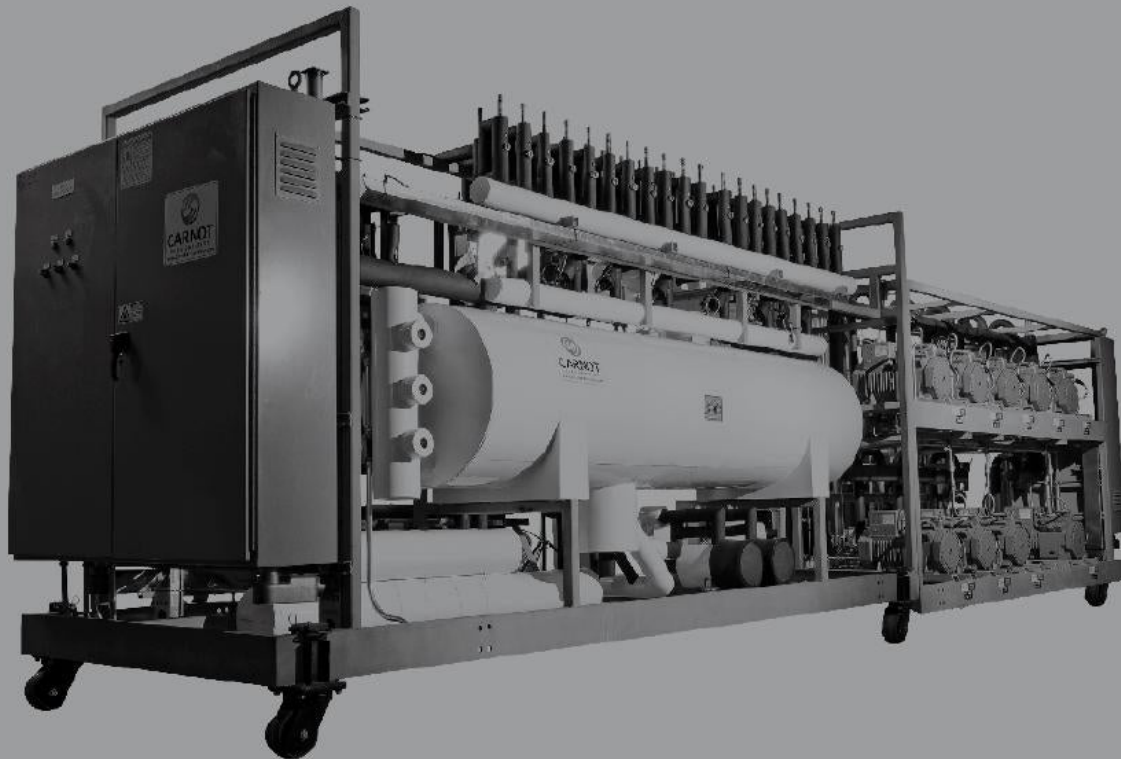
2015 Ice Arena Conference & Trade Showhttp://www.skateisi.com/site/sub.cfm?content=ice_arena_conference_and_tradeshaw

4

May 31-June 2 – Incline Village, NV

**Food Logistics Forum, American
Frozen Food Institute**<http://www.affi.org/events/2015-food-logistics-forum>

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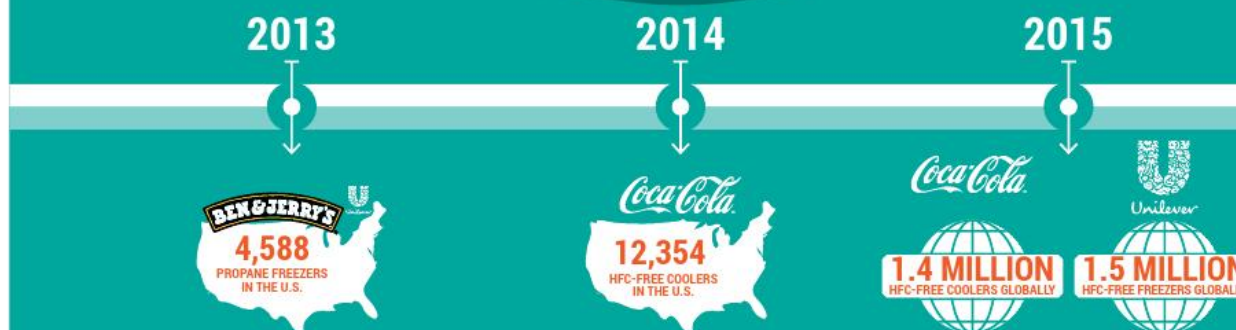
WHAT'S ON THE MENU IN FOODSERVICE?

— Factors affecting natural refrigerants adoption —

POLICY DRIVERS TIMELINE



COMPANY COMMITMENT TIMELINE



Coca-Cola “Over the past decade we have invested more than \$100 million to make our coolers better for the environment.”

“We believe that HC refrigerants for our ice cream freezer cabinets are the best refrigerant option.” *BEN & JERRY'S*

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Tomas Ambrosetti
eKOfreshment Global Program Director
The Coca-Cola Company



COKE'S QUEST TO REINVENT REFRIGERATION

The beverage giant would like to teach the world to use CO₂ – rather than hydrocarbons – as a natural refrigerant in beverage coolers and vending machines



Atlanta Georgia



By Michael Garry and Marc Chasserot

continued on p.22

During the 2000 Olympic Games in Sydney, Australia, Greenpeace challenged Coca-Cola to stop using hydrofluorocarbon (HFC) gas – a powerful global warmer -- as a refrigerant in its millions of vending machines and beverage coolers worldwide.



The activist group's anti-HFC campaign featured polar bears – a symbol of global warming's impact on the environment, as well as an iconic emblem of Coke's own advertising.

And the campaign worked, probably well beyond Greenpeace's wildest dreams. Doug Daft, Coca-Cola's chairman at the time, set the company on a journey to become HFC-free in its commercial refrigeration units. A few years later in 2004, Coke became a founding member with Greenpeace of Refrigerants, Naturally!, a non-profit dedicated to helping companies transition from HFCs to natural refrigerants.

Thus began an unlikely partnership between Greenpeace and the world's largest beverage company that has resulted in a major shift in the way soft drinks are cooled around the globe. (Coke has also pledged some \$2 million over five years to help ease the plight of polar bears with World Wildlife Fund.)

Fast-forward to November 2009: After spending \$50 million in search of a climate-friendly cooling technology, Coke, now under the leadership of chairman Muhtar Kent, announced a global goal to phase out the use of HFCs in all new cold drink equipment by 2015. In 2010, the Consumer Goods Forum, with Kent serving as co-chair, declared that all of its retailer and manufacturer members would begin phasing out HFC refrigerants as of 2015.

As of June 2014, Coke had installed 1.1 million HFC-free units – including more than 12,000 in North America – most of them using carbon dioxide as the company's non-HFC, natural refrigerant of choice. Some equipment employs the hydrocarbon refrigerant propane, but 230 models are now certified for CO₂, which Coke is using in many of its units going forward.

Over the past year, the growth of CO₂ deployment in North America has jumped from almost

nothing to about one-third of new equipment purchases. In addition, the number of HFC-free units worldwide has grown to 1.4 million.

Coke has no IP on CO₂ technology as it is supplied by third parties; the company would like to share all technical information in order to create more demand in the marketplace and bring prices down.

Of course, CO₂ is woven into the fabric of Coke's carbonated beverages, making it perhaps no surprise that the company would favor the gas as a refrigerant as well. And with refrigeration the biggest piece of Coke's carbon footprint, its push for CO₂ units has become a key part of the company's overall sustainability strategy, which includes conserving water and changing its bottles to plant-based material.

With 20% annual growth in the number of CO₂ units, Coca-Cola expects by the end of 2015 to achieve its HFC-free goal for all new cooling equipment – a major environmental accomplishment that puts the Atlanta-based beverage giant in the front rank of companies using natural refrigerants.

Buying more than one million pieces of cold drink equipment annually, Coca-Cola and its bottling partners have about 10 million vending machines and coolers stationed in more than 220 countries around the world. Replacing all of them with HFC-free units would cut carbon emissions by 52.5 million metric tons over the lifetime of the equipment (typically 10 years), the equivalent to taking 11 million cars off the road for a year, according to Coke and Greenpeace estimates.

In selecting CO₂ its natural refrigerant for self-contained units, Coke made the conscious decision not to use hydrocarbons, even though many other beverage and food companies are heading in that direction. Moreover, the company's choice of CO₂ puts it up against the challenges associated with that gas, including

higher operating pressures and a still evolving marketplace in North America for refrigeration components and servicing.

But Coke's enthusiasm for CO₂ remains undiminished. At shecco's ATMOSphere America Conference last June in San Francisco, Steven Cousins, equipment quality manager, Coca-Cola Global Quality, Safety and Environment, rebutted what he called "myths" about CO₂ refrigeration in self-contained cases: that it's inefficient, that it can't be used in high temperature climates and that it's too noisy.

"These issues have been resolved," he said. "Our cabinets are highly efficient, and are Energy Star qualified, and 38% are designed for high-temperature ambient conditions. The noise standards are the same as for HFCs."

Moreover, Coke's assessment is that CO₂ is a safer refrigerant than hydrocarbons.

For Coke, poised to remake the commercial refrigeration marketplace, it's been an extraordinary journey. How did it get here? And why did it choose CO₂? To find out more, *Accelerate America* sat down for an in-depth discussion with Tomas Ambrosetti, global program director of the eKOfreshment (KO being Coke's stock symbol) program, which is responsible for the transition to HFC-free refrigeration; and Cousins, whose group handles the certification and approval of beverage-cooling equipment purchased by Coke's bottlers and franchise operators.



Making the Transition

Accelerate America: How did Coke get started on this journey?

Tomas Ambrosetti: Doug Daft, our chairman, made the original commitment at the Sydney Olympics that we would be HFC-free. Many years later, in 2009, as we were progressing through and researching technologies, Muhtar Kent, our current chairman, made the follow-up commitment to be HFC-free by the end of 2015. This is a commitment and a position the company has had for probably longer than most companies in the industry. We've learned a lot along the way.

Steven Cousins: When Doug Daft made his original commitment, he didn't know and we didn't know what HFC-free solution it was going to be. We investigated a number of technologies. We looked at thermo-acoustics quite a bit and spent a great deal of effort looking at helium as a refrigerant. But helium wasn't scalable – it worked for less than half of our equipment portfolio. We wanted a single solution that would work everywhere, from a small countertop cooler to a big triple-door unit in a big-box retail store.

TA: That's why Coke chose CO₂ as its preferred refrigerant. We were looking for one portfolio solution that gives us economies of scale. CO₂ is what best fits our system, best fits our portfolio and we believe it's the most sustainable solution for us in the future. We probably have more experience in this space than most others in the industry. Grocery stores are moving to CO₂; auto manufacturers are considering CO₂ or HFOs. Japan's been using CO₂ for more than 10 years. It's a 100% proven technology. We have proof point after proof point.

AA: Why did it take Coke so many years to come to a decision on CO₂?

TA: You need to balance sustainable types of initiatives with the business. You need to do it in a very commercial, sustainable way and not spend huge amounts of money on something you can't sustain over the long term. We're finally hitting the inflection point – after all of the years of research – of creating the supply chain. We're finally at a place where we've proven the technology and created enough scale that our system's going to go forward in a big way. It's taken that much time to achieve that.

SC: As we're going through this transition and making the refrigerant change, we're at the same time looking at what we're replacing. We've been saying, it doesn't make sense to continue with this or that model. Some models we've retired, and we've developed some new models.

TA: North America has a lot of specialty equipment. You can get through the first 80% to 90% of purchase volume, but the last 10% you get into small quantities from obscure OEMs that are just learning about CO₂ and/or the technical challenges to make equipment certified in CO₂. On the very small, specialty-size equipment, we're challenged to find solutions that are CO₂-based. So for about 4% of the portfolio, technically we don't have a CO₂ solution. In those cases, we have a thermal electric solution that uses no refrigerant.

AA: Is North America the last market to go natural?

TA: That's not exactly correct. In terms of moving to CO₂-based equipment, North America has made significant progress. In 2014, a substantial portion of North America's equipment purchases were CO₂-based, making them one of the lead markets for us.



Steven Cousins
Equipment Quality Manager
Coca-Cola Global Quality,
Safety and Environment

AA: Do you have a personal motivation, too, in helping to change the market?

TA: Absolutely. I think I've got the coolest job in the Coca-Cola system. We're implementing a technology that's not easy, that puts a lot of pressure on the system. But I absolutely believe that what we're trying to do here potentially leaves the world in a better place than we found it. I think there's a social responsibility to doing some of this. I have a lot of passion for what I do. It's not unlike our PlantBottle; it's got similar challenges. But it's a key part of the sustainability strategy of The Coca-Cola Company, and I'm very fortunate to be part of it.

AA: Given that this is a billion-dollar decision, do you feel the pressure to get it right?

TA: No, especially having lived it and seen how many years this technology has been in place.

Working with OEMs

AA: Are you helping OEMs convert to CO₂?

TA: It's no surprise we're providing a lot of support because if you design equipment with R134a knowledge and think you can design CO₂ equipment, you will fail miserably. We see that all the time. So we're spending a lot of time even this year visiting each of these suppliers to see where they are in their design maturity and see if we can provide some insight to improve efficiency and reduce costs.

AA: Do you have enough OEMs? You can't just depend on a few OEMs. You need competition.

TA: We've got plenty of competition. That's not an issue. The procurement folks may say that fewer might be better. I tell OEMs that if you want to compete, you need to have the best CO₂-based equipment in the world. Some OEMs are resisting and some are way ahead. The ones who are in-between, we are bringing along. We go to those OEMs and share a lot of best practices to

cut that learning curve to one day's meeting vs. six months of trial and error. We also provide a lot of technical training for our OEMs. We can ask an OEM three questions and tell where they are on the maturity curve.

In the future, when we require CO₂-based equipment, we'll buy from the ones that are ready. They have to be more energy efficient and give it to me

continued on p.24

→ in CO₂. That's what we expect. And it's doable. I would tell you that 80% of the 230 models we have certified in CO₂ are more energy efficient than legacy models – and we're working with the other 20% to bring them up.

AA: How much of a cost premium does CO₂ equipment carry?

TA: There's no reason CO₂ can't be at a cost parity, pound for pound, in a mature supply chain. It's about getting more compressor suppliers interested in manufacturing CO₂ compressors, providing more competition in the marketplace. And all the subcomponents – heat exchangers, tubing – are right in line on price, if not better.

AA: How is Coke getting other beverage companies onboard with CO₂ refrigeration?

TA: I'm more and more trying to influence the industry to move to CO₂. Until now we've been very careful how we talk about CO₂ vs. hydrocarbons because we have used both. But at this point, I recognize that if we could get the industry to move along with us on CO₂, the cost parity would come much faster. And so we're starting to talk to some other competitors, suppliers – the whole supply chain – to influence it to move to CO₂. But we have to take that first step as the leader in this space.



The Impact of Regulations

AA: How have regulations in the U.S. – both the EPA's SNAP (Significant New Alternatives Policy) proposal to delist certain HFCs and the Department of Energy's new 2017 efficiency requirements – changed the way people are viewing natural refrigerants?

TA: We appreciate what the EPA is trying to do – trying to phase out R134a. We think it's accelerated the conversation. There's a lot of pressure now on our OEMs and us to move in that direction. The flip side to that is if you're not ready, you can run into some trouble. It may generate significant costs in the system; there's a lot of angst about what that might do to your business. So we're highly supportive of what the EPA is trying to do but we need help to be commercially viable in getting there. That's the feedback we're providing to the EPA.

SC: We like the approach the EPA has taken. We think the SNAP program is an appropriate mechanism to drive this type of change. We are also encouraged that SNAP is not an across-the-board, overnight change. It's a slow, phased transition: for these specific end uses, for these specific applications, here's where you can no longer use these gases.

AA: How is the DOE influencing the market? Is it complementing the EPA proposal – or creating confusion?

TA: It feels like they are operating independently. I keep them separate because the proposed ruling is for 2016, and the DOE is for 2017. I don't know that they're aligned in what they are trying to do, but they're both good. One is energy

efficiency and one is the gas.

AA: Do you need both?

TA: Absolutely. At the end of the day, it's about energy efficiency. I'm not surprised DOE's come out with new standards. I believe it's going to require some work but there's no reason why our equipment can't meet DOE standards. It's just going to have to be spec'd in that way. As of today we haven't asked in every instance for new equipment design to meet DOE 2017. But as we continue to purchase equipment from OEMs, we'll say that's a requirement, the same as Energy Star. We're starting to ask that already.

SC: We're asking OEMS to be focused on [the DOE 2017 standards]. But we're not mandating that their equipment right now has to meet the 2017 standards. OEMS are talking to us about it because they see both EPA and DOE rules and in their minds they're struggling with what solution option to take. They're not sure how to prioritize this and they're conferring with us on what to do.

AA: What do you anticipate will happen after 2017?

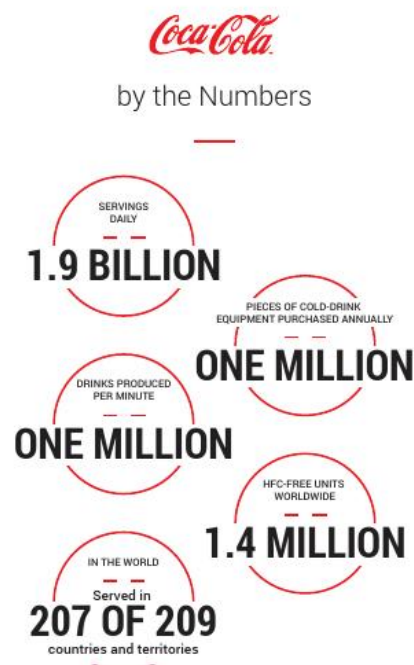
SC: By law the DOE has to reevaluate these standards every five years, and they want to do it every three years. So we anticipate there will be a discussion about this again in 2020 and 2022. There will continue to be a reduction in energy consumption in this space.

No matter which technology you talk about, there are commercial challenges with all of them. We think the industry's going to face some

challenges to achieve some of the changes that the regulatory agencies are striving for. For example, the commercial components for hydrocarbons are nowhere near as mature as they are for HFCs. And, of course, CO₂ is equally if not more challenged. We don't have a crystal ball to see what's going to happen, but everyone has these challenges.

AA: It gets tougher and tougher.

TA: That's the key. But it needs to be done in a way that's commercially viable.



What About Hydrocarbons?

AA: At the recent NAFEM Show in Anaheim, most of the talk was about hydrocarbons replacing HFCs. Do you think you're going against the grain with CO₂?

TA: It's no mystery that Coca-Cola was using hydrocarbons early on. But the more we learned about its capabilities and CO₂'s capabilities, we found CO₂ provides us a much better solution across the whole portfolio.

I wonder whether folks who are deciding to move to hydrocarbons are where we were in the journey 10 years ago. I fundamentally believe we made the right decision to go with CO₂, for many, many reasons. The decision continues to reinforce itself the more we learn and move forward. I don't waver from it in any way just because the industry is moving [towards hydrocarbons].

I've had some informal conversations with some of these folks and they're not really opinionated about one refrigerant over the other. What they're starting to feel, particularly in the U.S., is the pressure of the EPA's proposed rule [to delist high-GWP HFCs like R134a and R404A in certain applications]. And they find what's on the shelf and readily available is hydrocarbon equipment. Not all businesses have done the research and had the experience we've had over the last 15 years on this journey, which has led us to the decision to go with CO₂ as a better one-solution-fits-all for us.

SC: It seems to me that the movement on the part of many toward a hydrocarbon solution may show more than anything that CO₂ is not as easy to implement as a hydrocarbon. Hydrocarbons still use the vapor compression approach and it's still in the Rankine cycle that everybody knows backwards and forwards. So naturally it would be more comfortable to go in that direction. A lot of these same people are just not familiar with how CO₂ is done.

TA: CO₂ is maybe more technically challenging to develop and the supply chain is not as readily available. But otherwise I haven't heard an argument against it. It's the proper path vs. the easy path.

SC: There are costs for our OEMs associated with transitioning to any new refrigerant. They have to scale up, put production lines in place, put in charging stations, safety systems, technician training. There's a great deal of expense there. If it appears they're going in the direction of hydrocarbons, that's because it's easier to see what you need to do than it is with CO₂ or an HFO. So for those OEMs that we work with, we're partnering to address what needs to be done to achieve manufacturing capability for CO₂.

AA: What about the countries that have your hydrocarbon equipment?

TA: Some of the countries with hydrocarbon equipment were grandfathered in before we decided CO₂ is our refrigerant of choice. But they are expected to migrate to CO₂ in the future.

AA: How would you describe the challenge of maintaining CO₂ systems?

TA: We believe that CO₂ is going to be easier and safer to maintain in the field than hydrocarbons. It requires very few additional tools. The training is not unlike being trained to maintain R134a or hydrocarbons or anything else. You can do CO₂ maintenance on site; I don't think I would want to do hydrocarbon maintenance on site.

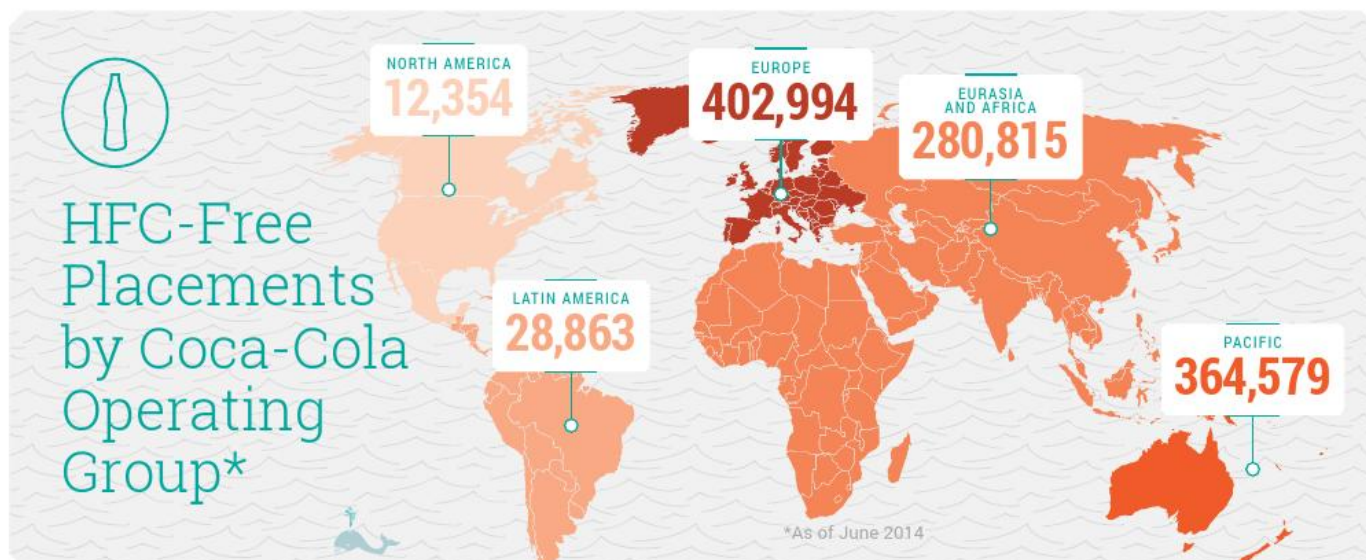
AA: What about HFOs? Will they be an option as well?

TA: I don't know. I don't think we would go down that road unless absolutely necessary. Ultimately you are going to have hydrocarbons and CO₂ technologies competing in the marketplace.

SC: When you look at the whole landscape of HFC-free on the commercial/industrial side, I think there's a lot of learning yet to happen. This is not just with CO₂, but with hydrocarbons and across the board, and that'll happen over the next five to 10 years. As our partners learn, they'll be making adjustments. Because of that, the future for CO₂ refrigeration is brighter than some might project right now.

AA: Will you have a big party in 2016?

TA: Maybe internally we do need to stop and take time to celebrate the successes on this journey. We have a lot of work yet to do so we need to stay focused. **MG + MC**



REFRIGERANTS, NATURALLY!: AN EXAMPLE TO THE WORLD

— By Michael Garry

One of the obstacles to progress in the adoption of environmentally friendly refrigeration technology is an apprehension about how it will work in the real world. Will it hurt businesses? Will consumers be inconvenienced?

To overcome that apprehension, business users of the technology need to step up and say, "We use this and it works just fine! In fact, it's better than our legacy system!"

That's the philosophy taken by Refrigerants, Naturally!, an 11-year-old global nonprofit initiative consisting of companies in the food and drink, foodservice and consumer goods sectors.

Currently comprised of The Coca-Cola Company, PepsiCo, Red Bull and Unilever, Refrigerants, Naturally! advocates the replacement of climate-warming hydrofluorocarbon (HFC) refrigerants by HFC-free natural refrigerants like carbon dioxide and hydrocarbons in new light-commercial refrigeration equipment (beverage coolers, vending machines, self-contained ice cream cases, etc). Greenpeace and the United Nations Environment Program (UNEP) are supporters of the initiative, whose secretariat is based in Königstein, Germany.

"We can be proud of what we've been doing," said Antoine Azar, Brussels-based chair of Refrigerants, Naturally!, and global program director for Coca-Cola. "Our voice has been heard many times and on many occasions. When we make presentations and the market sees that these guys are serious, I'm sure our influence is felt by the industry."

Greenpeace, he added, "takes our example to say [natural refrigerant technology] is possible – those companies are doing it."

As an advocacy group, Refrigerants, Naturally! tries to encourage the adoption of natural refrigerants by writing letters to governmental bodies like the European Union and the Environmental Protection Agency, sharing



technical best practices, and speaking at industry events such as UNEP conferences and shecco's ATMOSphere conferences. The group also supports the phasedown of HFCs by The Montreal Protocol, the body responsible for phasing down ozone-depleting refrigerants.

"The idea is that by working together we can do more than each [company] separately," said Azar. Indeed even companies as fiercely competitive as Coke and Pepsi have found common cause in Refrigerants, Naturally! "When industry and governments see four companies, competitors, working together, the message is very strong," he noted.

To alleviate any anti-trust concerns, the group makes a point of reading and adhering to the European Union's statement on competition law at its twice-annual meetings.

ENVIRONMENTAL IMPACT

The four members of Refrigerants, Naturally! practice what they preach. Collectively, they have deployed 3.7 million pieces of self-contained refrigeration equipment using natural refrigerants, thereby preventing the emissions of around 20 million tons of carbon dioxide equivalent, comparable to the annual emissions of more than four million passenger cars. Coke is the leader with 1.4 million units of CO₂ equipment; the rest use hydrocarbons (propane or isobutane), led by Unilever (1.5 million units), Red Bull (500,000) and PepsiCo (300,000).

With regulatory pressures coming from the EPA and the Department of Energy, Azar expects more

commercialization of HFC-free equipment to take place in North America.

The companies, which together purchase more than half of light commercial refrigeration equipment in the world, select the type of natural refrigerant most compatible with the size and function of their equipment; they set their own pace for the transition from HFCs, replacing legacy equipment at the end of its life with the HFC-free models. New members are welcome as long as they have a commitment to moving to HFC-free systems.

Other food and foodservice companies have been members of Refrigerants, Naturally! at various times since its formation in 2004, including McDonald's, Ikea and Carlsberg Group. "Companies don't leave because they don't believe in it," said Azar. "The main reason is resource issues – they prefer to put the effort elsewhere."

Azar is optimistic about the future of HFC-free refrigeration. "Technically speaking, there is no issue," he said. "All four companies have proved that CO₂ and hydrocarbons are efficient, and perform at least as well and usually better than HFCs." Among the keys will be the availability of components and refrigerants, which affects cost of implementation, and compliance with local safety codes **MG**



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'I'LL HAVE NATURAL REFRIGERANTS WITH THAT EQUIPMENT, PLEASE'

— By Michael Garry



Roy Buchert
Worldwide Energy Director
McDonald's

McDonald's is trying to bring its success with naturals in Europe to the U.S. by convincing franchisees of their merits and pushing for the creation of a service infrastructure

McDonald's got its start in the U.S. more than 60 years ago, but the American market has proved challenging to the fast-food giant when it comes to installing natural-refrigerant-based refrigeration equipment.

But natural refrigerants are clearly on McDonald's to-do menu, in the U.S. and elsewhere.

"We believe addressing this issue is the right thing to do and makes good business sense for the future," said Roy Buchert, the company's global energy director.

In its 2012-2013 Corporate Social Responsibility Report, McDonald's, the world's largest restaurant chain, stated that "we have committed to working with our equipment suppliers to develop and implement hydrofluorocarbon(HFC)-free refrigerant solutions, where possible, to help reduce impacts to climate change."

So far, most of the progress has taken place in Europe, helped by an accommodating regulatory environment and the existence of a service infrastructure. In 2003, McDonald's opened its first 100% natural-refrigerant restaurant in Vejle, Denmark, which uses a CO₂-based HVAC system, a CO₂/propane system for low- and medium-temperature storage, as well as hydrocarbon-based equipment in the kitchen.

Between 2010 and 2013, the company deployed 9,427 pieces of restaurant equipment using propane in European countries,



including 3,811 meat freezers, 2,802 frozen-fry dispensers, and 1,614 blended ice machines, according to the CSR Report.

In 2015, the number of HFC-free pieces of equipment at McDonald's European restaurants has grown (unofficially) to as high as 13,500 units using propane, isobutane or CO₂, out of an estimated 700,000 units worldwide.

But McDonald's is still at the fledgling stages in the U.S., with just a sprinkling of tests taking place, said Buchert. The company plans to convene a "natural refrigerants summit" for the foodservice industry, focusing on the challenges inherent in bringing natural-refrigerant equipment to the U.S. market, according to the CSR Report.

The biggest obstacle to deployment of natural-refrigerant systems at McDonald's more than 14,267 U.S. restaurants — almost 40% of its worldwide total, generating about one-third of its global revenues — is the lack of a service infrastructure able to maintain the equipment, said Buchert. "Until we get a good answer to that, the deployment [of natural-refrigerant equipment] in the U.S. will not likely be as significant as it could be."

McDonald's is looking towards its equipment suppliers to help establish a service infrastructure in the U.S., as well as manufacture more components and systems stateside, said Buchert.

He acknowledged that with the growing regulatory pressures on HFCs coming from the EPA, as well as the new energy efficiency standards for commercial refrigeration set by the Department of Energy for 2017, the market for natural refrigerant technology in the U.S. is likely to expand in the next few years.

What complicates the issue is that McDonald's, under the leadership of new CEO Steve Easterbrook, is trying to rebound from a tough stretch financially. Turning around the business remains a "higher priority," said Buchert. Still, he is intent on "continuing the momentum" around natural refrigerant deployment in the U.S. and elsewhere.

McDonald's regards natural refrigerants as the "final destination" in the evolution from HFC-based equipment. "There are a lot of other options starting to pop up in between, but they don't seem quite as good as natural refrigerants," Buchert said. "So why not set your sights on the final destination and head in that direction?"

WORKING WITH FRANCHISEES

Unlike other companies with large installations of light commercial refrigeration equipment like Coca-Cola and PepsiCo, McDonald's does not make equipment-buying decisions for about 80% of its restaurants; those are made by its franchisees, independent business owners who operate their own restaurants, albeit under the core standards established by McDonald's. It's up to McDonald's to persuade franchisees to invest in natural-refrigerant equipment.

"We have to do our best to create a solid, compelling business case to get adoption to go up," Buchert said. Franchisees are not likely to replace existing equipment, but may be open to natural-refrigerant options for new stores or when existing equipment is at the end of its life.

One way to encourage adoption is to point out that reach-in freezer and coolers using propane "get an energy benefit," he said. In some cases McDonald's has seen improvements of up to 30%, brought about by the refrigerant as well as other adjustments, such as better insulation.

McDonald's franchisees operate up to 22 pieces of refrigeration equipment in a restaurant – everything from small units like reach-in freezers or refrigerators, to medium-sized pieces like walk-ins, to large HVAC systems on the roof.

In terms of natural-refrigerant technology, the smaller equipment (under 150-gram charge) has migrated to propane, while medium-sized units may use either hydrocarbons or CO₂. The jury is out on what HVAC systems will employ, but McDonald's is intent on working with other industry players to move the technology in the direction of natural refrigerants, said Buchert.

McDonald's has established four criteria that natural-refrigerant equipment needs to meet: an existing service infrastructure; improved energy efficiency compared with legacy units; parity with conventional equipment on first costs and maintenance cost; and support from local regulations. If these criteria are met, "we are giving the independent owner a solid reason to choose [natural-refrigerant equipment]," said Buchert.

Any additional costs incurred by natural-refrigerant equipment would need to be recouped via a "reasonable ROI," said Buchert, adding that anything more than two years "won't be well received." **MG**



McDonald's Propane Refrigeration Equipment Deployed in Europe, 2010-2013



MEAT FREEZERS

3,811



ICE MACHINES

688



FROZEN FRY DISPENSERS

2,802



BLENDED ICE MACHINES

1,614



JUICE DISPENSERS

503



BEVERAGE SYSTEM CHILLERS

9

Source: McDonald's Corporate Social Responsibility Report, 2012-2013



Paige Dunn
CSR and Sustainability Project Head
Red Bull

RED BULL CHARGES TOWARD SUSTAINABLE COOLING

With more than a half-million hydrocarbon beverage merchandisers deployed globally, the energy-drink giant is finally making headway with installations in the U.S.

— By Elke Milner

Red Bull, producer of the best-selling energy drink in the world (more than five billion cans sold annually), is also well known as a sponsor of sporting events, owner of professional sports teams, and even as a record label.

Now the beverage maker is becoming known for its environmental leadership, particularly in the area of beverage refrigeration.

Acutely aware of its environmental responsibility, Red Bull strives to keep its carbon footprint as small as possible. From cutting almost 5.5 million miles of truck travel, to its 100% recyclable can, to its ultra-efficient can coolers, the company's sustainability efforts encompass the entire value chain.

But refrigeration gets special attention. Paige Dunn, CSR and sustainability project lead for Red Bull North America, told *Accelerate America*, that cooling is responsible for up to 20% of the company's carbon footprint.

To rein in its refrigeration impact, in 2008 Red Bull decided to deploy hydrocarbon ECO-Cooler beverage merchandisers. In 2011, the company joined the Refrigerants, Naturally! initiative, consisting of PepsiCo, Coca-Cola and Unilever, in taking action against climate change by using natural refrigerants in point-of-sale cooling and freezing units.

Red Bull's ECO-Coolers use environmentally friendly hydrocarbon refrigerant R600a (isobutane). The coolers use 45% less energy than conventional HFC refrigerators, and to maximize performance, they also employ LED lighting, energy-efficient fans, intelligent controllers and insulated glass. According to the company, seven ECO-Coolers consume only as much energy as a single 100-watt light bulb.

Red Bull's ordering guidelines now states that wherever feasible, from a legal and technical point of view, only ECO-Coolers will be installed in the future.

In 2013, more than 50% of Red Bull's entire fleet of cooling equipment used hydrocarbons, said Dunn, adding that last year, 65% of the coolers Red Bull purchased for North America used hydrocarbons, amounting to 59,948 coolers. Today, the company has more than 500,000 hydrocarbon ECO-Coolers functioning across the globe, according to Jürgen Brenneis, Red Bull's global purchasing manager.

"We are proud of this dramatic increase in percentage year after year and will aggressively pursue our goal of 100% hydrocarbon procurement," Dunn said.

Getting SNAP Approval

In Europe, the market for hydrocarbon refrigeration is highly developed, and in domestic and light commercial refrigeration, the market is saturated. Implementing the ECO-Coolers in Europe posed no real issues. North America, particularly the United States, on the other hand, has been a different story.

While hydrocarbons were approved under the Significant New Alternatives Policy (SNAP) Program in December 2011, R600a (Red Bull's refrigerant of choice) was not approved for commercial stand-alone coolers.

"The only reason it was not approved is because no one asked," said Dunn. "This is a problem for both the federal and private sectors."

So, Red Bull did the only thing left to do – it pushed for approval to use R600a in beverage coolers. The company submitted a request to the US Environmental Protection Agency (EPA).

"We reached out to the EPA's SNAP team and partnered with them to have R600a approved as a pilot program," Dunn said. "This was significant, as it immediately increased our hydrocarbon cooler fleet in the U.S. by 10%."

After a solid year of hard work, collaboration with system suppliers, continued discussions with the SNAP team, and, of course, more red tape, R600a was granted approval under the SNAP program in July 2013.

"R600a should have been approved as a valid substitute in the initial ruling, but due to stringent regulations and bureaucracy, we were delayed by one year," said Dunn. "Partnering with the SNAP program allowed for greater flexibility and we became the first company in the United States to have R600a-approved coolers for commercial use. This is something we are proud of. Now that the EPA has officially approved R600a, we look forward to the proliferation of this technology."

The U.S. isn't the only market that's tough to penetrate. At ATMOsphere Asia 2015, Brenneis explained that as of 2015, Red Bull had succeeded in placing natural-refrigerant-based coolers everywhere except Japan. According to Brenneis, of the 10,000 Red Bull cooler units in Japan, exactly zero of those use hydrocarbons. The major barriers in the Japanese market are finding components designed for small-sized hydrocarbon units and a lack of trained service partners.

But in the U.S., Red Bull has implemented ongoing training of cooler service technicians from six partner companies for the repair and proper disposal of hydrocarbon coolers.

In general, demand for hydrocarbon units in North America is increasing, as was evident at the AHR Expo and the NAFEM Show this year.

"We have found that this technology is the best solution for both us and for our accounts," said Dunn. "As early adopters of this technology, we have seen a significant decrease in energy usage. Less harm to the planet while increasing profit to our accounts' business is clearly a win/win. Our hope is that as our use of this technology grows, the overall light-commercial refrigeration market will convert with us. Hydrocarbon coolers are not the future; they are by far some of the most premium products on the market now." **EM**



Red Bull® by the Numbers

Annual global sales
(number of cans)

more than
5 BILLION

Number of ECO-Coolers purchased
for North America (2014)

59,948

Number of ECO-Coolers
deployed worldwide

More than
500,000

Energy saved by
ECO-Coolers

45%

— By Michael Garry

IS PROPANE A GOOD REFRIGERANT FOR SUPERMARKETS?

In a new test of self-contained frozen cases that use propane, Lowe's Markets is expecting better efficiency — and substantial longevity



By all accounts, hydrocarbon-based refrigeration systems are starting to make inroads in the U.S. foodservice and convenience store sector as an energy-efficient and low-GWP (global warming potential) answer to impending regulations.

But with their low charge limits (5.3 ounces, or 150 grams), hydrocarbon systems would appear to be a poor fit for supermarkets, which traditionally run large central systems containing hundreds of pounds of refrigerant.

But slowly, supermarkets are getting into the hydrocarbon game by testing condensing units that use small amounts of propane (R290) to chill or freeze individual refrigerated cases.

In perhaps the best-known example, H.E. Butt Grocery Company, a San Antonio-based chain of 369 stores, launched this concept at a new 83,000-square-foot store in Austin, Texas in July 2013. The majority of the 70 refrigerated cases at the store (medium- and low-temperature) are self-contained Hussmann units that use propane as a refrigerant, according to a case study published by the Climate and Clean Air Coalition. Each condensing unit used in the cases contains no more than 5.3 ounces of propane. All the cases are connected to a

water-chilled condenser (running on R134a), which serves up water in a loop to remove heat from the cases.

"We believe that an R290 system will achieve approximately a 50% energy reduction compared to our typical store refrigeration load," said Charlie Wernette, director of engineering for HEB, in a statement at the time of the store opening.

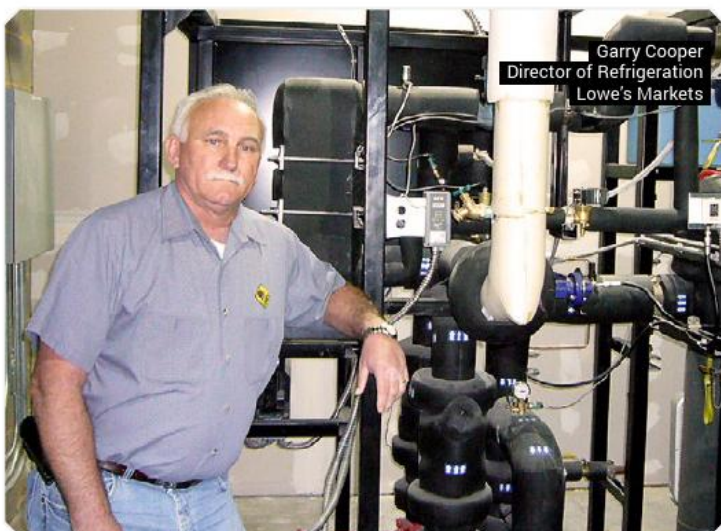
Since then, other food retailers such as Whole Foods Market and Fresh & Easy Neighborhood Market have conducted tests of propane refrigeration in self-contained cases. The most recent grocer to try its hand at this is Lowe's Markets, another Texas chain, with 146 stores, based in Littlefield, Texas.

In a remodeled 34,000-square-foot store located in Lubbock, Texas, Lowe's installed a lineup of frozen-food cases from Hussmann with 88 doors across them. Sitting atop the cases are condensing units of two types: one with 4.3 ounces of propane serving a two-door case, and one with 5.1 ounces handling

a three-door case. All together there are 35 condensing units containing a total of 170 ounces of propane.

Similar to the HEB setup, the cases are connected to a copper loop delivering water/glycol to remove heat; the fluid is then recirculated to the machine room where it is cooled via an R407F DX system, and sent back to the cases.

Hussmann approached Lowe's about doing the propane project, which piqued the curiosity of Lowe's director of refrigeration, Gary Cooper. "I'll try almost anything," he said in an interview with *Accelerate America*, noting a particular interest in hydronic loops. Cooper is considering a CO₂/ammonia test, as well as a second propane test. He has left open the possibility of expanding the propane test at the Lubbock store to medium-temperature cases, almost all of which are behind glass doors at the store.



Unlike HEB, which opted for a more comprehensive propane test, Cooper went with a "dedicated purpose" design focused on freezer cases "to narrow down the data required for specific analysis of the R290 performance versus other natural refrigerants," he said.

There's also an environmental motivation for Cooper. "What everybody's really looking for is the end game – zero GWP or close to it. Propane has a GWP of 3. He is more inclined to test propane as a natural refrigerant than carbon dioxide in a transcritical system, due to the warm temperatures present in his Southwest geography. He is also looking at employing an alternative to R407F in the machine room to further "knock down the GWP," but without boosting energy costs.

“We're environmentally conscious and good stewards of the environment.”

After less than six months of operation, Lowe's is still collecting data on the novel frozen-food system at the Lubbock store. "The main thing we've accomplished so far is we got an A3 (flammable) refrigerant inside a store," said Cooper, who learned about the system by visiting HEB's test store. "We're still tinkering with it." He's looking for about a year's worth of data.

To that end, Cooper is submetering the panel linked to all the condensing units as well as the pump station for the hydronic loop and the suction group that chills the water/glycol in the machine room. He expects that overall the cases will "meet or exceed" 10% to 15% in energy reduction, compared with a low-temperature DX system.

There are, however, some caveats. Since the condensing units are sealed systems, Lowe's only has access to temperatures and amperage information. "It really tests your ability to analyze

data and draw conclusions," Cooper said. "But it's a great to be working with cutting-edge technology and the support I've received from both Hussmann and my management has been fantastic. It's an intriguing blend of basic refrigeration with advanced controls and environmentally friendly refrigerants."

In addition, the pump station for the hydronic loop varies in power consumption, based on the number of condensing units running at a particular moment, which depends on the shopping activity and the electric defrost cycle (once per night), among other factors. "We have redundant pumps but we have found only one to be required," he noted.

He admits Lowe's is still learning more about the system as an end user. "A little tweaking could reduce the LCCP (life cycle climate performance) by a lot."

LOOKING FOR LONGEVITY

In terms of first costs, Cooper acknowledges that the low-temperature cases came with "a little bit of a premium" – about 6% to 7% – compared with standard DX system. He expects the cost of the propane fixtures to come down over time with growing demand. In the hydronic loop, Lowe's could have saved \$7,000 by using lighter-weight copper tubing.

He hopes to get 14 to 16 years out of the compressors in the condensing units. "If we can keep the discharge temperatures down, why can't this be like a home refrigerator where you buy one, plug it in and it runs for 10 or 15 years?" he said. "The store cabinets take more wear and tear [than a home unit] but for the refrigeration itself that's an obtainable goal."

Every Wednesday, Cooper measures all relevant temperatures in the fixtures, and puts these results in a database. He has been able to drop the discharge temperature in the condensing unit about 25%, which should also help improve energy efficiency and increase longevity, he said.

Energy is important, but longevity is "where we're really going to save," he said.

Installation is fairly straightforward – the cases are powered by single-point connections. The only additional work is connecting the heat-rejection hydronic loop. Cooper followed his engineer's recommendation to install a flow-regulator valve at each fixture, but he also put one at the end of the three branches of the hydronic loop, with each branch serving seven condensing units. He is still comparing the "as designed" configuration with his own design to determine whether he can follow the later, which would substantially decrease the number of required valves. The hydronic loop also needed some adjustment to maximize effective heat transfer at the condensing units.

Refrigerant-grade propane is not cheap – up to \$87 per pound – but given the minute quantities used, Lowe's 30-pound container should "last a while," Cooper said.

continued on p.34

→ There turns out to be a merchandising benefit in the propane cases that helps offset costs, Cooper noted. Unlike many frozen-food fixtures in a DX operation, in the test store there is never any frost build-up on products, regardless of their shape or size. "That's a problem that plagues everybody – especially with smaller pints," he said.

SIMPLE MAINTENANCE

Lowe's Markets uses its own in-house technicians as well as outside contractors. Because the Lubbock store is located near the Lowe's warehouse where he is based, Cooper checks in on the store frequently.

Maintenance is much simpler with the propane cases than with a conventional DX refrigeration system. "Even though the refrigerant's a little exotic, the system itself is just about as simple as you can get," he said. "It's a different animal. There are no gauges or expansion valves. You take temperatures at various parts and draw conclusions. If it breaks, there are only a couple of things it could be."

On the whole, he added, "If the compressor is running and it's the right charge, it'll work."

Training primarily involved showing technicians how to charge the condensing units with a flammable refrigerant and weld it shut. "I thought that would be interesting, but it's not that big a deal," Cooper said.

There is not enough propane in each condensing unit to become flammable in the store, but if the refrigerant leaks inside the cabinet itself that could pose a hazard. As a result, each evaporator has a propane detector. A fire alarm panel indicates which fixture has sprung a leak. "Fire marshals want you to be as specific as possible," he said.

Cooper is confident that the propane-cooled cases are safe for the public and employees. For one thing, the system passed muster with the local fire marshal, who was impressed by its low charge and safety features. "Out of all the people I was worried about, it was them," said Cooper. "But the fire marshal said, 'You've got to be kidding me – you're doing this whole thing with 170 ounces of refrigerant?'"

Lowes hasn't publicized that it's using propane refrigerant in the Lubbock store to its customers, but he doesn't think doing so would engender any negative pushback. "Most grocery stores carry Coleman grill refills that each have 16 ounces of propane," he pointed out. He would like to share what the store is doing with the public to show that "we're environmentally conscious and good stewards of the environment."

With the growing interest in energy-efficient, low-GWP self-contained cases, a propane lineup like Lowe's stands a good chance of catching on, said Cooper. "From what I've seen, it's definitely a viable alternative. Not sure if in fact we've arrived at the end game, but no doubt it warrants more trials. As usual time will tell." **MG**

Lowe's Market store in Lubbock, Texas has a lineup of frozen cases with the following refrigeration setup:



- » Two-door condensing units (4.3 ounces of propane) and three-door condensing units (5.1 ounces of propane)
- » Total number of condensing units: 35
- » Total number of freezer doors: 88
- » Total propane charge: 170 ounces
- » Capacity: 250,000 BTUs of total heat rejection
- » Case supplier: Hussmann
- » Compressor supplier: Embraco
- » Hydronic loop containing water (35%)/glycol mix
- » Machine room DX R407F rack supporting hydronic loop, meat prep and medium-temperature cases.
- » ECM Fan Motors in cases
- » Propane detectors in each evaporator
- » Flat-plate heat exchangers at each condensing unit and in the machine room
- » Additional DX R407F rack in machine room serving freezer walk-ins and medium-temperature walk-ins.



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PREPARING FOR THE INEVITABLE

Emerson's Rajan Rajendran readies the industry for a brave new world of regulations from the EPA and DOE

— By James Ranson




EMERSON
Climate Technologies



At Emerson Climate Technologies' E360 Forum last month in Anaheim, the company's executives did their best to prepare equipment manufacturers, as well as end users and contractors, for two impending U.S. regulations certain to have a dramatic impact on their businesses.

One of those regulations is set to start in 2017 – the Department of Energy's energy-level reductions that apply to a variety of refrigeration equipment. The other may begin as soon as next year, but is more likely to be postponed – the Environmental Protection Agency's proposed delisting, under its SNAP (Significant New Alternatives Policy) program, of several high global warming potential (GWP) refrigerants across several types of equipment. The EPA is expected to issue a final ruling on the proposal this year – as early as April but probably not later than the end of summer.

Rajan Rajendran, Emerson's vice president, innovation center and sustainability, used his platform at the E360 Forum to review the two new regulations and put them in perspective as the cost of doing business over the next several years.

"The EPA authority is more limited than the [European Union's] authority in terms of banning refrigerants, but importantly, they do have the authority to approve certain refrigerants as alternatives and specifically for applications," Rajendran said. "If you're using a particular refrigerant in a certain application you can do

that only if the EPA allows you to do that and that is through their SNAP program."

Directly in the firing line of the delisting proposal are R404A/507A and R134a. Under the proposal, neither R404A/507A would be permitted in retail food refrigeration, condensing units, stand-alone self-contained units or vending machines. In addition, R134a, along with R407A/R4047F, would be delisted for use in self-contained units as well as in vending machines.

In his presentation, Rajendran said the proposal, if approved, would have significant implications for manufacturers and end users in the U.S., particularly those still utilizing R404A and R134a. "Pretty much everything we use is included," he said.

"R404A is the worst offender that we have right now and unfortunately we are still using it in huge amounts," he noted. "So if you're sitting with R404A or R134a, then life is going to change. It is already happening in Europe and there is a very high likelihood that it is going to change for us in the U.S. once the summer has come."

The EPA's delisting proposal has elicited a strong response from the refrigeration industry. Its Notice of Public Rulemaking (NPR) for the proposal, issued last August 6, drew over 8,000 comments. Many respondents submitted comments requesting delays and exemptions from delistings.

Last October, Emerson submitted a response to the EPA delisting proposal that asked for the delisting of R404A/507A to be delayed six years in condensing units and stand-alone self-contained refrigeration equipment (factory-charged sealed systems). Emerson also requested that R407A, R407F and R134a not be delisted for stand-alone units.

Among Rajendran's and Emerson's other concerns are the EPA's seemingly systematic approach to eliminating refrigerants from certain applications. "The EPA is going application by application and if a lower-GWP refrigerant is commercially available then they are going to take out the higher-GWP refrigerants," he said.

But the EPA proposal can overly simplify this process, he noted. "For example, some people believe all freezers are the same, and it should be just one refrigerant. That's not true. All these applications have different temperature ranges and refrigerant requirements and work differently.

"It's true that we have to keep pushing technology; we have to keep developing and innovating, but in the end we cannot forget that whatever we do has to make sense in terms of

return on investment."

Still, the mounting regulatory pressure and restrictions on the use of synthetic refrigerants may be good news for natural refrigerants in the U.S., in particular CO₂ and hydrocarbons.

"There are people, especially in the supermarket arena, that are very seriously going after CO₂," Rajendran said. "CO₂ is a very viable refrigerant for a lot of applications, definitely supermarkets and definitely in cooler climates.

"It's even better in some of these cascade systems because CO₂, when you start lowering the condensing temperature, starts to look better and better. When you go below 50° F condensing, CO₂ is as good as R404A in terms of efficiency."

He also referred to propane (R290) as another emerging refrigerant. "Up to 150 grams is allowed in self-contained units, and we are going to see a lot of that," he said.

EPA's Proposed Rule on Delisting HFCs by Application

Refrigerant	Supermarket*	Condensing units (field charged)*	Commercial Refrig. Equipment Stand-alone self-contained*	Vending machines*
R404A/507A	Jan-16	Jan-16	Jan-16	Jan-16
HFC-227ea, R-407B, R-421B, R422A, R-422C, R422D, R-428A, R-434A	Jan-16	Jan-16	Jan-16	
R407A/R407F			Jan-16 (new)	
R134a			Jan-16 (new)	Jan-16 (new)
Various Blends GWP (600-3,990)			Jan-16 (new)	

* New and retrofit only; service is allowed. Source: Emerson Climate Technologies

Here to Stay

While the EPA looks to delist refrigerants in certain applications, the DOE's energy regulations aim to improve the overall energy efficiency of self-contained units, ice makers, display cases (including remote) and walk-ins.

Using varying deadlines and different base levels, the DOE's regulations state that self-contained units must reduce energy consumption by 30%-50% kWh/day, ice makers by 5%-15%, display cases by 30%-50% and walk-ins by 20%-40%.

The levels were amended from 12%-25% for ice makers following notice of data availability in

September 2014, while the industry continues to challenge the DOE's rules in regards to self-contained units, walk-ins and display cases.

Rajendran's view is that EPA and DOE regulations will only become more stringent and that the industry will slowly start to focus more on applied efficiency – energy efficiency of the end user's entire facility – rather than just the system.

"The efficiency regulations, we all know that they are here to stay and we all know that they are going to get higher and higher and higher," he said. "Are we better off pushing the efficiency to

higher and higher levels or are we better off going after the actual applied efficiency of everything? [Emerson's] answer is 'let's go after that applied efficiency.'

"All of these energy efficiency regulations over the course of the next several years are going to drift from an equipment focus to a building focus. They are going to look at an entire supermarket and say 'What is the efficiency of this whole supermarket?' and 'What is the efficiency of this restaurant?'" he said. [JR](#)

DOE's Refrigeration Energy Regulations

Product classification	Current	NOPR	Final	Effective	Energy level reduction
Closed-door reach-ins (self-contained)	2010	Oct-13	Mar-14	Mar-17	kWh/day 30%-50%
Ice makers	2010	Mar-14 (NODA September 2014)	Dec-14	Jan-18	kWh/100 lbs 12%-15% kWh/100 lbs 5%-15% (amended Sept. 9, 2014)
Display cases	2012	Oct-13	Mar-14	Mar-17	kWh/day 30%-50%
Walk-in (foodservice)	2009	Sep-13	June 2014	Jun-17	AWEF 20%-40%

Source: Emerson Climate Technologies



EPA APPROVES MORE USES OF HYDROCARBON REFRIGERANTS

Expanding on 2011 ruling, agency allows R290, R600a, R441A and R170 to be used in commercial and domestic applications

— By James Ranson

The U.S. Environmental Protection Agency has approved four hydrocarbon refrigerants for use in six refrigeration and air conditioning applications under its Significant New Alternatives Policy (SNAP) Program, expanding on an earlier ruling and paving the way for wider adoption of hydrocarbon refrigeration in the U.S.

The final ruling, announced February 27, largely follows the EPA's original proposal made in June 2014, which listed the four refrigerants – propane (R290), isobutane (R600a), hydrocarbon blend R441A and ethane (R170) – as acceptable under the following conditions:

- Propane in household refrigerators, freezers, or combination refrigerators and freezers, in vending machines, and in room air conditioning units.
- Isobutane in retail food refrigeration (stand-alone commercial refrigerators and freezers) and in vending machines.
- The hydrocarbon blend R441A in retail food refrigeration (stand-alone commercial refrigerators and freezers), in vending machines and in room air-conditioning units.
- Ethane in very low temperature refrigeration and in non-mechanical heat transfer.

The final ruling contains only one change from the June 2014 proposal - regarding the charge limits for portable AC units, which the EPA modified to be consistent with the requirements of UL 484.

In addition, the latest action exempts the four hydrocarbon refrigerants from the Clean Air Act's prohibition on venting, release or disposal for the specific end-uses, on the basis of evidence that they do not pose a threat to the environment.

With the EPA expected to delist certain high-GWP (global warming potential) HFCs, including R134a, in specific applications, EPA Administrator Gina McCarthy said the final hydrocarbons rule would present component makers, OEMs and end users in the U.S. with further opportunities to innovate with low-GWP technology.

"Today's rule is an example of how we can turn the challenge of climate change into an opportunity to innovate our way to a better future," McCarthy said. "By working together, businesses and EPA are bringing new, climate-friendly refrigerants to market that better protect our health and the environment."

The EPA's SNAP program first approved of propane, isobutane and R441A in a December 2011 final ruling. At that time, isobutane and R441A were permitted for use only in domestic refrigeration, while propane was allowed only in retail food refrigeration. In the new ruling, domestic refrigeration's regulations have been expanded to include propane, retail food's to include isobutane and R441A, and for the first time room air-conditioning can use propane and R441A. All three refrigerants can be employed in vending machines for the first time in the new ruling.



Gina McCarthy
Administrator for the U.S.
Environmental
Protection Agency

“By working together, businesses and EPA are bringing new, climate-friendly refrigerants to market that better protect our health and the environment.”

SHIFT IN PERCEPTION

The new ruling represents the continued shift in perception towards hydrocarbons in the U.S. since the EPA's first approval of R290, R600a and R441A in retail and domestic refrigeration in 2011.

Prior to 2011, hydrocarbons were only allowed in industrial process refrigeration – an application where there is limited public access – due to entrenched service and safety concerns, especially about flammability.

In addition, in the 2011 round of hydrocarbon approvals, the venting prohibition wasn't lifted until two-and-a-half years later. By contrast, the latest SNAP approval incorporated the immediate lifting of the venting prohibition.

Despite the new opportunities for hydrocarbons in the U.S., the charge sizes allowed under Underwriters Laboratories (UL) standards limit the use of hydrocarbons largely to smaller equipment. This is perceived as a major barrier to rolling out these solutions on a broader scale. For commercial refrigeration, the charge limitation is 150 grams, for domestic refrigeration, 56 grams.

However, despite the disparity in charge sizes, there is growing interest in the U.S. service industry to carry hydrocarbon refrigerants, particularly propane, in light of the inevitable delisting of R134a.

Moreover, at the recent NAFEM Show and AHR Expo in the U.S., equipment manufacturers True, Fogel, Tecumseh, Danfoss and Carel unveiled hydrocarbons solutions for commercial refrigeration and the foodservice industry – further evidence of the growing desire to replace R404A and R134a models with environmentally friendly, energy-efficient hydrocarbon equipment **JR**



CO₂ can be used in transport, too

Further supporting the use of carbon dioxide as a refrigerant in commercial applications, the U.S. Environmental Protection Agency has endorsed the use of carbon dioxide as a refrigerant in new transport refrigeration equipment, without conditions.

The notice, issued last October, came in response to a petition by Carrier, a major provider of HVAC&R solutions, to allow CO₂ in refrigeration equipment used in transportation. The ruling followed an assessment of health and environmental risks.

Carrier expects to commercialize a CO₂-based road transport refrigeration system by 2020. At the 2014 International Motor Show, Carrier unveiled a prototype of a trailer unit that uses CO₂ in a closed-loop system.

In September 2014, Carrier lent its support to the creation of the Global Food Cold Chain Council at the United Nations Climate Summit, where it announced plans to pursue the development of CO₂-based systems across its cold chain offering.



SHORT TAKES

— By James Ranson



US and India Make Progress on HFCs



India has been one of the last obstacles to an amendment, supported by the U.S. among many other nations, to use the expertise of the Montreal Protocol to phase down the production hydrofluorocarbons (HFCs).

But in January President Barack Obama and Indian Prime Minister Narendra Modi agreed to open up negotiations on the HFC amendment ahead of the next United Nations Climate Change Conference in Paris in December.

Despite the lack of clear climate change commitments in the India-US announcement, India's shifting stance was the most significant outcome of the meeting.

The US-India joint statement read: "The President and Prime Minister reaffirmed their prior understanding from September 2014 concerning the phase down of HFCs and agreed to cooperate on making concrete progress in the Montreal Protocol this year."

Both countries recognize the need to utilize the institutions and expertise of the Montreal Protocol and have agreed to hold bilateral meetings to discuss issues related to safety, cost and commercial access to alternative technologies to HFCs. Integral to this will be the role the US plays in assisting India to revert to efficient, low-carbon air conditioning for its hot climate.

To date, India and China have been the major economies blocking genuine progress in discussions on HFCs. In a November 2014 bilateral meeting, Chinese President Xi Jinping and President Obama agreed to discuss the management of HFCs, but China has yet to make any firm commitments **JR**

Colombian Port to Use Ammonia-Based Warehouse

A major domestic and international port in Santa Marta, Colombia, will be home to the country's first ammonia-based cold storage facility.

The 108,000-square-foot warehouse will be equipped with a state-of-the-art ammonia refrigeration system, which the port acquired, by public tender, in January.

The cold-storage facility's main features include a refrigeration area and cooling tunnels at -37°C, a temperature range from -33°C to +10°C, storage capacity of 8,615 pallets, 19 docks with hermetic seal, and eight exchangeable modules for the cooler/freezer.

The port and distribution center, which operates 24/7, 365 days a year, stores frozen products and provides logistics support.

The system, which is located at the Corpus Christi, Texas, port, will be transported to Santa Marta in the coming months and installed **JR**

UNFI Installs CO₂ Refrigeration in Warehouse



United Natural Foods Inc. (UNFI), a major distributor of natural, organic and specialty foods in the U.S. and Canada, has revamped its 500,000-square-foot distribution center in Montgomery, N.Y., with carbon dioxide refrigeration systems for coolers and freezers.

Completed last October, the Montgomery facility is the company's second largest in the East Region and reinforces the environmental stance taken at its 590,000-square-foot distribution center in Lancaster, Texas, which is equipped with an ammonia-based refrigeration system.

The Montgomery warehouse's sustainable design has led to a 26% reduction in energy use and a 45% drop in water consumption compared to a comparable building, and is expected to be acknowledged with LEED (Leadership in Energy and Environmental Design) Gold certification.

UNFI is also leading on the recycling front with 75% of the Montgomery distribution center's construction waste diverted from landfill, and building materials that contain 30% recycled content.

Meanwhile, a 655 kilowatt rooftop solar array at the Lancaster facility is already generating more than 1 kilowatt of clean energy annually.

UNFI services conventional supermarket chains, natural product superstores, independent retail operators and the foodservice channel **JR**

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the podcast now*

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Components for CO₂, hydrocarbon and ammonia systems abound at convention as the market responds to impending regulations

— By Michael Garry

In late January, while the wintry winds off Lake Michigan buffeted Chicago's McCormick Place convention center, inside at the 2015 AHR Expo the winds of change were ushering in a growing number of natural-refrigerant products.

The Expo, co-sponsored by ASHRAE and AHRI, dubs itself "the world's largest HVACR marketplace," with more than 2,000 exhibitors. Among those were at least 80 companies — far more than a year ago — showcasing products or services that incorporate natural refrigerants like carbon dioxide, hydrocarbons or ammonia.

Over three days, *Accelerate America* crisscrossed the exhibit halls of McCormick Place to visit many of those companies and report on the new and compelling components on display. The following account breaks down our reporting into CO₂, hydrocarbon- and ammonia-related developments. (For more details on products showcased at the AHR Expo, visit shecco's online platforms R744.com, hydrocarbons21.com and ammonia21.com.)



CO₂ IN WARMER CLIMES

CO₂ products



Alfa Laval
Brazed-plate heat exchanger



Danfoss
Controller



Conex Banninger
Tubing



Sporlan
Gas cooler/flash
gas bypass valves



Agrankow
Charging station



Westermeyer
Receiver, accumulator,
oil separator, oil reservoir

With the Environmental Protection Agency possibly delisting some HFCs in 2016, stricter Department of Energy efficiency requirements looming in 2017, and the Montreal Protocol inching closer to phasing down HFC production, more end users in the U.S. are seriously looking at transitioning from HFC refrigerants to “future-proof” natural fluids like CO₂.

The interest from end-users is drawing the attention of refrigeration system OEMs and driving the development of the CO₂-ready components observed at the AHR Expo.

So far, much of the adoption of CO₂ refrigeration in North America has been at supermarkets. Thus it was no surprise that a good bit of natural-refrigerant technology at the AHR Expo related to systems

used by grocers. But we also saw CO₂ components for smaller-footprint outlets like convenience stores as well as for beverage coolers, stand-alone food cases and heat pumps.

Many U.S. operators have been reluctant to use CO₂-only transcritical systems in southern locations because of concerns about the efficiency of these systems in warmer climates. Some of the technology featured at the AHR Expo was designed to address that issue.

For example, Baltimore Aircoil's TrilliumSeries condenser for transcritical CO₂ applications uses an adiabatic design to “eliminate restrictions due to warmer climates,” according to the company.

Also on display was an adiabatic cooling system from Guntner, which works as gas cooler or condenser in a CO₂ transcritical system in warmer climates.

Guntner's CO₂ cooling systems are used in European supermarkets and are beginning to be employed in North American stores as well, said Glenn Comisac, vice president, industrial cooling business, Guntner U.S. He believes CO₂ systems have a future in the U.S. “Other companies [at the AHR Expo] are playing up the CO₂ angle. It's a coming trend and we want to be a part of it.”

Another company that is stretching the geography for CO₂-only refrigeration is component maker Danfoss. “We have transcritical systems [in a lab and a supermarket] as far south as

CO₂ Tips and Caveats

In a presentation at the AHR Expo, Jae Chon, OEM key accounts manager for Danfoss, provided some advice on how to run a CO₂-only transcritical refrigeration system for supermarkets:

- » A transcritical CO₂ system should run subcritically more than 90% of the time.
- » In the receiver, which separates the CO₂ vapor and liquid, maintain constant pressure and pressure “so you have quality liquid CO₂ for [the cases].”
- » Use solenoid valves to manage oil flow into and out of the compressor.
- » Whenever possible, [recover] heat to gain efficiency. The more heat removed, the more energy saved.
- » Mount a leak detector near the floor since CO₂ is denser than air. In a closed area it will displace oxygen and create a risk of suffocation.
- » An adaptive defrost mechanism can reduce the frequency of defrost and save a considerable amount of energy.

CO₂ for C-Stores

In North America, supermarkets have been the primary outlet for CO₂ transcritical refrigeration, but now component makers and OEMs are turning their attention to smaller outlets like convenience stores (a hotbed for natural refrigerants in Japan).

C-stores have resisted transcritical systems due to their higher cost, noted Andre Patenaude, director, CO₂ business development for Emerson Climate Technologies. Still, at the AHR Expo several companies offered products earmarked for small retail formats:

For example, Danfoss announced a CO₂ transcritical controller, the AK-PC 772, designed for smaller formats. The all-in-one unit oversees compressors, gas cooler, oil, receiver, electronic expansion valves and heat reclaim.

"Danfoss is trying to reduce the complexity of CO₂, which is already a complex concept to begin with," said Jae Chon, OEM key accounts manager for Danfoss.

Carel introduced its pRack pR300T controller, which uses a single electronic board to fully manage a self-contained transcritical system suited for convenience store applications. Moreover, the controller includes a third-suction-line control for a parallel compressor, which can improve a transcritical system's efficiency in warmer climates.

Atlanta using adiabatic coolers and operating very efficiently," said Jae Chon, OEM key accounts manager for Danfoss, in a presentation at the Danfoss booth. The company is also helping to develop ejector technology and parallel compressors that will also enable transcritical systems to function efficiently in warmer climates.

Transcritical CO₂ systems are also notorious for the high pressures under which they operate, especially in the summer, when a compressor's discharge pressure can surge up to 1,700 PSI (117 bar). These pressures call for more robust components and sophisticated controls than would be found in conventional refrigeration equipment.

The more advanced componentry tends to boost the upfront cost of transcritical systems. However, there are countervailing cost

factors, such as the low price of CO₂ and energy savings possible via heat reclaim and adaptive defrost, noted Chon.

As a result, "We're starting to see significant volume and interest in projects in North America," he said. "We're constantly training contractors, OEMs and retailers and the competency is growing. So the cost of service is coming down and [transcritical CO₂] will be at some point, we believe, a sustainable technology and a more mainstream technology."

There were many examples of high-pressure components at the AHR Expo. For example, copper-alloy tubing from Wieland (displayed at the Conex Banninger booth), consists of 2% iron, which allows it to handle pressures up to 1,740 PSI, said Andreas Hinkler, Conex Banninger's group OEM sales director.

"We are talking to OEMs and gave samples to companies here," added Hinkler. "We think the market in the U.S. is really big and will increase in the next years."

The Sporlan Division of Parker Hannifin Corporation showcased a new range of valves for gas coolers and flash gas bypass that are rated 140 bar (2,031 PSI) for transcritical systems.

Gordon Coates, engineering supervisor, new products, for Parker Hannifin, expects more demand for transcritical CO₂ refrigeration systems in the U.S. as manufacturers make them work more efficiently in warmer climates. But adoption of the systems will need to be accompanied by "a steep learning curve for contractors," he said.

REGS PUSHING HYDROCARBONS

Hydrocarbon products



Galileo Charging station



Tecumseh R290 Compressor



Embraco R290 Compressor

At the AHR Expo, the prospect of stiffer regulations is making hydrocarbon alternatives like propane a "necessity" this year, said Michael Carman, national sales manager, refrigeration controls, Carel.

"The EPA sees it as a necessity because they are trying to get rid of all synthetic refrigerants in self-contained cabinets," he said. "And the DOE is driving the efficiency requirement."

In 2011, The EPA added three hydrocarbons – propane (R290),

isobutane (R600a), and R441A – as acceptable alternatives in household and small commercial refrigerators and freezers through its Significant New Alternatives Policy (SNAP) program.

Carel displayed a new controller that Carman said takes care of regulatory concerns: the Ir33+ Wide for Embraco Fullmotion compressors, a variable-speed compressor employing propane. The variable-speed technology combined with the controller generates energy savings of up to 40%.

This technology is designed for plug-in islands and units, catering and professional equipment, ice cream coolers, small cold rooms, and wine coolers.

John Prall, technical support, North America Region, Embraco, agreed

with Carman that the EPA and DOE regulatory announcements have led to "significant interest in propane systems since last year."

Among its propane products, Embraco announced the Plug n' Cool. The sealed unit includes

an evaporator, a water-cooled condenser and a compressor, pre-charged with R290. It is mounted on top of a cooler or freezer.

LOWERING AMMONIA CHARGE

Ammonia products



Ammonia technology was also well represented at the AHR Expo, with some companies displaying low-charge components and emphasizing the increased safety of those units.

For example, compressor maker Bitzer displayed an open-drive screw compressor, model OSKA7472, designed for low-charge —100 pounds or less — ammonia air-conditioning systems.

"There's a trend in the industry toward minimizing the charge of ammonia in systems for air-conditioning applications," which improves safety, said David Sylves, Bitzer's director of inside sales and marketing.

Three to four OEMs are in the "validation phase" of design and testing of ammonia air-conditioning

systems incorporating the Bitzer compressor, said Sylves, adding that a food manufacturer has installed one such system to cool offices in its warehouse.

At its AHR Expo booth, Colmac Coil promoted a two-year-old ammonia (NH₃) evaporator that is being used in public warehouses in the U.S. and Australia. The evaporator supports a DX (direct exchange) refrigeration system that can operate under 10 degrees F — temperatures that would otherwise require a recirculated ammonia system, said Kent Perkins, engineering manager for Colmac.

Moreover, he added, the DX system holds a "minimal charge" (six pounds per ton of refrigeration vs. 25 pounds for a pumped bottom feed system),

The lower charge results in greater safety and the avoidance of U.S. government restrictions on the allowable quantity of ammonia (10,000 pounds). "If you're approaching the limit, you could go to this," said Perkins. The cost of the evaporator is comparable to that of existing evaporators, he noted, adding that DX systems are more energy efficient than recirculated systems because all of the ammonia liquid in DX is converted to gas. **MG**

Saving Energy with Hydrocarbons

The Department of Energy's efficiency targets for 2017 will have a marked impact on refrigeration cases used in food retail, observed John Prall, technical support CCS/D&AM, North America Region, Embraco, in a presentation at the AHR Expo.

For example, he said, upright glass door freezers will need to consume 57% less energy than 2010 levels; ice cream freezers, 53% less; and bottle coolers, 48% less. "Equipment is going to have to be redesigned to meet these requirements."

Embraco has found that energy efficiencies can be achieved by converting from an R404A to an R290 (propane) compressor. For example, an ice cream freezer with a R290 compressor, keeping the same condenser and evaporator, yields a 16% energy reduction.

Making the same compressor change with a medium-temp glass-door merchandiser, while inserting LED lighting and ECM motors, cuts energy consumption by 32%.

Finally, a vertical freezer, with updated lighting and fan motors plus a propane compressor, gets a 43% reduction in energy -- close to DOE's requirement.



NAFEM'S COMING OUT PARTY FOR HYDROCARBONS

With new regulations looming, equipment suppliers were out in force with hydrocarbon refrigeration equipment

— By Michael Garry

The 2015 NAFEM (North American Association of Food Equipment Manufacturers) Show, held at the Anaheim (Calif.) Convention Center last month, could fairly be described as “a coming out party” for natural refrigerants in the foodservice sector, particularly hydrocarbons.

With the Department of Energy’s 2017 energy requirements a done deal, and the Environmental Protection Agency’s ruling on delisted HFCs (such as R134a) expected this summer, component makers, OEMs and end users in the U.S. can no longer get around the need for energy-efficient, low-GWP technology incorporating natural refrigerants. That message could be heard up and down the four exhibit halls at the NAFEM Show, which featured 543 exhibitors and more than 18,500 attendees.

The day before the NAFEM Show, at Emerson Climate Technologies’ E360 Forum conference down the road in Anaheim, the buzz was all about the impending DOE and EPA regulations. “It’s quite a tsunami,” said Allen Wicher, director of marketing for the company. The DOE changes, in particular, “aren’t an option; this is what you have to contend with to continue doing business,” he said. And even though it seems unlikely that the EPA will delist HFC refrigerants as soon as 2016 – as it originally proposed – it’s incumbent on end users and suppliers to begin testing new equipment “to see where you are,” said Wicher.

Much of that equipment is starting to feature hydrocarbons. The U.S. marketplace’s attitude toward hydrocarbons has done a “total about face” in the past two to three years, going from “taboo to the only choice,”



Anaheim Convention Center
Anaheim, California

observed said Julian Attree, CEO of Minus Forty, at his NAFEM Show booth. He would prefer a longer period of adoption for hydrocarbon units in the U.S. – more in line with European phasedown plans – that would allow repair technicians to gain more expertise.

There are other challenges facing manufacturers and end users as they transition to natural-refrigerant foodservice equipment. The charge limit set for hydrocarbons in the U.S. – 150 grams for commercial equipment and 56 grams for residential – limits the size of the equipment that can be used. And given the flammability of hydrocarbons, end users will need to deal with building and fire code restrictions – as well as lingering safety concerns among consumers.

But none of these issues stopped several manufacturers from making a splash with hydrocarbon equipment at the NAFEM Show.

TRUE'S HYDROCARBON BOOTH

Throughout its booth at the NAFEM Show, True Manufacturing made its transition to propane refrigeration in the U.S. abundantly clear with signs on everything from panels to water bottles that read, "Hydrocarbon Refrigerant: The Future, Now."

"This year it's all about awareness," said Todd Washburn, True's beverage division director. "It's our coming out party for hydrocarbons in the U.S."

True, which has marketed propane cooling equipment for years in Europe, makes more than 900 refrigeration models, of which less than half have been designed for R290 use in the US (115 volts/60 hertz). "We feel we can do our entire product line with R290," said Washburn. He acknowledged there's a "slight premium" for the hydrocarbon equipment.

But the premium can be recouped via energy savings. At the NAFEM Show, the company displayed a lineup of glass-door merchandisers, and solid-door refrigerators for restaurant kitchens, accompanied by charts showing the greater efficiency of the R290 units compared with HFCs.

The tipping point for R290 adoption in the US occurred last year, when the EPA announced that hydrocarbons, with their low GWP, could be vented to the environment. "That was the last piece of the puzzle" for the R290 service infrastructure that True has put together over the past three years, Washburn said.

True's customers for hydrocarbon equipment have included a major beverage manufacturer and a few retail chains that have rolled out R290 front-end multi-beverage merchandisers chainwide, said Washburn, who declined to name the companies without their approval. Target is testing one of the merchandisers in a store in Minneapolis. "Customers are buying them every day," he added.

Still, True understands the education process ahead. "The market is not used to [hydrocarbons as refrigerants]," said Washburn. "We're educating customers about what's coming, why it makes sense, and why you shouldn't be worried about it. For the most part, they get it."

At its NAFEM booth, Guatemalan OEM Fogel, and its U.S. distributor Howard McCray, showcased four glass-door R290 (propane) merchandisers. These include two in the "deck" line – with all of the refrigeration technology sequestered at the bottom of the unit – and two in the split line, which houses the evaporator at the top.

The deck merchandisers allow the bottom drawer containing the refrigeration equipment to be easily removed for servicing, replaced by fully functioning equipment. This arrangement is designed to calm end users' fears regarding servicing with a flammable refrigerant.

"The main concern with hydrocarbons is service," said Federico Barquero Tefel, Fogel's vice president of commercialization. "[End users] don't want servicing on site with a tank of propane." The detachable draw allows the technology to be serviced back at the shop in a ventilated area.

Fogel's service network is just starting to carry refrigerant-grade propane, noted Christopher Scott, president, Howard McCray. "A year ago they didn't; there was no demand for it. But with the delisting of R134a coming, the drive is on to get R290 in."

Thus far, Roche, the pharmaceuticals giant, has been the largest user of Fogel's deck-model glass-door R290 merchandisers in the U.S., with a "couple of hundred" installed in pharmaceutical labs and campus cafeterias, said Scott. Roche, which plans to eliminate R134a from its facilities, will install the split R290 merchandisers as well, he added.

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CO₂ Gets Some Love

While hydrocarbons dominated natural-refrigerant news at the NAFEM Show, a handful of exhibitors featured or discussed plans for carbon dioxide systems in North America.

For example, most of the medium-temperature glass-door cases displayed at the ISA booth incorporate CO₂, though one uses propane. The Italian manufacturer, which markets these units in Europe, was showing them in the U.S. for the first time, noted Alessandro Pedini, export sales manager, North America, Far East and Australia. They are undergoing UL- and NSF- certification.

Asked why he largely opted for CO₂ rather than hydrocarbons, Pedini explained that for the larger units, the 150-gram maximum on hydrocarbons was insufficient. "We only use hydrocarbons in small applications," he said.

If more than 150 grams were permitted, there would be concerns in the U.S., about hydrocarbons' flammability, he said.

Among component makers, Danfoss featured a high-pressure cartridge control switch for CO₂, designed to safely shut down a compressor when pressures get too high in a glass-door merchandiser.

Also at its booth, Carel showcased a beverage cooler along with an accompanying controller configurable for CO₂ applications.

TESTING IN THE FIELD

While not all the foodservice equipment exhibitors at the 2015 NAFEM Show were as far along with hydrocarbon conversions as True and Fogel, many showcased a sample unit or spoke about being committed to transitioning to propane equipment in the U.S. market in the near term to meet coming regulations.

In its first step toward transitioning to hydrocarbon refrigeration, Traulsen, which shared a booth at the NAFEM Show with its sister companies Hobart and Baxter, demonstrated an "eco-Traul" commercial concept unit that uses propane.



Fogel (left) and True both stressed propane refrigeration at the NAFEM Show.

The refrigerator is being field tested by a "large chain restaurant operator," said James Piliero, Traulsen's sales development manager, who declined to name the company without its authorization. The unit has the 2014 Energy Star rating and is close to meeting the DOE's 2017 efficiency requirement.

The concept unit gave Traulsen a chance to highlight a natural refrigerant, which Piliero called "a hot topic" at the NAFEM Show. "Up until now, I don't think [U.S. end users] really knew what was going on," said Piliero. "But this show is natural refrigerants' coming out party."

Traulsen aims to take advantage of the growing U.S. interest in natural refrigeration by making its entire refrigeration line available in propane or HC blend models by January of next year, Piliero said. To that end, the company can leverage the experience of Foster, its European refrigeration brand, which has been selling propane-based systems for almost 20 years.

Traulsen has chosen propane as its natural refrigerant option because it is readily available and inexpensive, has excellent cooling capacity and is "almost a drop-in solution," said Piliero. And despite its rating as a flammable fluid, in regulated quantities (under 150 grams), propane is "perfectly safe," he added, observing that where propane systems are used "we haven't heard on CNN about any commercial refrigeration disasters."

Manitowoc also displayed a sample propane unit – a small foodservice refrigerator that represented "an easy conversion from an existing R404A model to propane," said Darrel Walker, the company's director of engineering.

The propane unit reduces energy consumption from 1.88 KWH/day to 1.15 KWH/day, saving about \$30 annually. It carries a slightly higher cost than the HFC model.

The propane refrigerator was designed in response to a large foodservice chain that "wants to use natural refrigerants," Walker said, declining to name the chain. But Manitowoc is still waiting for an early adopter of the system.

A PREFERENCE FOR PROPANE

Beverage-Air is very close to producing its first propane refrigerators and shipping the first models to U.S. foodservice customers next month, said John Tinney, senior refrigeration engineer.

The company displayed its Horizon series commercial refrigerators/freezers, which, Tinney said, will be among the first units transitioning from R134a or R404A to propane. Ultimately all models will make that transition.

"One customer told us they are going to come to a point where they will not accept anything but R290," said Tinney.

For some models, Tinney explained, Beverage-Air only needed to swap out the compressor and expansion device to convert to propane refrigeration. The company also removed some electrical devices such as light switches that could create an ignition source. But condenser and evaporator coils have not been altered. All models are Energy Star 3.0-certified.

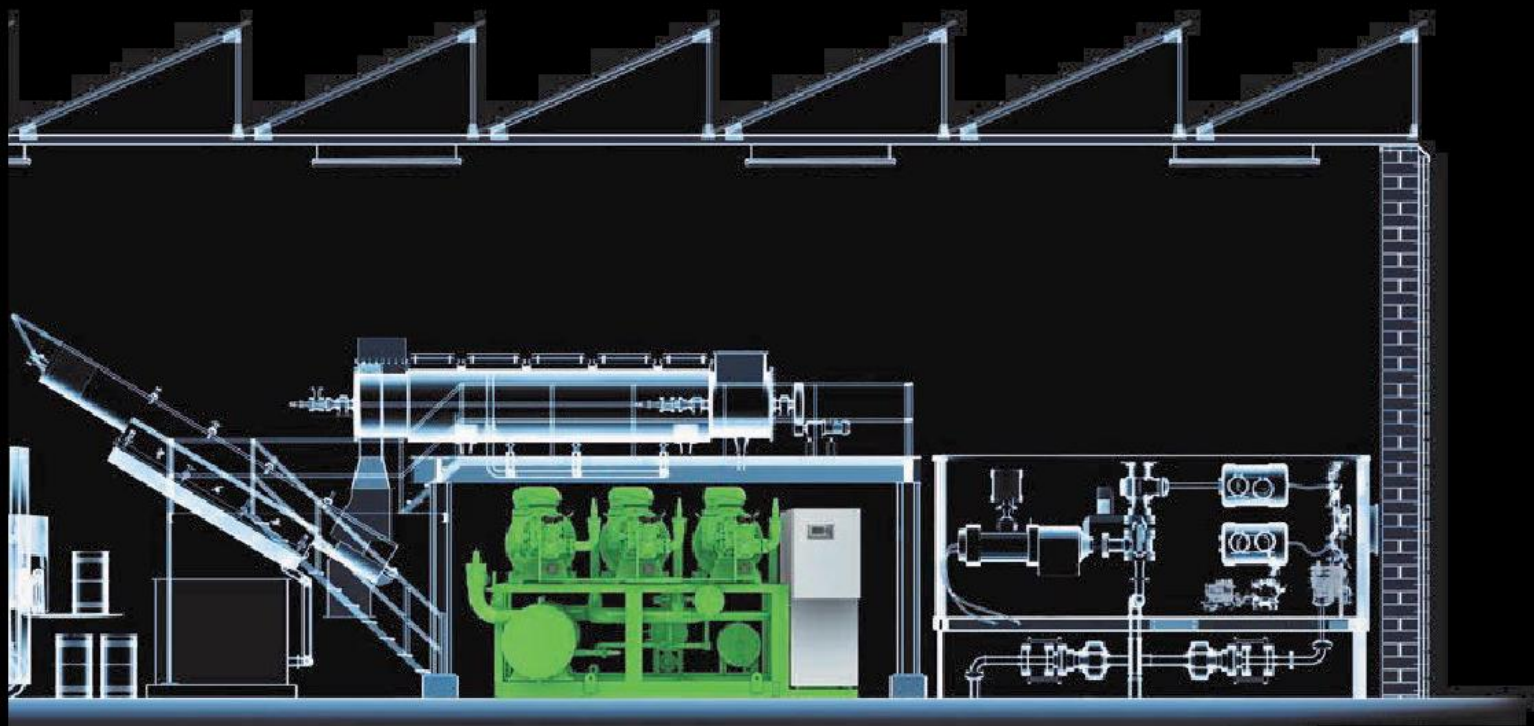
Beverage-Air's service technicians have prepared for the switch by taking an online training class certifying them to work with R290.

For Tinney, propane is a better choice for the company's refrigerators and freezers than carbon dioxide. "If I can use the same system I've got with just a different compressor, and I can use mineral oil, why mess around with CO₂?"

Tinney believes the EPA will eventually increase the charge limit on propane so that it can be used in larger units. Another strategy is for condenser and evaporator coils to be redesigned to increase their surface area, thereby getting "more heat exchange with less refrigerant," he said.

As for propane's flammability, "the most dangerous part is to the manufacturer who has to follow proper safety guidelines. And the service guy has to be aware. He can't take out a torch and start brazing something

MG



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ATMOSPHERE ASIA FINDS DYNAMIC MARKET FOR 'NATURAL 5'

Japan's uptake of natural refrigerants is set to go into overdrive, with a projected 24% increase in government subsidies for natural working fluids in 2015, and green procurement policies set for the Tokyo 2020 Olympics

— by Jana Topley Lira

IN JAPAN, NATURAL REFRIGERANTS ARE HERE TO STAY.

That was the message at ATMOSPHERE Asia 2015, hosted by shecco and held for the second time in the prestigious Shin-Marui Conference Square in Tokyo. With the tagline "Natural Refrigerants – Solutions for Asia", the international conference provided a platform for more than 160 HVAC&R experts and policy makers to discuss market trends and the newest technology and innovation across all five natural refrigerants: carbon dioxide, ammonia, hydrocarbons, water and air.

Exploring Japan's legislative landscape, the ATMOSPHERE Asia 2015 policy session focused on the upcoming measures aimed at addressing the country's rapidly increasing f-gas emissions. Presentations by Masafumi Oki from the Ministry of Economy, Trade and Industry (METI) and Motoyuki Kumakura of Japan's Ministry of Environment (MOE) focused in particular on the country's stricter F-gas law designed to discourage the use of hydrofluorocarbons (HFCs). The revised law, which will take effect in April 2015, sets global warming potential (GWP) targets for sectors with the highest levels of emissions.

As a complement to this, end users and system manufacturers can expect continued financial support from MOE, METI and the Tokyo Metropolitan Government (TMG) for their natural refrigerant investments. This year will see a budget increase of 6.2 billion yen, compared with 5 billion yen in 2014, from MOE's subsidy scheme, designed to encourage operators to use natural refrigerant technology. METI's scheme, designed to support R&D activities for the development of high efficiency, HFC-free air conditioning systems, freezing and refrigeration equipment, has an allocated budget of 280 million yen for 2015. The TMG subsidy program covers one-third of equipment cost and has an annual budget of 200 million yen.

"We face the challenge of high cost of new systems, and without government support it would be difficult for us to install this many systems," said Shinichirou Uto, director, Lawson, a major Japanese convenience-store chain.

Alongside these measures, METI is developing an environmental labeling scheme to promote natural refrigerants. To be finalized this year, the label will enable companies to better understand the environmental impact of refrigerants.

At the international level MOE's Joint Crediting Mechanism (JCM) is helping to distribute low-carbon technologies in developing countries, including the installation of NH₃/CO₂ and CO₂ refrigeration systems in Indonesia.

CO₂, JAPAN'S PREFERRED LOW-GWP REFRIGERANT

For end users such as Lawson and The Coca-Cola Company, ATMOSPHERE Asia 2015 reaffirmed their commitment to CO₂ as "the" climate-friendly refrigerant of the future. Lawson has stated its desire to become "the world's number-one natural refrigerant retailer," and is rapidly approaching the international benchmark, set by Denmark, of 712 CO₂ stores. The retailer had 461 CO₂ stores in operation but expected to increase that figure to 570 by the end of February 2015.

In Japan, the Coca-Cola Company has added 85,000 CO₂ peak-shift vending machines to its fleet, able to chill drinks for up to 16 hours without running a compressor.

Helping to support Japan's position as a world leader in producing CO₂ heating and refrigeration technologies, presentations from

system manufacturers Panasonic, Sanden and Mitsubishi Heavy Industries discussed the expansion and improvement of their CO₂ product line-ups. For example Panasonic's next generation of "pressure adjust control" CO₂ units are 35% smaller and 23% lighter, while Sanden's CO₂ units with three compressors are 75% smaller and 58% lighter.

Tetsuro Homma, executive officer at Panasonic, expects demand for the company's CO₂ systems to continue to grow and estimated that by March 2015, there would be 763 stores using Panasonic's CO₂ refrigerated technology in Japan.

Junya Ichikawa, Sanden's GM and division head, confirmed the company's one-millionth CO₂ system sale and predicted another one million in 2015.

In the heating industry, Mitsubishi Heavy Industries hopes to distribute its Q-Ton CO₂ commercial heat pumps in South Korea and beyond. Launched in 2011, the Q-Ton can supply 90°C hot water in ambient temperatures as low as -20°C. Units have already been installed throughout Japan, including in a nursing home in Fukushima, in a school in Shizuoka, and in hot springs, saunas and other industrial applications.

CHALLENGING MARKET FOR HYDROCARBONS IN JAPAN

Although hydrocarbon refrigerants have not until now been very popular in Japan, the arrival of R290 cabinets from Japanese HVAC&R product distributor REI-TECH could help to change this.

REI-TECH's AHT marketing department manager, Kazuhiro Tatewaki, presented the company's efforts to further the market share of hydrocarbons and eventually have 100% of its showcases using HCs by 2020. REI-TECH began selling AHT R290 cabinets in 2013 and in 2015 the company plans to add two more models employing the same refrigerant. REI-TECH's global sales grew by 35% between 2013 and 2014, with units sold rising from 3,364 to 5,021.

On the other hand, Red Bull, a major proponent of hydrocarbons in commercial refrigeration, believes there is still considerable work to be done to bring R290 and R600a components faster to Japan. The Land of the Rising Sun remains the region in which Red Bull has not yet been able to make a market impact. The

company's environmentally friendly ECO-Coolers use around 45% less energy than traditional coolers but a shortage of components, and a lack of service partners and training in the country, are stalling Red Bull's progress.

According to Jürgen Brenneis, Red Bull's global purchasing manager, visibility items/point of sale, the company has 10,000 cooler units in Japan and a market share growing by 25%-30% every year, but due to hydrocarbons' negative reputation, none of them use hydrocarbons as a refrigerant.

"We would like to fulfill our hydrocarbon policy in Japan but we are struggling to find and get components for R600a," said Brenneis.

OPPORTUNITIES FOR CO₂/NH₃ IN INDUSTRIAL REFRIGERATION

Although the commercial refrigeration sector was the focus at ATMOsphere Asia 2015, industrial refrigeration remained a hot topic with huge opportunities to transition to natural refrigerants before the HCFC phase out in 2020. In Japan, more than 500 installations of Mayekawa's NewTon CO₂/NH₃ system have been completed in cold storage, ice arena and freezer applications, but there are still approximately 10,000 industrial refrigeration plants utilizing the R22 refrigerant.

The Kobeya Baking Company presented a prime example of a CO₂/NH₃ installation at its frozen dough production facility in Kanto, Japan. Used to replace an R22 system, the NewTon F600 90kW enabled Kobeya to achieve 38% in annual power savings, including an energy reduction of approximately 45% in the summer, and 25% in the winter. The company plans to replace other existing R22 systems with CO₂/ammonia solutions in order to reach a company-wide goal of 30% power-consumption reduction.

The government's increased budget for subsidies will likely further increase the number of end users switching their R22 industrial refrigeration systems to CO₂/ammonia systems.

AIR AND WATER AS NATURAL REFRIGERANTS

While less prevalent than CO₂, hydrocarbons and ammonia, air and water complete the "natural five" refrigerants as the ultimate environmentally friendly, low-risk solutions, with zero ozone depleting potential (ODP) and zero GWP. At

ATMOsphere Asia, Mayekawa and Sea Sky Global outlined the benefits of using air as the working fluid in ultra-low temperature storage with the Pascal Air system.

Using an integrated turbo compressor expander, wherein the compressor and expander are connected to the same shaft with a motor in between, the Pascal Air system is able to save 25% energy in comparison with a conventional system, because there is no defrost required. "When I saw the Pascal Air for the first time, my gut feeling said, 'This is it,'" said Dong Gyu Kim, Sea Sky Global.

ATMOsphere Asia 2015 also confirmed water's bright future in the industrial refrigeration sector, with Kawasaki Heavy Industries' R718 turbo chiller and Denso's new micro-fin technology, designed to improve heat transfer and reduce size for adsorption heat pumps, showing their flexibility.

Summarizing the event, Marc Chasserot, conference chairman, and managing director of shecco, concluded that natural refrigerants are no longer emerging in Japan; they are here to stay. "There is a strong sense 2015 will provide the industry with its watershed moment, and shecco Japan and ATMOsphere will be back in 2016 to share the progress we've made once again," he said.  JTL

First all-natural-refrigerant store in Japan

Following in the footsteps of Supervalu's (now Albertsons') pioneering CO₂, hydrocarbon and ammonia store in the U.S., convenience store operator SAVE ON opened Japan's first 'all-natural-refrigerant' store last month.

Part of the Besia group in Japan, SAVE ON operates 605 stores. Its new "all green" store, located in Isesaki City in Gunma Prefecture, features Panasonic CO₂ systems as well as AHT's R290 cabinets.



FASTEN YOUR SEAT BELTS, NORTH AMERICA!

Embraco's Doug Schmidt expects a major shift towards hydrocarbons in the U.S. light-commercial refrigeration market as a result of new regulations

— By Michael Garry

Most people are reluctant to make big predictions, preferring to hedge their bets. Not Doug Schmidt.

"The market is going to change," said Schmidt, commercial sales manager, North America, Embraco, based in Suwanee, Ga. "It's just a matter of how fast. What people are using today, in two to three years it will be different. So fasten your seat belts."

Schmidt is referring to the type of refrigeration technology made by his company, a 44-year-old Brazil-based manufacturer of compressors, condensing units and other components for light-commercial refrigeration systems (1.5 horsepower and below).

Who uses those systems? Everyone from convenience stores and supermarkets to fast-food restaurants and fine-dining restaurants to research labs – and people grabbing a drink from a vending machine or taking a sip from a water fountain. (Embraco also makes compressors for household refrigeration.) And he's referring to his marketing territory – North America.

What will be different about those commercial refrigeration systems? They will be using a natural refrigerant, the hydrocarbon propane (R290), for greater efficiency, and to help rid the environment of high-GWP (global warming potential) hydrofluorocarbons (HFCs).

Embraco, owned by the U.S. household-appliance-maker Whirlpool, "is fully supporting the transition to hydrocarbons," said Schmidt. "Compared to the current technology, it's more efficient, less costly and uses a smaller compressor to do the same cooling as a larger one."

Currently, about 40% of Embraco's compressors operate with hydrocarbons. For commercial refrigerators, that hydrocarbon is mostly propane; for household units, it's isobutane (R600a). Most of the hydrocarbon units are used in Europe and Asia.

In North America, currently representing 5% of Embraco's commercial sales, most of its installed compressors still refrigerate with R134a, an HFC with a GWP of 1,430. But Schmidt estimates that over the past year Embraco has sold about 50,000 hydrocarbon compressors for use in commercial settings in the U.S. (The uptake in Mexico has been much faster, he noted.)

“These regulations are going to change the market”

And more hydrocarbon systems are coming to the U.S., thanks to regulatory pressures from the Environmental Protection Agency, which has set its sights on delisting R134A and other HFCs in certain applications, and the Department of Energy, which has imposed stricter efficiency standards for refrigeration systems beginning in 2017.

"These regulations are going to change the market," said Schmidt. "Hydrocarbons help you with both of them."

END-GAME SOLUTION

While it's not clear exactly when the EPA will delist HFCs – most observers doubt it will take place in 2016 as originally proposed – it will happen eventually. One of the pluses of a hydrocarbon replacement is that, given the refrigerant's near-zero GWP, it can be viewed as an "end-game solution" that will not be subject to future EPA delisting, said Schmidt.

On the efficiency side, switching to a hydrocarbon will by itself cut the energy costs of a refrigeration system by about 5%, said Schmidt. On top of that, the third-generation propane compressors Embraco is producing yield an additional 15% or more in efficiency compared to HFC compressors. That combined 20% gain in energy efficiency is "huge in our business," Schmidt noted.

But does the efficiency improvement meet the DOE's requirements for 2017? That depends on other components in the refrigeration system, but "it's certainly a big help," he said.

So far, more than food or restaurant retailers, some beverage and food makers, such as Red Bull, PepsiCo and Unilever, are helping to drive the conversion to hydrocarbon refrigeration in North America. But some retailers, such as McDonald's and Target, are pursuing hydrocarbon solutions as well, Schmidt noted.

At the AHR Expo in January, Embraco showcased products that were "specifically designed" to support the growth of hydrocarbon systems in the U.S. marketplace, Schmidt said. These included two new propane compressors and a "Plug n' Cool" condensing unit pre-charged with R290. Component maker Carel also displayed a new controller for Embraco's variable-speed Fullmotion R290 compressor.

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→ Embraco manufactures its compressors in five plants spread around the globe – Brazil, Slovakia, China, Italy and Mexico. The propane units are currently built in Brazil and Slovakia, but the company plans to start making them at

its three-year-old Monterey, Mexico, plant in preparation for the DOE rule changes in 2017. Given the impending market growth, “it makes sense to start producing compressors for hydrocarbons in North America,” said Schmidt.

GETTING COMFORTABLE WITH HYDROCARBONS

The reluctance to use hydrocarbons as a refrigerant in North America largely derives from their status as a flammable (A3) refrigerant (though they are used in very small quantities). In the U.S., a notably litigious society, that fact has been an issue for people “with an aversion to do anything that can present obligations later,” said Schmidt.

But, as demonstrated in the European market, the flammability “can be handled to minimize the risk so that end users and employees are comfortable,” he said.

Schmidt expects that, over time, as efficiency-minded OEMs and end users in North America gain more experience with hydrocarbon systems, they will become more comfortable with the technology and it will become the norm.

Another concern about hydrocarbons is their per-unit charge limitation – 150 grams (5.3 ounces) for propane. Embraco’s Plug n’ Cool system helps address this restriction by allowing units to work in tandem. For example, multiple units of the Plug n’ Cool system, plugged into a water loop, could be used in a supermarket’s frozen and refrigerated cases, replacing a conventional HFC rack system.

Embraco is participating in a group assembled to assess the 150-gram limitation set by the International Electrotechnical Commission (IEC) and possibly increase the allowed quantity. The company is also reducing the volume of its compressors

to get more out of the available refrigerant.

Another hurdle for hydrocarbons in the U.S. is the availability of technicians to service them. That should improve over time, as it has in Europe and “shouldn’t stop the adoption of the technology,” Schmidt said. He pointed out that the modular Plug n’ Cool units can be taken out, replaced with a functioning model, and repaired at the shop rather than on-site, helping to establish a comfort level with maintaining hydrocarbon systems.

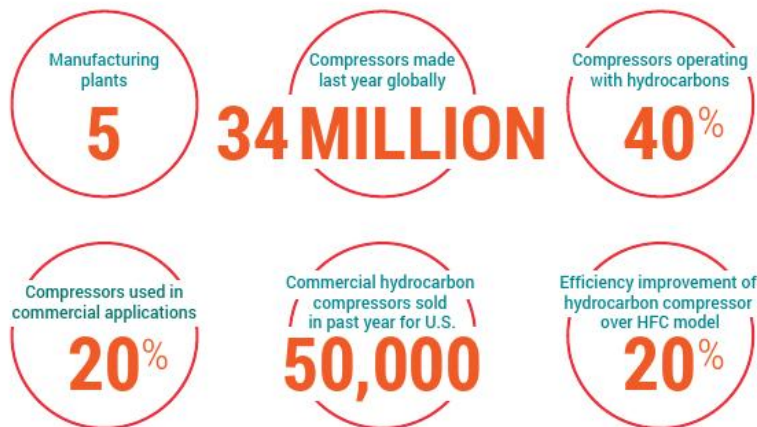
One more issue is the need for hydrocarbon equipment to pass muster with local fire departments, each with its own standard. “We’re in the early stages of this and it’s a little challenging,” said Schmidt. “How do we get to each one and assure them that we have a well-thought-out design and the product is safe?”

Despite these challenges, Embraco remains committed to hydrocarbons – so much so that it has phased out production of CO₂ compressors, though it made the very first carbon dioxide compressor for light-commercial refrigeration.

“We feel that CO₂ can’t get to the same efficiency level as hydrocarbons for the same cost,” said Schmidt. **MG**

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by the Numbers





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