WINTER 2015 / 2016

# ACCELERATE

ADVANCING HVAC

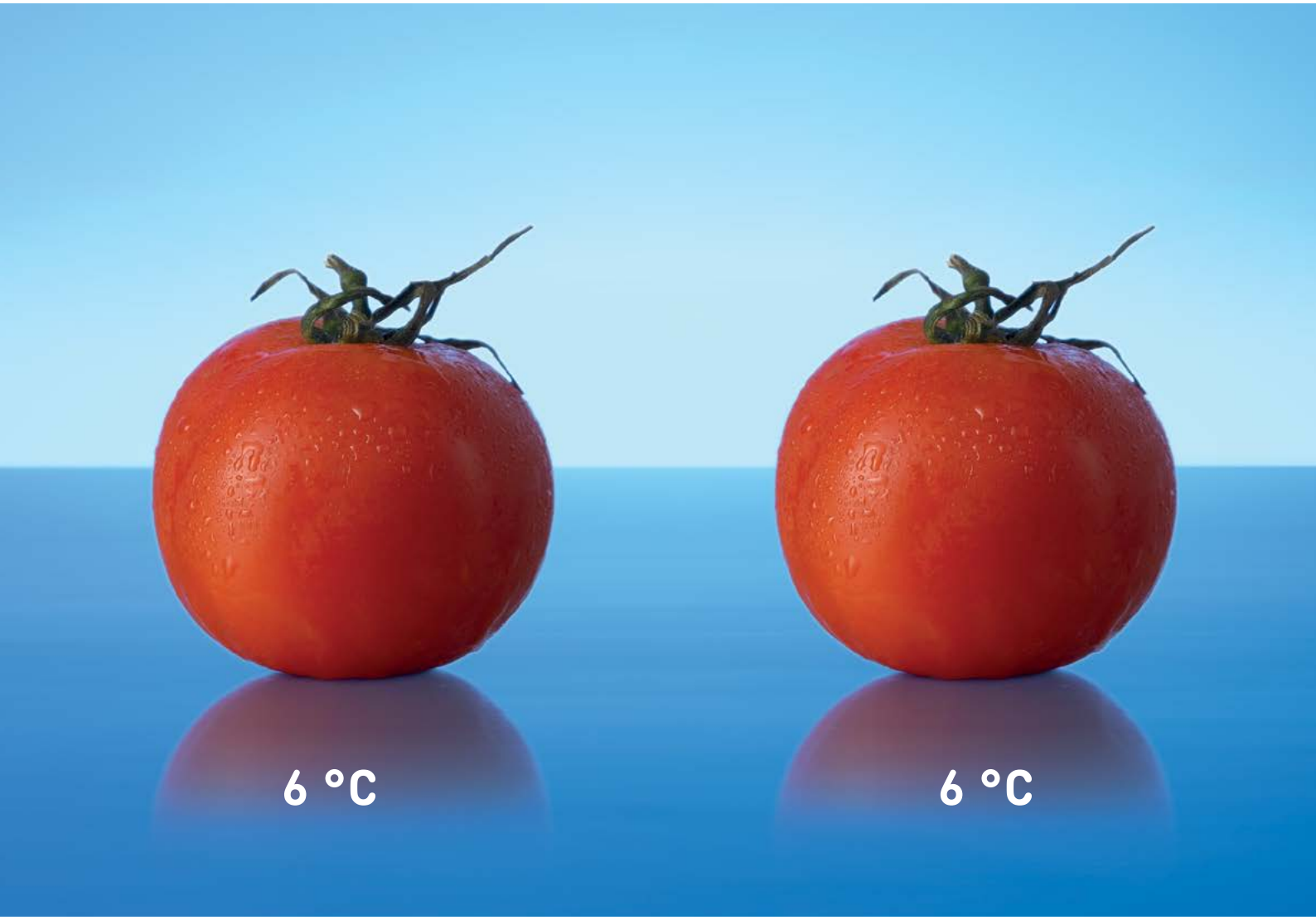
EUROPE



**OLAF SCHULZE**
Director, Energy & Management
Metro AG
—
p.34

# METRO AG COMMITS TO ALL-NATREF FUTURE

# There's a difference .... obviously

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Publisher's note
by Marc Chasserot

# FULL SPEED AHEAD!

Today the European HVAC&R industry is at full speed, driven by the EU F-Gas Regulation and the need to find cost-efficient, safe, low-GWP solutions that won't be faced with regulation in the future. We're moving quickly from a world where the use of synthetic refrigerants did not matter as long as they were cheap and efficient to a world where customers care not only about their bottom dollar, but also the environment.

Key to this shift is a change in 'mindset', which has created a massive opportunity for $CO_2$, hydrocarbons, ammonia, air and water to displace HFCs. Equipment manufacturers are no longer locked in to a particular family of synthetic refrigerants. They can innovate, knowing that there are viable alternatives known as 'natural refrigerants', able to fulfill their customers' needs with future-proof solutions that can only be improved by future generations. This trend is ocurring across all applications of the HVAC&R industry.

It is very exciting to be part of this change. Over the past decade, I've had the pleasure of meeting hundreds of these innovators who 'want to do the right thing'. These early adopters have stories to tell and we at *Accelerate Europe* want to share with them in order to help the remaining 95% of the industry transition to a more sustainable future.

*Accelerate Europe* will look at all aspects of the industry. Everywhere refrigerants are used, we will go: whether for heating or cooling, large or small applications. End-user experiences will be at the heart of this quarterly magazine. We'll tackle not just the technologies themselves but also training and servicing. We'll attend every major trade show in Europe and report on the policy trends shaping our market. We'll provide data to measure these trends and hear the opinions of industry leaders. Last but not least, we'll bring you stories from other markets around the world that are helping to drive our global industry.

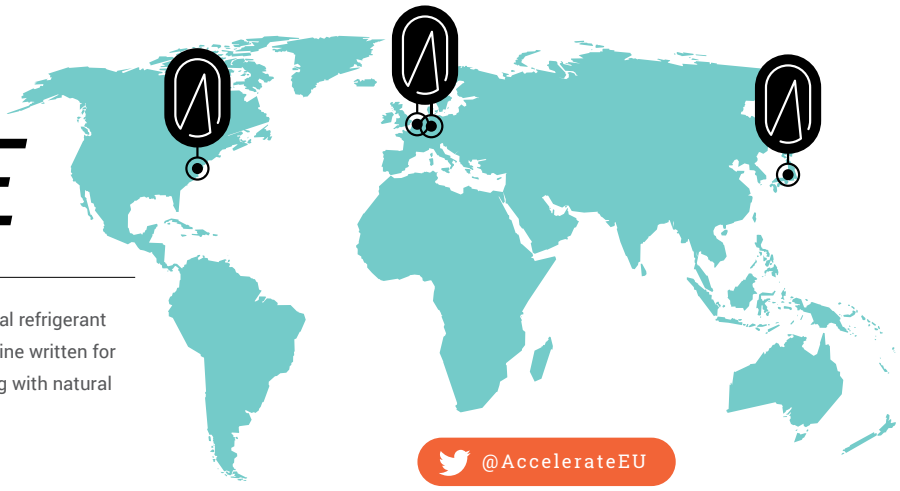
Enjoy our first issue! I look forward to receiving your comments at marc.chasserot@shecco.com MC

EUROPEAN EDITION ISSUE #1, WINTER 2015 / 2016

# ACCELERATE

ADVANCING HVAC&R NATURALLY

Brought to you by shecco, the worldwide experts in natural refrigerant news, *Accelerate Europe* is the first quarterly news magazine written for and about the most progressive business leaders working with natural refrigerant solutions in all HVAC&R sectors.
http://accelerateEU.com



ISSUE# 1
VOLUME 1

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Editor's note by Nina Masson

# LEADING BY EXAMPLE

The launch of *Accelerate Europe* coincides with global climate talks in Paris that see industrialised nations and emerging economies plot a course towards decisive joint action to combat emissions of potent greenhouse gases. Europe, as a strong voice in these talks, can lead by example.

In Europe, early movers divesting from fluorinated gases in heating, refrigeration and air-conditioning are already proving that a compelling business case for environmental solutions can be built by embracing new opportunities. By innovating and thinking laterally, via individual leadership and common political positions, Europe has emerged as a leader in areas where natural refrigerants are not just an alternative to f-gases, but the baseline for further progress.

Such leadership shines throughout *Accelerate Europe*. Our cover story on METRO AG is evidence of this. As a leading retailer, the METRO group has committed to phasing out fluorinated gases by 2025. Energy & Management Director Olaf Schulze touches on three of METRO's strengths – first-mover confidence to enter new areas, curiosity to learn, and willingness to share technological successes; mean the group drives rather than follows change (see full story on p. 34).

Inviting technical directors from across the world to see Europe's natural refrigerant-based HVAC&R technologies in action is another great way to spread change. French food giant Carrefour's innovation forum discussed emerging competition between natural refrigerant systems and the trend toward smaller stores (see p. 24). Also harnessing its leadership status to convince others is Delhaize, whose technical director David Schalenbourg met us at their Chazal store (see p. 44): one of 5,550 in Europe that use $CO_2$ transcritical refrigeration systems – a success story mirrored by the increase in hydrocarbon-based solutions in food services (p. 18).

Knowledge-sharing is another way to drive change. Danish company Danfoss developed its vapour ejector technology – a promising $CO_2$ refrigeration option for hotter climates – together with OEMs (p. 60). Torben Hansen, founder of $CO_2$-only system manufacturer Advansor, shows that leading the way sometimes requires embracing radical ideas (see p. 56).

Effective leadership also means learning from the best. Europe, oft-heralded as the most progressive region for industry readiness to adopt natural refrigerants, can still learn from others regarding legislative drive. California's bold HFC reduction strategy may outpace Europe's (p. 70), and China's recommended substitutes feature natural refrigerants (p. 72).

*Accelerate Europe* is a space to showcase success stories and lessons learned by those leading by example in order to move industry more quickly towards the wider adoption of natural refrigerants in Europe. NM


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# GLASS CEILING SHATTERED ON GLOBAL HFC PHASE-DOWN TALKS

After seven years of informal talks on whether to manage HFCs under the Montreal Protocol, opposition to a move that always seemed inevitable was finally toppled during a November Montreal Protocol meeting in Dubai.

— By Sidi Menad Si Ahmed
International Chief Advisor, shecco

The breakthrough regarding a potential global HFC phase-down kick-started official negotiations regarding challenges and possible solutions for managing HFCs in developed and developing countries, and couldn't have come at a better time just weeks before COP21 in Paris.

The main issues revolved around availability of technologies, particularly in countries faced with high ambient temperatures, whereby exemptions could be granted for a determined period of time. Perhaps more telling, developing countries came to the table, indicating that eligibility of funding for third-stage conversions (enterprises that were previously converted from CFCs and HCFCs with funding from the Multilateral Fund) is an essential topic.

An important point was raised by India regarding whether a definition of 'low-GWP' should be considered to guide countries in their technology choices. So far the only proposal identified by the technical assessment panel (TEAP) refers to a GWP threshold of 300. However, Switzerland, supported by the EU, made a rather surprising proposal in suggesting to link the level of funding with the level of $CO_2$ equivalent, while completely avoiding the question of adhering to a 'low-GWP' threshold. This proposal wasn't met favourably by developing countries, in particularly India.

The negotiations didn't quantify any measurable progress but rather enabled participants to put all the core issues on the table. At the end of the meeting, an agreement was reached on the way forward, including arranging several additional meetings during the next year and starting to work towards an HFC phase-down in 2016. SA

## Side events

Besides the main negotiation process, several side events were organised to highlight certain issues and provide new scientific information. NASA announced that HFCs were found to have ozone-depleting potential. Even if the ODP is negligible, legally, such findings would make them eligible for a control under the Montreal Protocol. This essentially resolves one of the key hurdles aired in previous discussions on a possible HFC phase-down, whereby it was argued that only ozone-depleting substances should be considered under the Montreal Protocol. Some other side events highlighted the fact that R32 is an interim solution and as such it could not be considered as a low-GWP alternative.

Favour for natural refrigerants as the ideal alternatives in many applications is spreading, particularly with safety concerns being addressed by large-scale enterprises in India and China, as was demonstrated in a number of very convincing technical presentations.

Many countries such as China, India, Nigeria, South Africa, Iran and Pakistan are seriously considering natural refrigerants as replacements for HCFCs and a means of leapfrogging HFCs. Demonstration projects like the aforementioned will be a determining factor in adopting a full-speed approach to natural solutions. SA

# THE NATURAL VOICE CALLING FOR GLOBAL ACTION ON NATURALS

With an industry-driven statement supported by more than 100 organisations worldwide, The Natural Voice aims to mobilise national governments to phase down HFCs and replace them with natural refrigerants.

— By Nina Masson

Relaunched in 2015, The Natural Voice (TNV) will serve as a vocal and proactive industry forum to increase awareness of natural refrigerant solutions among policymakers and climate negotiators, and harness the technology's full potential globally.

Originally unveiled in 2010, the TVN has been revamped with new initiatives and an open statement, currently supported by 105 signatories. Since then it has served as a platform for HVAC&R companies, end users, industry associations, NGOs and other parties to show their support for the environmental, economic and social potential of natural refrigerants – in particular, carbon dioxide, ammonia, hydrocarbons, water and air.

Despite the progress made over the past five years as natural refrigerants infiltrate a growing number of applications, barriers to wider adoption still exist at different levels. This is partly due to insufficient support from national governments, which is exactly what TNV wants to enable.

With only gradual progress being made towards establishing formal negotiations on a global HFC phase-down under the Montreal Protocol, the revival of TNV comes at a time of growing momentum, from developed and emerging economies, to search for less climate-damaging gases. Natural refrigerants are undoubtedly a major solution to these challenges faced.

With world-leading consumer goods brands and end-users among the 105 signatories to date, TNV will play a growing role in 2016 with key intitiatives to increase the visibility and address basic misconceptions (among national governments, commercial end users and consumers) surrounding natural refrigerant solutions.

Providing evidence of a global business case for users and producers of natural refrigerant-based technologies will remain at the heart of the programme, which will enable industry and non-industry partners to be actively involved in initiatives to fast-track natural refrigerants globally.

As one simple but effective tool to speak up, TNV will collect 'VOICES' from public forums, conferences, articles and other sources talking about the value of using environmentally friendly refrigerants. If you wish to add your voice, please do so by contacting speakup@thenaturalvoice.org

To sign up to TNV statement, organisations are invited to visit: www.thenaturalvoice.org. NM

# THE NATURAL VOICE

Each Nation and each Industry Sector bears an individual responsibility in the fight against climate change.
The refrigeration, heating and cooling industry recognises the role it can play to reduce direct and indirect emissions of greenhouse gases.

The Organisations who endorse this statement call upon the National Governments to responsibly shape today the climate opportunities of tomorrow, and acknowledge the potential of Natural Refrigerants.

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# EVENTS GUIDE
# DECEMBER 2015


**1**

December 2-4, Belgrade, Serbia
46th International HVAC&R Congress and Exhibition
http://kongres.kgh-kongres.rs/index.php?lang=en

**2**

**December 3, online, 18:45 CET**
IOR Webinar: Innovation in carbon-ammonia adsorption heat pump technology
https://attendee.gotowebinar.com/register/2737197182568286721
**twitter : @thecoolinghub**


#GoNatRefs

# EVENTS GUIDE
# JANUARY 2016


**1** January 13-16, Essen, Germany
DEUBAUKOM
http://www.deubaukom.de/construction-trade-fair/

**2** January 26-29, Vienna, Austria
Aquatherm Vienna
http://www.aquatherm.at/en/
**twitter : @messe_at #aquatherm**

**3** January 28-31, Bolzano, Italy
Klimahouse 2016
http://www.fierabolzano.it/klimahouse/
**twitter: @Klimahouse #Klimahouse**

**7** January 28-31, Vienna, Austria
BAUEN & ENERGIE WIEN 2016
http://www.bauen-energie.at/
**twitter : @messe_at #bauenenergie**

**8** January 21-24, Stuttgart, Germany
Haus und Energie
http://10times.com/haus-und-energie
**twitter: @10_times**

**9** January 21-23, Prague, Czech Republic
FOR PASIV
http://forpasiv.cz/en/

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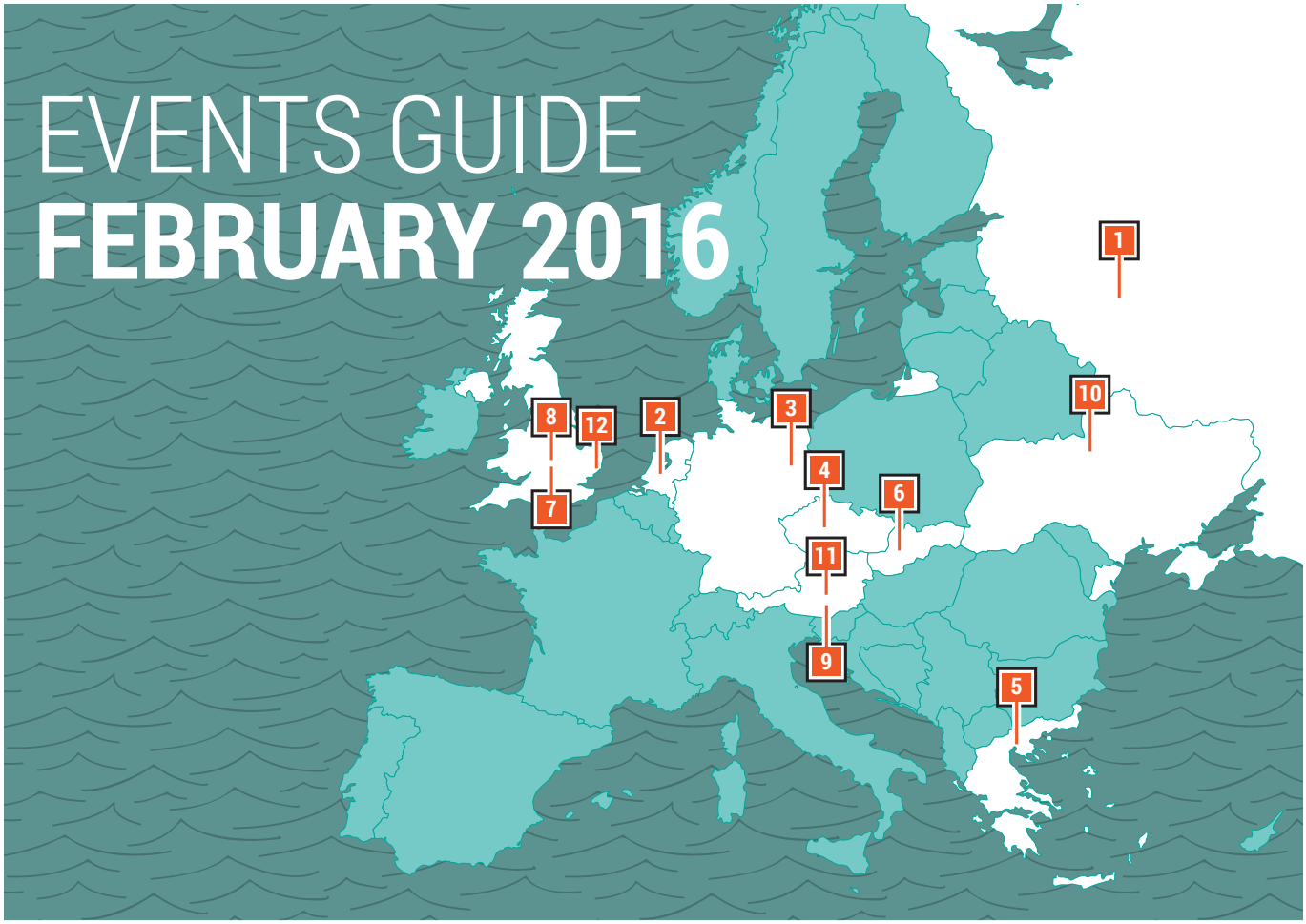


**1** February 2-5, Moscow, Russia
Aqua-Therm Moscow
http://www.aquatherm-moscow.ru/en/
**twitter : @AquaThermMoscow #aquatherm**

**2** February 2-5, Utrecht, Netherlands
VSK 2016
http://www.vsk.nl/nl-NL/Bezoeker.aspx
**twitter : @VSKbeurs #VSK2016**

**3** February 3-5, Berlin, Germany
Fruit Logistica
http://www.fruitlogistica.de/en/
**twitter: @FRUIT_LOGISTICA**

**4** February 4-7, Prague, Czech Republic
Modern Heating 2016
http://www.modernivytapeni.cz/en.html

**5** February 12-15, Thessaloniki, Greece
EnergyTech
http://shows.newmaker.com/fairs/EnergyTech-Greece.html
**twitter : #EnergyTech**

**6** February 9-12, Nitra, Slovakia
Aquatherm Nitra
http://www.aquatherm-nitra.com/en/
**twitter : #aquatherm**

**7** February 16-18, Birmingham, UK
ACR Show 2016
http://www.acrshow.com/
**twitter : @theacrshow #TheACRShow**

**8** February 18, Birmingham, UK
IOR Annual Conference 2016
http://www.ior.org.uk/conference2016
**twitter: @thecoolinghub**

**9** February 19-21, Klagenfurt, Austria
HÄUSLBAUERMESSE KLAGENFURT
http://www.kaerntnermessen.at/en/fairs/der-hauslbauer.html
**twitter: @ktnmessen #Häuslbauermesse**

**10** February 23-25, Kiev, Ukraine
Industrial Cold
http://promholod.euroindex.ua/index_e.php

**11** February 24-26, Wels, Austria
World Sustainable Energy Days
http://www.wsed.at/en/world-sustainable-energy-days/

**12** February 29 - March 3, London, UK
HOTELYMPIA
http://www.hotelympia.com/
**twitter: @Hotelympia #hotelympia16**

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# HOST MILAN 2015
## NATURAL REFRIGERANTS SECURING THEIR PLACE IN FOOD SERVICE

**Hydrocarbons and $CO_2$ are moving to become the European standard for commercial refrigeration equipment, ice makers, and refrigerated display cases. Manufacturers including Dorin, Gamko, Gram Commercial and Zanotti showcased this accelerating trend at HOST Milano 2015.**

**— By Silvia Scaldaferri**


HOST 2015, the professional hospitality show, held 23-27 October at Fiera Milano Rho — the same colossal location as the international EXPO 2015 – made for a bustling event of some 150,000 visitors (and an interminably packed metro ride). As well as a record-breaking 2,004 exhibitors from 47 countries, the event, which has traditionally been dominated by Italian manufacturers, showcased 714 international companies, a 26% increase compared to 2013.

Walking through the HOST halls was a feast for the senses, with appetising demonstrations dedicated to desserts, ice cream, coffee, pastry, bread and chocolate; sophisticated machines and cutting-edge design. Thanks to new technologies developed for the food sector, processing, storage and the cold chain, it is possible today to preserve the nutritional properties of food and keep items refrigerated for longer.

The introduction of natural refrigerants in Ho.Re.Ca. (hotel, restaurant and café) equipment, thanks to some smart thinking and seriously bright ideas, has turned a previously stagnant industry into a hot-bed of activity. Special signage, ECO branding, and energy labeling were at the forefront of equipment manufacturers' exhibition booths.


But before this terminology becomes so ubiquitous that it loses impact, it should be noted that new generation HFC technologies bearing environmentally friendly labels are still a middle solution as compared to natural refrigerants. In the light commercial equipment sector, natural refrigerants hydrocarbons (R290, R600a) and $CO_2$ (R744) are the most commonly used. Their advantages are: compliance with the EU F-Gas legislation, financial savings for the end user, and negligible environmental impact.

For example, the hydrocarbon MaxiGlass bottle cooler by Gamko provides a 55% reduction in energy from the previous model using R134a, thanks to the hydrocarbon refrigerant, and improved glass and fans.

"While the products are 7% more expensive in initial price, the ECO-Line provides end users with a 65% savings, which in the Netherlands equates to about €400/year. Over the 10-year lifetime of the product, you can earn the price of the entire system only through these savings," commented Fredrik Breda, Bar Engineer Export.

Among one of the 400 scheduled events at the conference, HOST Smart Label awarded its virtual quality label for groundbreaking innovation, effectiveness and sustainability. The jury awarded the SMART Label to 63 products, including Gram Commercial A/S, for its R600a Superior Plus K 72 CCG Refrigerator, and Zanotti Spa, for its R290 monoblock refrigerator.

In a roundtable event hosted by the Assofrigoristi on Natural Refrigerants, Giacomo Pisano, Technical Commercial Manager at Dorin remarked, "there is no definitive solution today, if not that of natural refrigerants. Supermarkets, to name one application, want to find long-term and future-proof solutions."

The fact is, the demand for cooling equipment is rising. Refrigeration and air conditioning are responsible for their fair share of global greenhouse gas emissions (especially in developing countries) and low levels of efficiency and high leakage rates of refrigerant gases with high global warming potential will only increase these emissions drastically.

Fortunately, besides the benefits of natural refrigerants already mentioned, they also present a compelling business case, generating an increasingly collective commitment from manufacturers and end users. SS

More info on http://host.fieramilano.it/en



# BUSWORLD 2015

## Road to Natural Refrigerants in MAC Clearing Up

– By Robert Davidson

busworld.
KORTRIJK EUROPE
16–21 OCT 2015


With mobile air conditioning (MAC) in the headlines recently for environmental reasons, one could get the impression the brakes have been put on R744 as a solution. Yet, the reality is somewhat different, with the industry gearing up for a future that will feature a market fragmentation set to benefit both $CO_2$ and propane for a variety of different modes of transport.

The role of R744 in MAC applications has hit some barriers in recent months. In October, Daimler, a prominent supporter of $CO_2$ MAC, announced that it would instead use HFO R1234yf for an interim period, to adhere to EU legislation, while it phases in $CO_2$ commencing from next year.

Remember, R1234yf is the controversial refrigerant that Daimler required "specific protective devices" for, in order to protect its vehicles in the event of head-on collisions due to flammability concerns.

While this news may indicate that the industry is moving away from natural refrigerants in, MAC the evidence suggests quite the opposite; that instead of a recession of interest in natural refrigerants, there is rather a growing reluctance to accept the status quo of the MAC sector.

Daimler themselves noted the short-term nature of their decision to use R1234yf: "From 2017, it will offer in Europe the S- and E-Class as the first production passenger cars equipped with $CO_2$ air conditioning systems."

Daimler's long-term commitment to using $CO_2$ in its MAC shows the fragmentation of the market, which is opening up new avenues for companies to explore as opposed to the traditional monotonous route of using fluorinated gases in MAC.

## BUSWORLD SHOWS AN INDUSTRY LOOKING AT MORE AND MORE OPTIONS FOR MAC

At Busworld, held in Kortrijk, Belgium from 20-25 October, an annual trade show that attracts over 30,000 visitors and exhibits just under 200 companies active in the transport industry, Oliver Rathfelder, Bitzer's Sales Manager, noted how the tides are changing for natural refrigerants, "there's a lot of discussion in transport applications about the safety of HFOs."

This is not new territory, with the aforementioned concerns surrounding HFOs dating back as far as 2012. Yet, it is a concern facing all manufacturers as the market becomes weary of pledging allegiance to one refrigerant. Rathfelder explained how this indecision affected its business:

"As a compressor manufacturer, we do not decide what to use, but what we can do is offer possibilities, therefore we have this wide range."

This wide-range is in stark contrast to the previous market make-up, persistently monopolised by environmentally damaging fluorinated gases, most recently

continued on p.22

R134a, and before that R22. The continual fragmentation in the European MAC market is shown in this new variety of choice that sees Bitzer offering an R290 compressor for MAC applications with a view to making same compressors compatible with $CO_2$ in the future.

The benefits are obvious, explains Rathfelder, who noted that the technical leap from maintaining a conventional system using R134a to R290 is not so pronounced. This factor and R290's high efficiency at high ambient temperatures make a compelling business case for the refrigerant in MAC.

That aside, the choices that manufacturers like Bitzer offer do not necessarily equate to market share, which today remains dominated by fluorinated gases. While Daimler and Volkswagen have committed to $CO_2$, few others in the automotive industry have. In addition, Bitzer noted that they are the only known manufacturer producing compressors compatible with R290 for MAC applications.

## NEXT STOP, $CO_2$: THE ANSWER TO EUROPE'S PUBLIC TRANSPORT MAC?

Konvekta, a system manufacturer of $CO_2$ MAC systems for buses, was also present at Busworld and gave a succinct account of where Europe is at in terms of the market penetration of natural refrigerants.

With 100 $CO_2$ air-conditioned buses on Europe's roads, Konvekta have a clear understanding of where they believe the market's end destination to be. Reiner Boland, Konvekta's Director of Business for Bus AC, spoke of their commitment to $CO_2$ MAC in buses:

"We are fully convinced about $CO_2$ and especially for battery buses. With the $CO_2$ heat pump you can work with temperatures as low as -10°C, which you can't do with a conventional refrigerant."

But it is safe to say that its energy efficiency at low temperatures is as talked about as its perceived inefficiencies at high temperatures and this is a concern that the industry brings up regularly. On the matter of $CO_2$ MAC in hotter climates, Boland did not shy away from the question, discussing their recent progress in the south of France (Marseille), where the company is testing its $CO_2$ systems with regional operator RTM.

"For these temperatures we still have to improve our product and the implementation which means we need a much higher RPM for the compressor and this has to be implemented in the U.S. So the units in Marseille are not running trouble free but they are improving," Boland said.


While progress is promising, the lack of industrial support is something Konvekta sees as a barrier for $CO_2$ MAC. "We need more support from our suppliers because at the moment, we have to make some of our own components, which we don't like to do, but we have to because there are not adequate suppliers."

Bitzer consolidated the view that $CO_2$ MAC will become increasingly prominent as increasing uncertainty about the potential severity of future regulations. "Especially for railways, once they install a unit now, they will operate it for 20 years or more. So they need to make a decision today, because in 10 years, the classic refrigerants will be much too expensive for them. So now, they are pushing today for $CO_2$ from 2020," he said.

"Deutsche Bahn [a German railway company] wants to buy only natural refrigerants from 2020, which is a big challenge, but they are really pushing in this direction. To have a green image in the future… This was actually accelerated last year, so companies are now preparing $CO_2$ field tests, so it is also accelerating in railway applications."

The road for natural refrigerants in MAC may still be a long and winding one, but the opportunity exists for all manufacturers and suppliers, now, and in the future. Boland summed it up perfectly when he said, "if we switch to $CO_2$, then it's done. There is no need to have any phase-down in the future because when we have $CO_2$, then it's done all over the world and we should do it not for commercial aspects alone but for environmental reasons." RD

# CARREFOUR'S INNOVATION FORUM COMPETITION FOR NATREF SOLUTIONS GROWING

When the world's second-largest food retailer handpicks suppliers to display their best refrigeration technology, the result is a showcase for natural refrigerant-based solutions.

— By Nina Masson

In an unusual 'Innovation Forum' that filled up two small halls with equipment suppliers, Carrefour, the French food retail giant, set the stage for an all-in-one discussion about the competition between natural systems, the trend toward smaller stores, and the need for integrated HVAC&R solutions.

Carrefour designed the private forum, held on 21-22 October in Les Ulis, France, to familiarise its technical directors, store designers and business development managers, who descended from Carrefour locations around the globe, with the best available natural refrigerant technology.

While lighting, solar power, geothermal energy and energy efficiency tools were represented at the forum, there was no doubt that HVAC&R solutions lie at the heart of Carrefour's continued quest for innovation. As such, a clear majority of booths were dedicated to refrigeration, air-conditioning and heating solutions, of which most were $CO_2$ or hydrocarbon-based systems.

The requirements set out by Carrefour in selecting suppliers were such that the entire spectrum of Carrefour's refrigeration needs were represented, from the smallest CVS store to the largest hypermarket, and from urban stores to remote locations.

Among the manufacturers selected to present their technology at the forum were Advansor, AHT, Alfa Laval, Carrier, Epta (Bonnet Névé), Hauser, Johnson Controls, Sanden, SCM-Frigo and Tripleaqua.

Products ranged from integrated solutions covering all refrigeration, heating and cooling needs for discount markets, to plug-in systems and condensing units for convenience stores, as well as third-generation $CO_2$ transcritical booster systems for larger stores. The forum also featured propane chillers with plug-and-play functionality that rely on off-the-shelf components.

## And the winner is… Naturals?

With the EU F-gas Regulation driving change among Europe's food retailers, natural refrigerant technology providers have high expectations that demand for their systems will increase. Forecasting the market share of $CO_2$, hydrocarbons and other natural refrigerants in Europe, Giovanni Dorin, Marketing Manager for Dorin, the Italian compressor manufacturer, said $CO_2$ could account for as much as 50% of the total commercial refrigeration market by 2030.

Other suppliers are even more confident. Italian system manufacturer Epta suggested that between 2020-2022 the majority of systems would be natural, with $CO_2$ and propane accounting for the highest market shares. "I don't think we will be so sensitive to which refrigerant is inside the product, provided it is natural," said Epta's Francesco Mastrapasqua, Sales and Marketing Manager for Refrigeration Systems. "We will not wonder any more if it is 20% $CO_2$ or 80% propane or the other way around, provided we deliver safe and sustainable products."

Sanden's European Sales & Marketing Manager Sylvain Gillaux said that natural technology will ultimately take the lion's share of the market, but saw HFOs as an interim solution, "disturbing the market for a short time period" leading up to 2020.

When analysing the competition between fluorinated gases and natural refrigerants, most suppliers were clear in stating that the market was moving towards the latter. "If it was only up to us, we would love to have already reached this point," Gillaux said. "We think that in any case HFCs will in some years be history.".

Dorin stated that the future for synthetics refrigerants was "very vague at the moment" and that while they could find their place in some applications, the long-term trend is natural refrigerants. "Absolutely. If you can use [a natural refrigerant], use it! Even if the system is costing a little bit more in the set-up costs, you take back the costs in a very short time."

Marco Caretto, Carel's Group Head of Sales, Retail and Refrigeration, and Diego Malimpensa, Carel's Business Unit Manager for Retail Solutions, predict a very limited market share for non-natural refrigerant solutions in Europe if system manufacturers can successfully deliver tried-and-tested solutions to warmer climates in the south of Europe.

Epta said that HFC-based equipment still represented valuable baseline technology to compare natural systems to for costs and performance. On the other hand, "the small river that was $CO_2$ some years ago is now becoming a flood because nothing more needs to be shown to the market to convince them, so I'm sure that today it is definitely standard technology," an Epta representative said.

## Comparing $CO_2$ and HCs

It would be naïve to suggest we are down to competition between natural refrigerant solutions only. But in comparing natural solutions, a representative for controls and valves supplier Carel believes that just charge limits and other regulations will determine their use: "Definitely it will be small plug-in units with propane; $CO_2$ for the rest."

Sanden believes that while the flammability of hydrocarbons (HCs) does not represent a risk per se, national regulations have limited their use in stores. This is particularly true in Europe, where Japanese supplier Sanden aims to fill that gap by entering into a partnership with Austrian manufacturer Hauser for their $CO_2$ semi-plug systems.

$CO_2$-only technology provider Advansor sees HC-based technology as a serious contender for its growing product portfolio for all store concepts -- from integrated systems for heating, refrigeration and cooling needs, to smaller standardised packs, and next-generation $CO_2$ booster systems.

Epta does not believe food retailers need to choose $CO_2$ above hydrocarbons, or vice versa, but should rather take advantage of "the best of each to respond to different market needs," said the spokesperson. "Both are available, both are reliable, both show excellent results for our customers, and we are going to make wide use of the two in our product range." As a symbol of this, Epta, one of the few companies offering both HC and $CO_2$ solutions, displayed a $CO_2$ water-loop system, which achieves high efficiency in combination with simplicity in design and operation, as well as various propane-based merchandising solutions.

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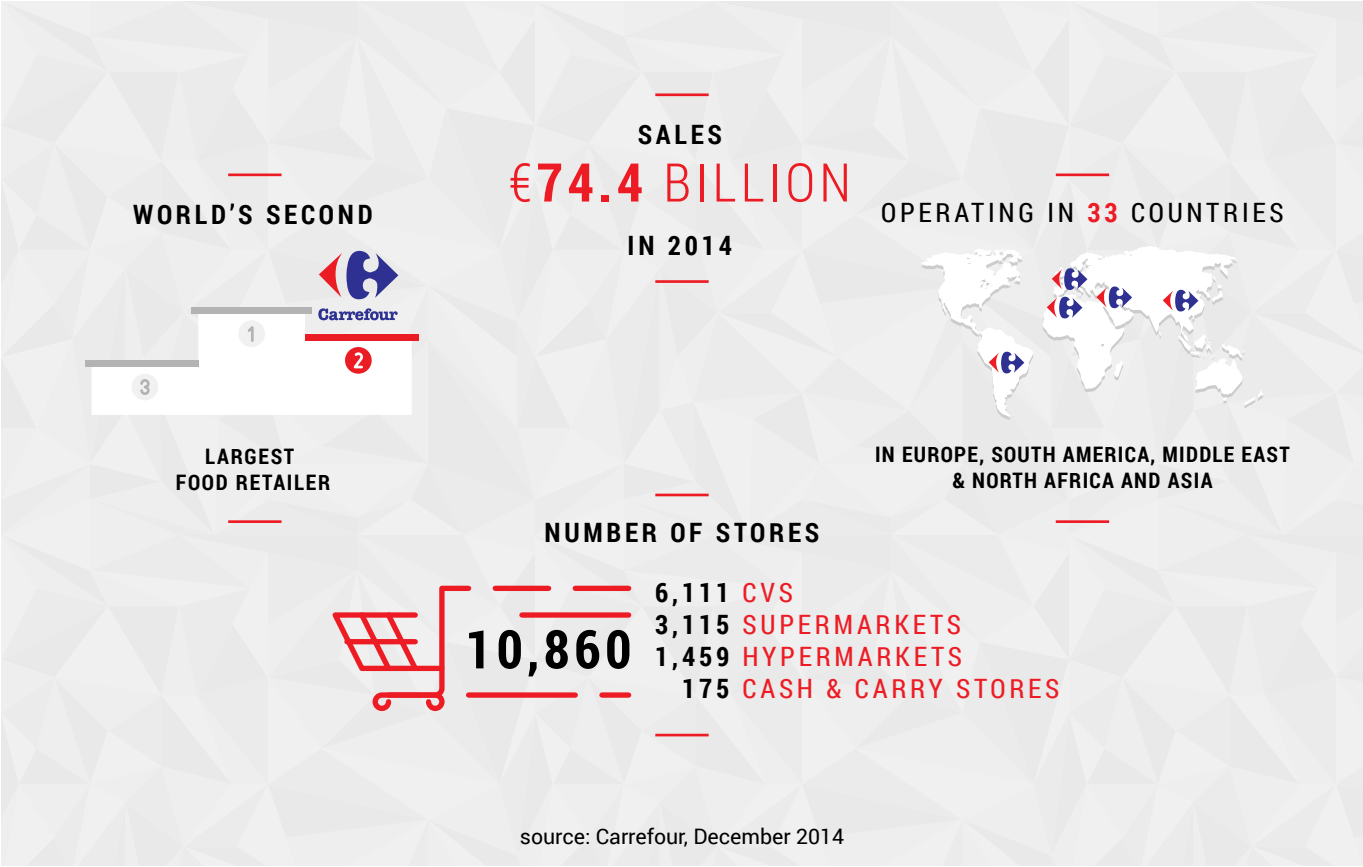


With $CO_2$ and HC solutions sharing more and more market applications, the boundaries between light-commercial and commercial applications are starting to dissipate. Johnson Control's plug-and-play low-charge propane chiller for hypermarkets is one such solution that transcends traditional application limits for natural refrigerants.

## CVS trend undeniable

Germany-based system manufacturer Carrier has concentrated its efforts on offering customers a better urban shopping experience with thinner multideck cabinets and vertical freezers with deeper shelves. Its ultra-narrow medium-temperature (Optimer) and low-temperature (Velando CS) cabinets are especially suited for convenience stores, and fitted with remotes for $CO_2$ and propane plug-ins. The systems save up to 35% in total energy consumption.

Carrier's competitors confirmed that the move to CVS stores is one of the most dominant trends in the European commercial sector, with this store segment showing the highest growth rates overall. Hauser's International Sales Director Markus Lichtenwallner believes standardised plug-in $CO_2$ systems with simple connections to water-loop systems would continue to emerge rapidly on the CVS market. Hauser is confident that this will be the right solution "for smaller stores, express stores and convenience stores."

## All-in-one thinking

Another major trend is the move towards integrated system solutions covering a store's entire refrigeration, cooling and heating needs. Against the backdrop of more and more energy-efficient buildings across Europe, the food retail sector is charged with finding better refrigeration solutions, particularly as HVAC&R will account for a large share of a building's total energy demands in the future. All suppliers confirmed that they are in some form or another already working on making such integrated solutions available to the market.

Hauser is confident that its concept of connecting the refrigeration system to a heat pump in a fully integrated $CO_2$ solution for the entire store will be what the market is seeking.

Market leader Carrier will concentrate its efforts on recouping excess heat from its refrigeration systems. The company has developed a standardised add-on heating module with full remote monitoring capability to optimise its operation for different heating and domestic hot water settings.

Lastly, Dorin said it was ready to support the industry, confirming that the shift towards integrated systems was the "main and the most interesting trend." NM

# LEADING $CO_2$ TECHNOLOGY

# FOR COMMERCIAL AND INDUSTRIAL REFRIGERATION

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# ATMOsphere EUROPE

## WARMING TO BARCELONA FOR 2016

— By Linda Toivio

**FRANZISKA MENTEN**
Head of Global Events
franziska.menten@shecco.com

Focusing on the latest trends and innovations in natural refrigerant technology, the ATMOsphere conferences have become something of an industry institution since their inception in 2009. And, although the 2016 edition of ATMOsphere Europe is still some months away, shecco's Global Head of Events Franziska Menten is readying her team to canvass ideas and tackle challenges in high ambient temperatures at the source, with the conference moving from its regular home in Brussels to Barcelona for the first time.

In relative terms, Menten is a veteran of the ATMOsphere circuit, having attended 26 previous events while already preparing what will be her seventh ATMO Europe, when Barcelona steals the limelight next 19 and 20 April. More end user sessions are planned as manufacturers, too, are presented with the ideal stage to bring their attention and technology to one of Europe's warmer climates in the South.

With natural refrigerant technology constantly evolving it seemed only natural that ATMOsphere Europe should voyage south to the heart of the next frontier. Next year's event will cast a particular focus on new market players based in the Mediterranean region, interested or already working with systems using $CO_2$, ammonia, hydrocarbons or water as refrigerants.

"The event is expected to attract over 300 industry experts, therefore networking is a significant reason to participate," Menten explained. "ATMO Europe offers a truly unique setting for building lasting partnerships and promoting business".

Among a number of the conference's focal points, Menten mentions the five-year vision for natural refrigerant technology in HVAC&R sectors and the lingering challenge posed by synthetic HFCs and HFOs. The policy dimension will include the impact and implementation of European and national F-gas regulations as well as the healthy competition generated between natural refrigerant solutions as the application boundaries between light-commercial, commercial and industrial sectors gradually dissipate. ATMO Europe will investigate what Europe can learn from other regions using natural refrigerant technology and what they, too, can learn from the unique challenges faced, and conquered, in Europe.

### SERIES OF FIRSTS FOR ATMO EUROPE

Staying true to its reputation, ATMOsphere Europe 2016 will offer participants a comprehensive two-day programme of end user, supplier and policy panels, as well as market and technology case study sessions, site visits and training workshops, among others.

One of the fastest growing sectors for natural refrigerant-based technologies in Europe is the Horeca (Hotel/Restaurant/Café) sector. The burgeoning sector will be one of a number of new topics including a discussion on effectively marketing natural refrigerant technology without 'green-washing', the huge potential for transport refrigeration technology, the latest trends in household refrigeration, as well as end user panels from light commercial to industrial refrigeration.

On the second day of the programme, the inaugural Accelerate 2017 Awards will be announced, highlighting the outstanding achievements of individuals leading the transition towards natural refrigerant-based technologies in Europe. LT

# ATMO sphere

## WORLDWIDE EVENTS IN NUMBERS

FROM 2009 UNTIL 2016

**31** INTERNATIONAL ATMOs


**540** EXPERT SPEAKERS

- **31%** END-USERS
- **25%** SYSTEM SUPPLIERS
- **17%** POLICY
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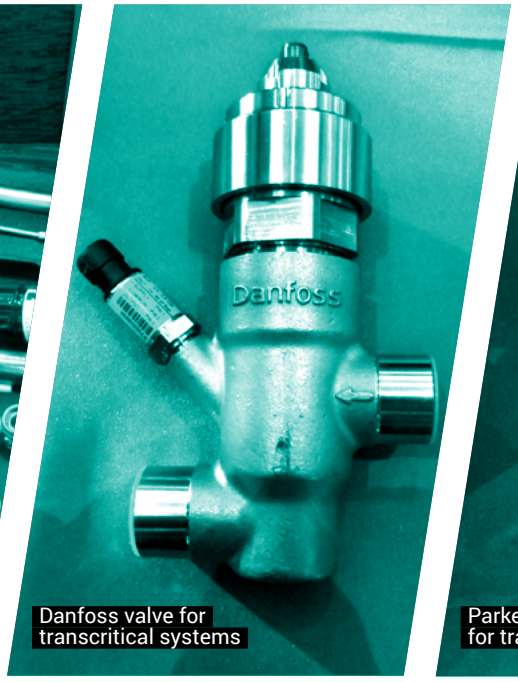
Mueller tubes and fittings for transcritical systems



Danfoss valve for transcritical systems


Parker Sporlan controller for transcritical systems

# NATURALS MAKE WAVES AT FMI E+SD CONFERENCE

At the Energy & Store Development Conference in San Diego, vendors discussed the SNAPhydrocarbon proposal, and new $CO_2$ and ammonia systems for supermarkets.

— By Michael Garry

At the Food Marketing Institute's 2015 Energy & Store Development (E+SD) Conference, held Sept. 27-30 in San Diego, a large room at the Sheraton Hotel was on two occasions filled up with equipment suppliers and retailers at what as dubbed the Manufacturer-Retailer Exchange. The room buzzed with activity, thanks to a record conference attendance of more than 600.

Accelerate America had the opportunity to chat with passers-by to find out what suppliers were saying about the adoption of their natural-refrigerant solutions at supermarkets in North America. Here's a sampling of what they said.

## CARTER'S UPCOMING SNAP PROPOSAL

While the majority of frozen and refrigerated cases in North America supermarkets are tethered to refrigeration racks situated in a machine room, there is growing interest in self-contained cases that employ their own hydrocarbon-based condensing units.

Birmingham, U.K.-based Carter Retail Equipment hopes to bring its popular self-contained hydrocarbon cases to North America. Carter's hydrocarbon cases, which use propene (R1270), are widely employed by the Waitrose supermarket chain in the U.K.

Tesco is testing the system at one store in Thailand while Cole's has a test in Australia. R1270 offers a 16% better capacity than R404A, said Geoff Amos, Carter's head of sales and marketing.

Waitrose's cases contain between 300 and 1,000 grams of propene, well above the 150-gram limit in the U.S. However, Carter plans to submit a draft proposal for an increase in the hydrocarbon charge limit to the EPA SNAP (Significant New alternatives Policy) programme later this year. The EN (European norm) 378 standard differs considerably, allowing up to 1,000 grams of hydrocarbons in equipment below ground and up to 1,500 above ground.

Some U.S. food retailers are already testing self-contained cases using 150 grams or less of hydrocarbon refrigerant, including H.E. Butt Grocery Co., Lowe's Markets, ShopRite (Wakefern Corp.) and Whole Foods Market. Whole Foods and ShopRite are already testing AHT Cooling Systems USA, a subsidiary of its Austrian-based parent company, which also had a table at the FMI E+SD Conference.

A representative of AHT said that the company is gaining traction in the U.S. with highly efficient modular islands and spot cases using hydrocarbon propane (R290). Next year, AHT will introduce multi-deck and vertical merchandisers with propane refrigeration to the U.S. market.

## HUSSMANN, LMP INSTALL FIRST $CO_2$ TRANSCRITICAL SYSTEM

Hussmann, in its alliance with Systemes LMP, has installed a Purity transcritical $CO_2$ system at an Aldi store in West Seneca, New York.

This is the first Hussmann/LMP transcritical system installed in the U.S., opened on 1 October. "Aldi is one of our biggest customers for our Protocol distributed systems, which reduces the amount of refrigerant and better matches loads," said technical sales specialist Chris Culhane.

Because of its northern climate, the West Seneca store's transcritical system does not incorporate LMP's patented mechanical subcooling system, which enables transcritical units to operate efficiently in warmer climates.

Aldi's is also installing a transcritical system from Hillphoenix in another store in New York. The store will also have self-contained cases using propane as a refrigerant.

## NEW $CO_2$ COMPONENTS SHOWCASED

At the event, the Sporlan Division of Parker Hannifin showcased its new range of valves and controllers rated 140 bar while Danfoss showed off its new control valve, both for transcritical $CO_2$ high-pressure systems.

The Sporlan line features five gas cooler valves (GC-10, -20, -30, -40, and -50) for system capacities from 7 to 200 Ton (25 to 700 kW). The gas cooler/flash gas bypass valves allow for fine pressure tuning in transcritical operation and can also be applied in heat reclaim applications to modulate the flow to subsequent reclaim coils.

Danfoss' new control valve can be used as a high-pressure or gas bypass valve. The valve, which comes equipped with a pressure transmitter, is designed specifically for commercial transcritical applications in food retail.

Hans Matthiesen, Danfoss's global segment director said the new valve has connections for Wieland's K65 high-pressure copper/iron tubing as well as stainless steel tubing. "Many are switching to the K65," said Matthiesen.

## THE NEW DANFOSS VALVE WILL BE APPROVED AND INSTALLED IN FIELD TRIALS IN THE U.S. AND EUROPE.

Carel spoke about its Heos waterloop system, which removes condensing heat from plug-in units in self-contained refrigeration systems, including those that use $CO_2$. These self-contained systems can be easily moved around the store and are very leak-tight, noted Mike Tokarsky, Carel USA's Midwest regional sales manager.

$CO_2$ versions of Howe Corp.'s icemaker machine, which produces ice flakes in supermarkets, are installed at a Boston Roche Bros. store and a Brooklyn, New York, Whole Foods outlet.

Howe's machines, which produce between one thousand and four thousand pounds of ice per 24 hours, employ subcooling to maintain temperatures at -5.6°C. MG

# TOGETHER STRONGER
## GUIDE NORTH AMERICA DRAWS PARALLELS TO EUROPE

*— by Robert Davidson*

shecco's GUIDE to Natural Refrigerants in North America – State of the Industry 2015 shows that while North America trails in the number of stores using natural refrigerants, they have a few lessons to teach Europe in industrial refrigeration.

As natural refrigerants continue to improve their market share in all major economies, GUIDE North America reveals that while North America excels at industrial refrigeration, the region still has a number of lessons to gleam from Europe.

With over 200 low-charge ammonia installations, 70 $CO_2$ cascade/secondary systems and 46 $CO_2$ transcritical installations, the North American industrial refrigeration sector is booming with natural refrigerants. This is complemented by the region's strong tradition of using ammonia, which is used in over 90% of large industrial installations.

While Europe is also accelerating its deployment of "next generation" installations, the United States' usage of low-charge ammonia systems for smaller applications is a road that Europe can also follow as it continues its f-gas phase-down.

### American supermarkets opening doors to $CO_2$ transcritical

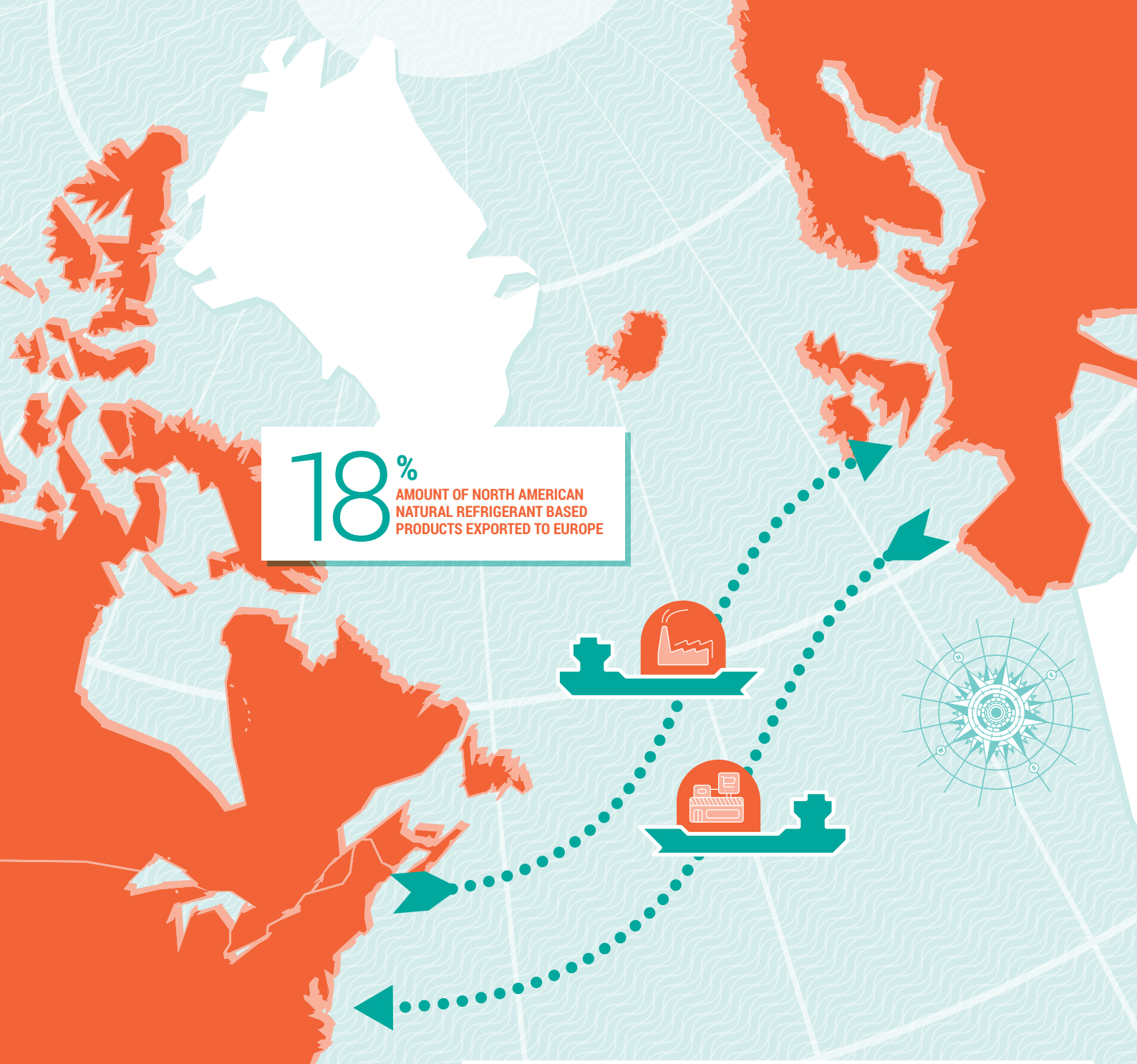
While North America leads the way in industrial refrigeration, the GUIDE also revealed where development falls far behind Europe, namely natural refrigeration installations in commercial refrigeration. Europe has over 5,500 stores using $CO_2$ transcritical solutions, a number that dwarfs that of North America's 191.

This large disparity is due to the relative infancy of transcritical supermarkets in the U.S., with the first installation completed only three years ago. It will be some time before the numbers for both continents converge, but it is an area where Europe can help, not just where transcritical supermarkets are concerned but for hydrocarbon plug-in units. Already, European suppliers are seizing such opportunities by bringing their proven technology to the United States.

While both regions have their respective areas of excellence, it is in the technological areas that Europe and North America can work together to perfect technologies such as transcritical systems for warm ambient temperatures.

Trials are ongoing in both Europe and North America for the best ways to transplant $CO_2$ technology, already present in colder climates, to warmer climates, but with comparative levels of performance. Together, the final hurdles can be overcome and could potentially help the world market to follow RD


*shecco's GUIDE to Natural Refrigerants in North America – State of the Industry 2015 can be read online for free here: http://publication.shecco.com/publications/view/guide-north-america-2015*




## ATLANTIC EXCHANGE HELPING TO ADVANCE TECHNOLOGY

The continual advancement of natural refrigerant technology globally has opened up new avenues for companies to explore. The use of $CO_2$ transcritical refrigeration systems in supermarkets has made waves in North America with innovations in Europe being used to fill the vacuum that is being created due to increasingly stringent F-gas regulation in North America.

This relationship works both ways, even though 40% of natural refrigerant-based products and services stay in North America, the biggest export market, according to the GUIDE North America survey, is Europe with 18% of products or services heading that way.

This increasingly integrated market opens up possibilities for greater knowledge exchanges between the two continents that could push the capabilities and penetration of state-of-the-art technology in all major applications. This is particularly the case where North America is advanced, such as the use of natural refrigerants in small industrial applications.

# AN IRREVERSIBLE STAND ON NATURAL REFRIGERANTS

## Retail giant METRO AG is making natural refrigerants an integral part of its trailblazing environmental sustainability strategy

— By Janaina Topley Lira & Nina Masson

**One of the largest international retailing and wholesaling companies, Düsseldorf-based METRO AG (also known as METRO GROUP), has made a name for itself globally as an environmental leader.**

The Dow Jones Sustainability Index, the most well known sustainability ranking, rated METRO AG the best performing company in the Food & Staples Retailing Industry in 2015. On top of that, METRO was included in the FTSE4Good Global and FTSE4Good Europe Index.

Cementing the Group's reputation is its pioneering F-Gas Exit Program. A cornerstone of the company's emissions reduction strategy, it will see METRO phase out f-gases by 2025, replacing them with natural refrigerants in all store locations worldwide, where technically feasible.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The man whose job is to oversee this change is Olaf Schulze, Director, Energy and Management. Trained as a lawyer, Schulze is a fast talker and a quick thinker. After joining METRO AG in 2005, he initially found success working on the retailer's energy reduction strategy. In less than two years he managed an impressive 10% decrease in energy consumption.

Now an expert on the subject, he has authored several scientific papers on energy management, and has even published an article about the Group's energy initiatives in the book "CSR und Energiewirtschaft" (Energy and Corporate Social Responsibility).

In 2013, Schulze embraced a new challenge. Following a decision by the METRO AG Sustainability Board to transition away from f-gases, Schulze has been working hard to ensure the company adopts natural refrigerants to become more sustainable. Under his leadership the company has already introduced natural refrigerants at 8 distribution centres including over 34 $CO_2$ transcritical systems at Cash and Carry stores in Germany, France, Poland, Romania and Spain.

"In our internal processes sustainability is a major driver for us," enthuses Schulze. "We are internalising sustainability into more and more products we are selling, into our behaviour with our customers, and with our employees."

"We take enormous pride in being at the top of the DOW Jones Sustainability Index. A lot of hard work has gone into being where we are today. We started working on these strategies in 2010 and earlier, and it has taken three to four years to achieve this success."

"In our internal processes sustainability is a major driver for us. We are internalising sustainability into more and more products we are selling, into our behaviour with our customers, and with our employees."

## With great power comes great responsibility

METRO was founded in 1964 by Otto Beisheimin in Mülheim an der Ruhr, Germany. Its revolutionary cash-and-carry concept was an instant hit. Customers flocked to the self-service, bulk-buying store and it wasn't long before several more opened.

Today, the Group operates around 2,200 stores in 30 countries, including around 760 METRO stores and almost 300 Real hypermarkets. Its sales divisions include METRO/MAKRO Cash & Carry stores, a leader in self-service wholesale, Real hypermarkets, and Media Markt and Saturn, its consumer electronics stores.

With sales in 2014/2015 of around €59 billion, it is one of the biggest retail groups in the world. A global player, METRO's size and influence come with certain responsibilities. One of these, according to Schulze, is the obligation to be a technology front-runner. "We have to use our strengths, such as our internationality and our first-mover mentality, to pilot and test new technologies."

This explains why METRO has factored environmental sustainability and energy efficiency into the core of its business. It also explains why the Group regularly investigates alternatives to traditional technologies. Its ambition is to drive technology change, not to follow it.

It is precisely this ambition that led the company to pilot its first $CO_2$ refrigeration installation in a store in Hamburg, Germany, in 2008. With refrigeration responsible for more than 20% of the company's greenhouse gas emissions, METRO AG was eager to find a way to reduce this negative environmental impact.

Two years later, METRO publicly committed to the Consumer Goods Forum (CGF) pledge to begin phasing out climate-damaging HFCs (hydrofluorocarbons) in 2015, publishing plans to use only natural refrigerants in new refrigeration equipment installations. This commitment was made not only by the METRO AG board in Germany, but also by the local boards of the 26 countries METRO operates Cash & Carry stores.

## A selfless, inspiring leader

As he describes it, "a good manager is someone who is sufficiently inspired to motivate others, and who has loyal, enthusiastic employees. I am not alone. Behind me are many colleagues who share the same convictions."

So how does Schulze find the inspiration to motivate his colleagues? He never stops learning, visiting the stores of his competitors to find out about the latest environmental technologies. For example, on a recent family vacation to Ireland, he took the opportunity to see Ireland's first "eco" store in Tramore, designed to the internationally recognised PassivHaus standard. A trip to visit his oldest son in Iowa, US, saw him drive his entire family to Wichita, Kansas, to visit the first Walmart Neighbourhood Market to feature all-LED lighting.

Schulze's insatiable curiosity and ability to apply a systematic approach and attitude to thinking and acting have helped make him an expert in energy management and sustainable building innovation. But it is his belief that each of us has a responsibility to preserve the natural environment that really pushes him forward. "For me it is clear that we have to save our environment for our children."

The father of four sons, Schulze is keen to instil in them a sense of environmental responsibility. As such, in the Schulze household, from March to October, all the men in the family shower in the garden so as to reuse the wastewater to water the plants. Being a good environmental steward is much more than just a day job.

As he says, "To be sustainable is to save our future."

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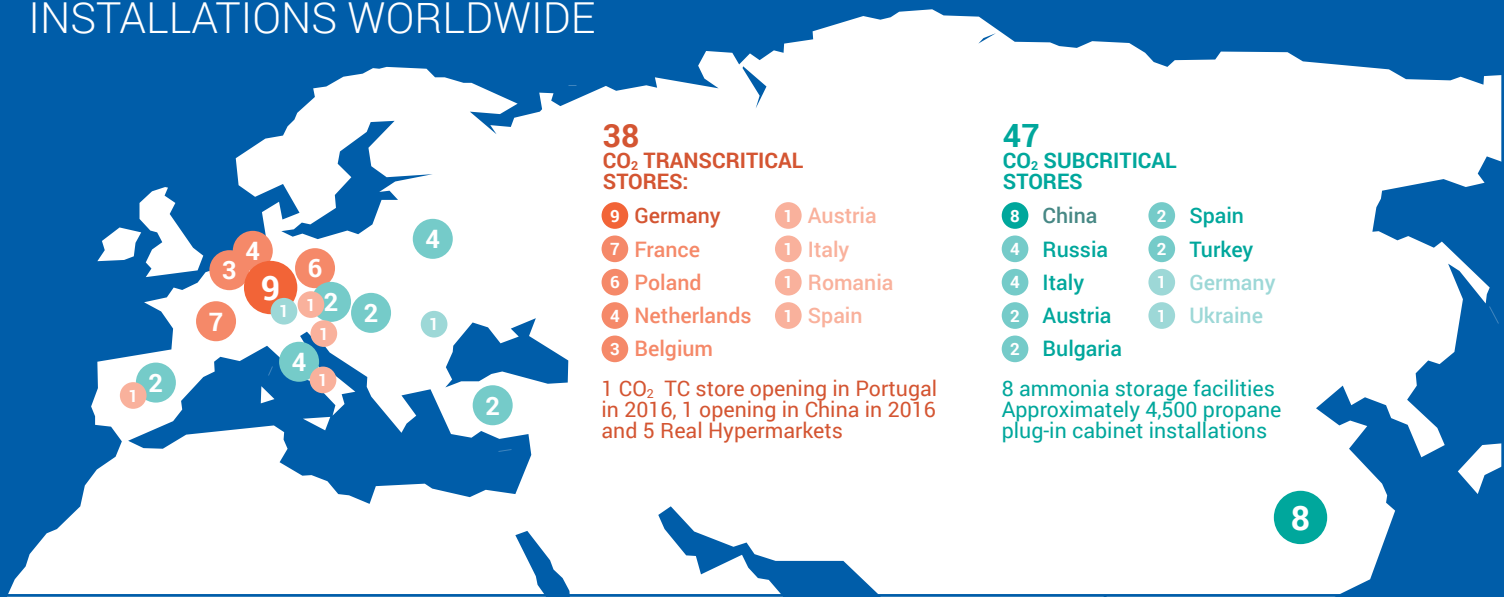
## **METRO'S** NATURAL REFRIGERANT INSTALLATIONS WORLDWIDE




## First-of-its-kind Exit Program to phase out f-gases

As Schulze explains, the decision to introduce natural refrigerants across all of the Group's stores worldwide was not an easy one. But in July 2013, after considerable debate and discussion, the Sustainability Board agreed to introduce the F-Gas Exit Program. Its priority: to replace existing refrigeration equipment with natural refrigerant technology.

One of the Group's biggest investment plans, The F-Gas Exit Program costs an estimated €1 billion. The sheer scale of the investment underlines the company's commitment to natural refrigerants. "It costs a lot of money, but represents a huge opportunity to save our environment and reduce our energy demand," says Schulze.

An important part of the Program is "business as usual." This means taking the opportunity to introduce state-of-the-art refrigeration technology when current equipment is near the end of its life, which can be anywhere between 18 and 25 years after its initial start-up.

To illustrate this point, Schulze uses an automotive analogy. "My old car is ten years old and when I have to replace it, I am not going to buy a new vehicle built using old technology. I am going to buy a new car, built to new standards. The same is true of refrigeration equipment. We have to buy new equipment built to modern standards, not new equipment built to old standards." For METRO, state-of-the-art, or modern, means using natural refrigerants.

Deciding where to begin exchanging refrigeration systems, however, was a difficult task. It required an analysis of METRO's entire installed base of refrigeration systems, taking into account refrigerant type, age of the system, leakage rate, depreciation status, and whether the equipment was located in an EU or non-EU state.

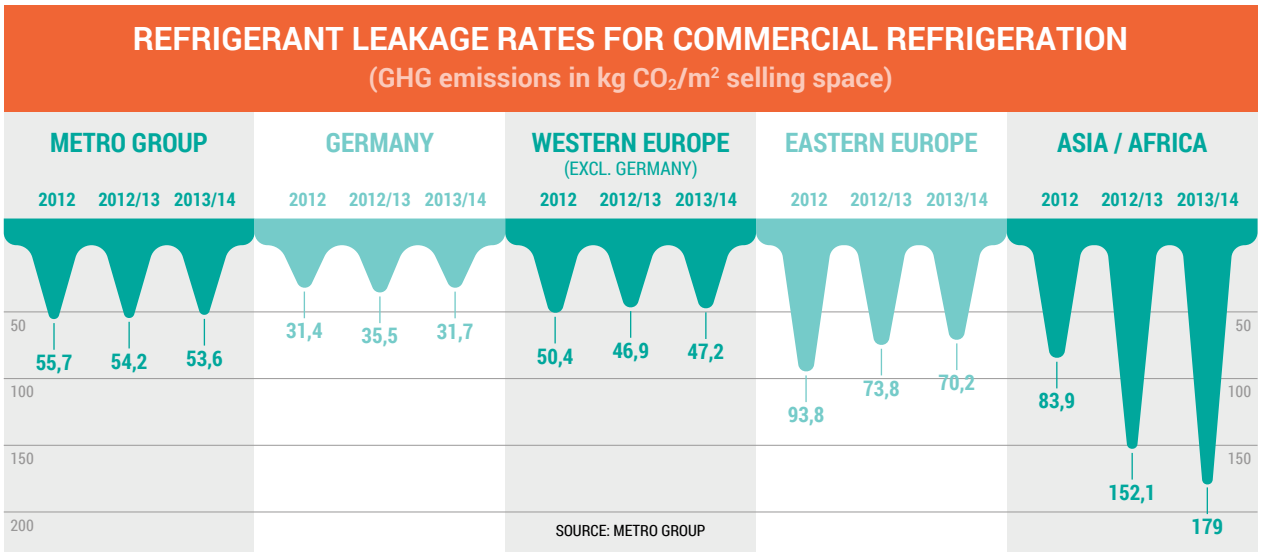
"We undertook extensive internal research, looking at all our equipment, and in the end we came up with a five level ranking system," Schulze explains. "We calculated a system's depreciation time as being on average 15 years. Then we decided that for each negative aspect of a system we would award one point. Very old equipment, older than 20 years for example, received an extra point. For refrigerant type, the use of R404A was awarded five points. The use of R134a, on the other hand, was awarded only one point, primarily because under the EU's revised F-Gas Regulation, R134a will still be allowed after 2020."

Based on the results of this analysis, the Group plans to replace f-gas equipment with natural refrigerant solutions in 58 stores in 2016, 62 stores in 2017, and 37 stores in 2018.

Inevitably, some fluorinated equipment was installed just before the F-Gas Exit Program was introduced, whose life cycles will come to and end in 2026 or 2027. These will have to be converted to natural refrigerants after 2025. Despite the lengthy cycle, Schulze has full confidence that the F-Gas Exit Program will prove a success. "I believe that in ten or eleven years time the roll-out of natural refrigerants across all our stores will be almost finished."

By 2025, he estimates that METRO will have stopped using f-gases in around 90% of its stores. Overall, 680 stores will be affected.

"We are on track to open, on average, 50 natural refrigerant stores every year," says Schulze, adding that a key lesson is that the F-Gas Exit Program is not a fast-moving strategy. "It is a long-term plan, one which required a relatively long time to prepare and one which will take a relatively long time to execute."




## Three-pronged strategy

One of three pillars of the F-Gas Exit Program, the shift to natural refrigerants goes hand in hand with leakage prevention through proper maintenance, and maintenance of detailed records for each refrigeration system, known as the refrigeration system logbook (LOCS).

Refrigerant losses are a major source of greenhouse gas emissions, as well as being a significant cost factor for the company. With METRO aiming to reduce emissions from refrigerant losses by 29% by 2020, proper equipment upkeep is essential.

If there are leaks, LOCS, the electronic repository for data on leakage, which is adapted to the METRO Group energy management system, helps to identify them early on, thereby shortening response times. The database makes it very clear what the leakage rate is across different regions, enabling local METRO boards to keep track.

Together, LOCS and the timely servicing of equipment have enabled METRO to reduce leakage rates, including accidents, by almost three percentage points. Between 2014 and 2015 the rate shrank from 14% to 11.1%.

Explaining the success of this triple approach, Schulze says, "time is money. When a leak is found we have a very fast reaction time, both from our repair teams and from the technicians of our industrial partners. Although we have a way to go to achieve our long-term target of a 5%-6% leakage rate, we are succeeding in our efforts to reduce the number of leaks."

## Global rollout of natural refrigerants

For any international company one of the key challenges in switching to a new technology is having qualified technical support on the ground. METRO stores are spread far and wide across the globe; thus the switch to natural refrigerants has required significant investment in technician training and education.

As Schulze says, "one of the lessons we have learnt is that you cannot expect to find the same level of technical knowledge as you find in Central Europe all around the world. This has been our experience in India, for example, which is one of the countries in which we are expanding rapidly. We currently have 16 stores in India and in order to transition to natural refrigerants we have had to ensure we have fully trained technicians who can provide support, maintenance and repair."

A second challenge is the negative impact high ambient temperature has on the efficiency of $CO_2$ refrigeration technology. For METRO to successfully switch to naturals, this newly adopted technology has to operate efficiently in all of the countries in which the Group operates. Fortunately, the very latest $CO_2$ refrigeration innovations, which include parallel compressions and ejectors, are now making this transition possible.

"To roll out natural refrigerants worldwide, the technology had to work in our stores in Spain, Portugal, Turkey and India," says Schulze. "And I am happy to say that the latest $CO_2$ innovations have enabled us to open our very first $CO_2$ transcritical store in Madrid, Spain, and that in the 2016 fiscal year we will open our first transcritical store in Portugal."

What is more, the industry continues to make new breakthroughs in $CO_2$ technology. METRO is now installing what Schulze considers to be "$CO_2$ technology 3.0," and he is enthusiastic about the future. "Who knows what the technology will look like in 2025. We may not be talking about ejectors anymore, but another new, cutting-edge technology. Whatever it is, we hope to be the front-runner when it comes to using the next generation of this technology."

continued on p.40


SOURCE: METRO GROUP – CORPORATE RESPONSIBILITY REPORT 2013/14

## Utilising heat recovery

For METRO GROUP, using waste heat is important. In many of the countries in which the company operates, adding heat recovery to the $CO_2$ refrigeration equipment is a minimum requirement. "Our dream is to avoid the need for additional heat sources in stores where we have a refrigeration system installed," says Olaf Schulze, Director, Energy and Management.

Beyond its stores, METRO also uses heat recovery and natural refrigerants in its refrigerated warehouses. Ammonia is used in nearly all of the Group's German warehouses, including in Bremen. Comprising an area of 4,400m², an air-cooled, two stage ammonia refrigeration system ensures the temperatures in Bremen stay between a cool -24°C and 12°C. The installation recovers waste heat from the oil coolers to warm the service water.

In other warehouses, ammonia refrigeration has been installed, including a Moscow cold storage unit in Noginsk, and in the Gross-Gerau Logistics Centre, near Frankfurt, Germany. The latter was awarded the German Sustainable Building Certificate for its construction method and processes.

With regards to transport refrigeration, the Group is still exploring natural refrigerant options. With only 150 trucks in its fleet, Schulze admits that changing refrigerants in METRO vehicles is not a priority. Therefore, for the foreseeable future, the focus will continue to be on greening store operations.

## International cooperation paves the way, local regulations remain a problem

In Schulze's words, $CO_2$ refrigeration represents a huge opportunity for METRO to move away from a technology of the early nineties and implement a technology that will help them to future-proof their business.

However, this has meant a steep learning curve. Meeting this challenge has required the Group to leverage their internal strengths and exchange best practices between countries. "To accelerate the roll-out, we must learn from each other," says Schulze.

Knowledge sharing is central to METRO's plans to open its very first $CO_2$ transcritical store in China in 2016. This follows the opening of the company's first $CO_2$ cascade system in the country in 2014. A collaborative effort between local companies Fute and General Fushi, METRO's Weifang store uses 18% less energy than a comparable store built in 2012. For the METRO Group, one thing is certain. Their expansion into China will rely on the use of $CO_2$ refrigeration.

The company is also one of only a few retailers investing in natural refrigerants in Russia. "We will install natural refrigerant systems in five new stores this year, for which of course we will need to ensure we have sufficient local expertise to guarantee system maintenance," says Schulze.

But Schulze is optimistic. "The bottom line is that technology change is possible, and we are making it possible in Russia."

International cooperation is also critical to reducing leakage rates. "Whether in Siberia or southern Spain, we have to have the same technical support as in Düsseldorf, Germany. Our success depends on the in-depth knowledge of our technical employees, coupled with widespread awareness of the need to reduce f-gas emissions from our local boards."

Whilst discussions with international partners on how to transition to natural refrigerants have been largely fruitful, Schulze says the company has encountered opposition. "We sometimes encounter technical resistance from local governments. As a result, it is not possible for us to select from all of the available natural refrigerant solutions. Our options are narrowed, forcing us to focus on one technology."

China is a case in point. METRO is not allowed to install AHT's propane refrigeration solutions, a technology allowed in many other countries. Seeking to overcome this issue, METRO is working closely with local associations and trade unions to drive regulatory change.

Alongside these discussions, METRO is also investing in pilot installations that people can visit, to prove the safety and efficiency of different natural refrigerant technologies. In Namur, Belgium, for example, an all-propane METRO Cash and Carry store was recently opened.

## The future is natural

METRO's faith in natural refrigerant technology may be rock solid, but the company has its work cut out when it comes to convincing store operators that there is sufficient availability from suppliers to meet servicing and maintenance needs and that it will not raise their costs.

"We know that we can bring this technology to Russia, India, or China," Schulze says. "The challenge relates to the price of natural refrigerant solutions and to ensuring their safe operation. For this, we have to convince people that this technology is widely available, produces the same cooling quality, and will not result in higher operating costs."

Could the decision to use natural refrigerants, and in particular $CO_2$ transcritical refrigeration, change? Not according to Schulze. "As a result of our efforts, I am confident that this decision is irreversible. All of the refrigeration systems planned in 2013 and built in 2015, and those that we will build in 2016 and so on, will use natural refrigerants. Every year we further entrench the use of natural working fluids, including $CO_2$, in METRO Group operations."

As the interview draws to a close, Schulze mentions an upcoming trip to Koblenz, Germany. He is excited to find out more about Globus' award-winning energy management practices. There is no doubt. Schulze's enthusiasm for sustainable construction is infectious. JTL & NM


## METRO's first Spanish $CO_2$ transcritical system

After opening its doors on 22 April 2015, Makro Madrid Barajas became the first of 37 Makro stores in Madrid, Spain equipped with a refrigeration system using only $CO_2$ as a refrigerant. It has since become a benchmark in cutting-edge technology for commercial refrigeration applications.

The flagship store, constructed on a 11,700m2 plot of land near Madrid's airport, had sustainability and energy efficiency at the heart of its build. Thanks to a €17 million investment, the Barajas store relies upon LED as well as natural lighting, and a $CO_2$ transcritical refrigeration system. As such it complies with the EU F-Gas Regulation as well as the Spanish F-gas tax.

Installed by Cofrico, the climate-friendly $CO_2$ technology has the following features:

- Independent cooling circuits
- 500kW cooling capacity for positive temperatures
- 100kW cooling capacity for negative temperatures
- Four gas-coolers, located on the building's roof
- An energy-saving system, which improves the Coefficient Of Performance (COP) of the circuits without modifying the system's performance
- A parallel compressor system, used when ambient temperatures are high
- Frequency converters on the compressors, evaporator fans and gas cooler, as well as on the economiser unit, maximising energy savings
- A glycol chiller system, used when ambient temperatures are high and when there are peaks in electricity demand
- Refrigerated cabinets equipped with doors, LED lighting and electronic expansion valves, complying with energy-efficiency requirements
- $CO_2$ detector-equipped cold stores and machinery. If necessary, the economiser and cold stores have safety valves to help relieve the pressure in low- and high-pressure circuits

In an article on R744.com, José María De Santos, project manager for the Makro Barajas store, says, "we chose $CO_2$ to move away from fluorinated gases and therefore minimise the impact of our activities on the environment by opting for natural refrigerant technology installations."

"Electricity demand in this kind of facility is very high and we expect to achieve significant energy reductions with this new system," De Santos continues.

Regarding the use of $CO_2$ in Spain in the coming years, De Santos was optimistic.

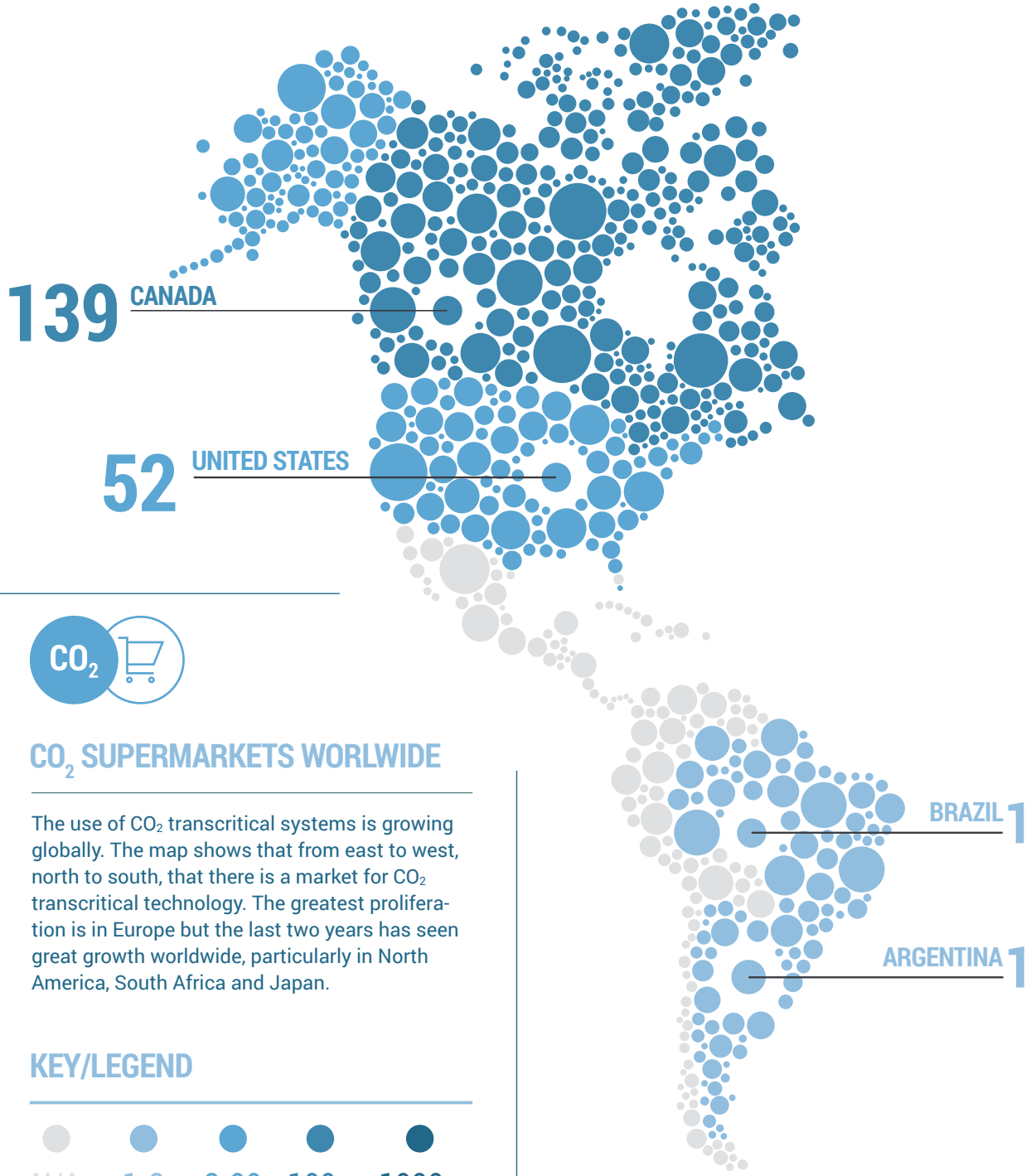
"Although the decision to either install a subcritical or a transcritical system could be determined by ambient temperatures in Spain or Portugal, I believe that $CO_2$ will become the dominant trend," he said.

## CANADA : 139

Canada leads the charge in North America, benefiting from $CO_2$ transcritical's excellent efficiency in low-ambient temperatures. Sobey's is the most proactive supermarket in installing $CO_2$ systems. Sobeys transition was accelerated in Quebec - where 63 of their installations are located - by subsidies provided by Quebec's OPTER programme.

## UNITED STATES : 52

The United States has improved its usage of $CO_2$ supermarkets with an increase from 2 installations in 2013 to 52 in 2015. While the United States may be behind in the total number of transcritical stores, they are at the forefront of technological advancements with innovative $CO_2$ installations in warm-ambient climates.




## $CO_2$ SUPERMARKETS WORLWIDE

The use of $CO_2$ transcritical systems is growing globally. The map shows that from east to west, north to south, that there is a market for $CO_2$ transcritical technology. The greatest proliferation is in Europe but the last two years has seen great growth worldwide, particularly in North America, South Africa and Japan.

## KEY/LEGEND

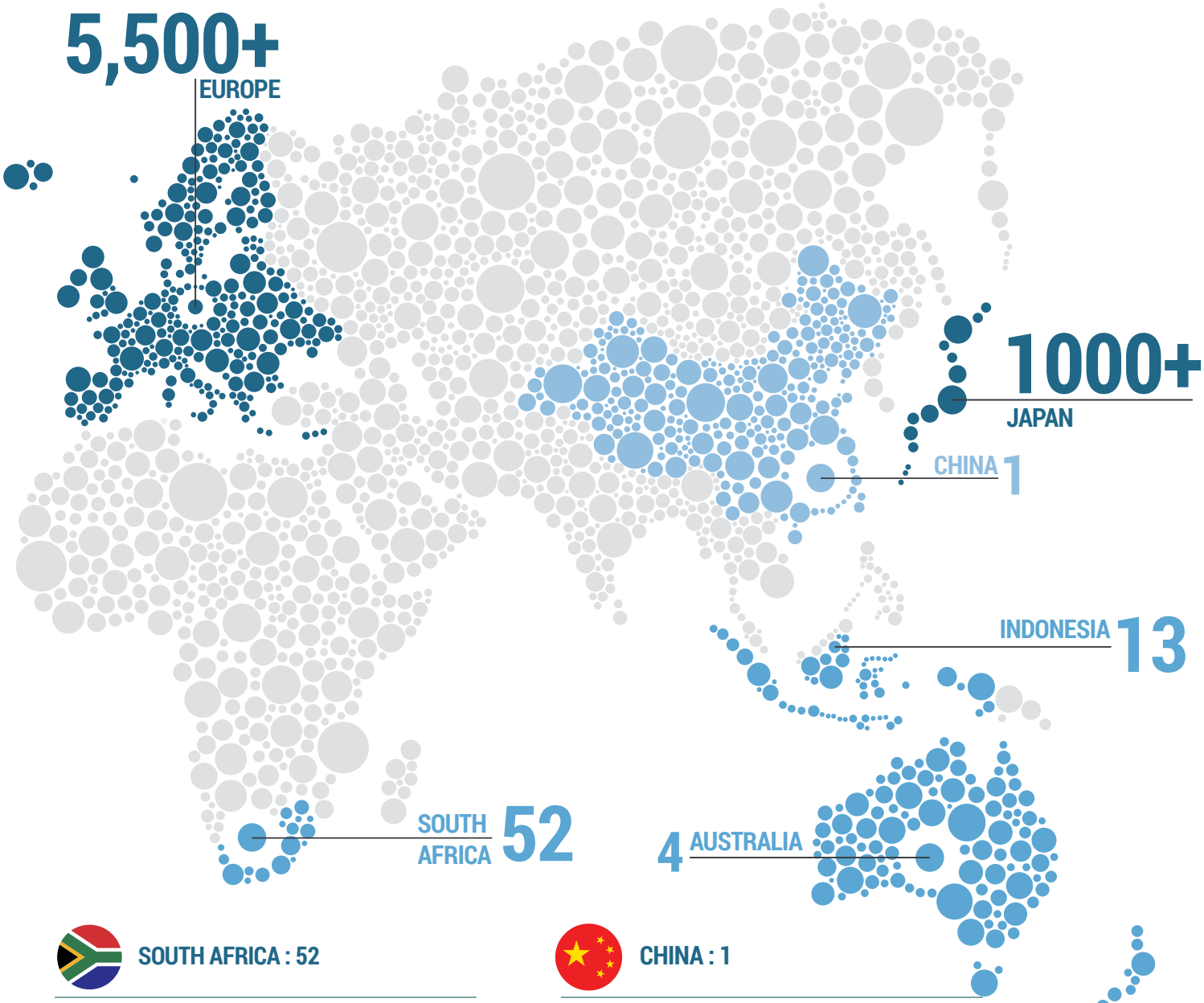
N/A 1-2 3-99 100+ 1000+

## EUROPE : 5,500+

Europe is the world leader in terms of $CO_2$ adoption in commercial refrigeration, with over 5,500 supermarkets using $CO_2$ transcritical systems, having risen from 2,885 in 2013 and 1,330 in 2011, and continual growth is expected. Starting in 2016, more than 6,000 $CO_2$ transcritical systems will be added to the European market each year.

## JAPAN : 1000+

Japan's $CO_2$ commercial refrigeration sector has exploded into life in the last year with over 1,000 systems in 2015 compared to 190 in March 2014. This growth is engendered by the commitments of two leading retailers, Lawson and AEON. This growth will continue as AEON will retrofit their existing 3,500 stores gradually with $CO_2$ systems.




## SOUTH AFRICA : 52

South Africa has a growing usage of $CO_2$ transcritical systems with retailers Woolworths and Makro using the systems in their supermarkets. As the market for $CO_2$ technology grows globally, system suppliers in South Africa are confident that this market will continue to prosper.

## CHINA : 1

China's commercial refrigeration sector is still in its infancy, with eight stores using $CO_2$, with one a $CO_2$ transcritical store. There is, however, an expectation that this will accelerate soon with international supermarkets such as Carrefour looking to increase penetration of $CO_2$ technology in China.

# THE MORE, THE MERRIER

The Delhaize Group, already on track to exceed its Energy plan 2020 target to reduce its total greenhouse gas emissions by 20%, is on a mission to install as many natural refrigerant systems as possible across its global store network, including $CO_2$ transcritical and hydrocarbon plug-ins

— By James Ranson

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Delhaize Chazal store

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David Schalenbourg

In late November, Accelerate Europe took a tour of the Delhaize Group's newly refurbished store in Schaerbeek, Brussels.

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

Schalenbourg does not support "green washing" but sees fresh opportunities in his new role to communicate the global food retailer's CSR initiatives to its customers and stakeholders. He notes that in Belgium alone reducing energy consumption and refrigerant leaks, and retrofitting equipment with low-GWP refrigerants like $CO_2$, have already led to a 38% reduction in greenhouse gas emissions, using 2008 as a baseline.

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

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

"We don't have specific targets for number of stores with $CO_2$ refrigeration," Schalenbourg says. "In Belgium, we plan to have three to four installations yearly. Currently, outside Belgium, we have 12 hybrid $CO_2$ systems operating in Greece, 770 plug-ins with R290 in Romania, and two $CO_2$ transcritical systems in the U.S. with one more planned."

## DELHAIZE CHAZAL

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

Central to the store's refurbishment was the installation of Carrier's $CO_2$OLtec transcritical $CO_2$ booster refrigeration system, which has been running since July 2015, replacing an HFC system.

The refurbishment also had the floor space extended, the ceilings heightened and a new self-scan system implemented. But arguably the biggest adjustment was Carrier's $CO_2$OLtec technology, which includes:

- 3 low-temperature and 4 medium-temperature compressors (cooling capacity 200kW);
- Reclaimed heat used for hot water, which fulfills the store's requirements;
- Doors on all fridges and freezers (except semi-vertical units and those with weighted products);
- The renovated store accommodates 3,700 shoppers daily


Delhaize Chazal store

## SEARCHING FOR THE 'REFRIGERANT OF THE FUTURE'

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

The Group's primary operations are in Belgium via numerous formats, including convenience store chain Proxy Delhaize. The Group also has a presence in Luxembourg, Greece, Romania, Serbia, Indonesia and the U.S. (operating Food Lion and Hannaford stores as Delhaize America).

In 2006, the company commenced the search for a new environmentally friendly refrigerant, a three-year process that included consideration of impending f-gas regulations and finished with $CO_2$ transcritical technology as the preferred option for new installations.

"In 2006 we were searching for 'the refrigerant of the future' and tested a number of different technologies," says Patkos. "It took us three years before finalising our choice to opt for transcritical $CO_2$ for new installations.

"Today it is still the refrigerant that answers best to all environmental and energy criteria. What is more, the technology and its components are becoming more affordable and the total cost of installations has decreased considerably over the last few years. The implementation of the F-Gas regulation wasn't an accelerating element, but rather a confirmation that we took the right options at the right time."

For existing stores, Schalenbourg says Delhaize's goal is to retrofit all installations containing harmful hydrofluorocarbons (HFCs) R404A and R507, with lower-GWP alternatives like $CO_2$ and hydrocarbons. Using its R404A systems as a comparison, Patkos says data collected typically confirmed a 5% drop in energy consumption a month after conversion to $CO_2$ , and a further 6.5% reduction after 10 months.

All of the company's refrigerated warehouses utilise natural fluids ammonia and $CO_2$, while some of its transport fleet uses Thermo King's innovative $CO_2$ Cryotech systems to keep food fresh during transportation.

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## LIEGE STORE WINS GRAND PRIX


Delhaize Groups's new Director of the Technical Department David Schalenbourg was in his element talking about another of the company's recent achievements, the Grand Prix de l'urbanisme (architecture and urbanism) awarded to its Guillemins supermarket in Liege, Belgium.

The French Ministry for Ecology, Energy, Sustainable Development and Planning panel voted almost unanimously in favour of Delhaize's project - which is also BREAAM certified.

The project incorporates a complete refurbishment of the Delhaize's antiquated Quai de Rome store (which dates back to the 1950s) and clever special planning to connect two adjoining districts, with a passage for pedestrians and cyclists.

Rather than demolish the supermarket and find another location on the city's outskirts, the architects chose to renovate the building, located between the streets of the Meuse and the neighbourhood of Fragnée.

The wooden facades and the building's low-energy design were among the key qualities that inspired the panel to select Delhaize's supermarket for the Grand Prix.

## END USERS UNITE FOR COP21

As a member of the Consumer Goods Forum, the Delhaize Group was among a number of Belgian companies to align itself with the United Nations Conference on Climate Change (COP21) in Paris (in December).

Aside from joining other end users in committing to reduce the use of commonly used HFCs, Delhaize's engagement letter for COP21 confirmed its broader sustainability philosophy: "We believe we have a responsibility to actively engage in global efforts to reduce greenhouse gas emissions," it read.

"Obviously, it is important for the whole industry to move," says Director of the Technical Department David Schalenbourg. "What we find is that it takes leaders on the mass market for other retailers, who don't have as much capacity, to be innovative."

"Through the Consumer Goods Forum and other collaborations with companies in our industry, our aim is for companies to develop and test new innovations so they can become leaders and help transform the marketplace and show others what is possible."

An area Delhaize is looking to improve, Patkos says, is its in-store bottle coolers, few of which operate with natural refrigerants. "A tender is running for cooling equipment with a special attention to plug-ins functioning with natural refrigerants," he adds.

Other measures adopted to reduce energy consumption include: heat reclaim to produce hot water for retail stores, doors on freezers and most cooling cabinets and LED lighting.

## U.S. AND GLOBAL REACH

Delhaize (through its Food Lion and Hannaford stores) is among a number of companies in the U.S. testing transcritical $CO_2$ systems, including Kroger, Ahold USA, Aldi and Whole Food Markets. What's more, for the first time, Food Lion is this year testing a transcritical $CO_2$ system in a high ambient climate (Southport, North Carolina).

For a global company, putting transcritical $CO_2$ technology to the test in warm temperatures is vital, says Schalenbourg. "Warm temperatures may pose a challenge for $CO_2$ installations, but that idea is being tested."

The company is actively engaged with the U.S. Environmental Protection Agency's Energy Star program to manage energy efficiency across its U.S. facilities, but Patkos admits the challenge is very different in other regions the company services, such as Greece, Serbia, Romania and Indonesia.

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

Patkos cited the availability of trained technicians as a key barrier in those other countries. JR

Chazal store: Carrier's $CO_2$OLtec transcritical system

Georgios Patkos
Former Director of the Technical Department

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John DeCicco, Jr.

# U.S. GROCER DECICCO'S BOLD MOVE

**Grocery operator becomes one of the few independent stores in the U.S. to implement a $CO_2$ transcritical refrigeration system at its new environmentally friendly store in Larchmont, New York.**

– By Michael Garry –

John DeCicco, Jr., president of DeCicco & Sons, a six-store grocery store operation based in New York, has been hearing about the need to protect the environment from his two young children, a girl, age 5, and a boy, age 3.

Wanting to preserve the environment for his children helped drive DeCicco's decision to make the 18,000-square-foot Larchmont supermarket (25,000 square feet including basement), a showcase for environmental technology.

In addition to such features as solar panels, LED lighting and a high-tech kitchen ventilation system, the store, opening later this year, will use a transcritical $CO_2$ refrigeration system. DeCicco is applying for not just LEED certification for the store but also EPA GreenChill platinum-level certification.

The choice of an all-$CO_2$ transcritical refrigeration system – an Advansor booster system from Hillphoenix - makes DeCicco & Sons one of only a handful of small, independent grocers in North America willing to invest in this technology.

By far, the majority of stores with transcritical equipment are operated by chains, including Sobeys, Hannaford Bros., Whole Foods Market, Roundy's, Ahold USA, Delhaize America, Kroger and other industry leaders.

"I feel like it's a big undertaking, what we're doing," DeCicco acknowledged. "It's not normal for a small operator to be doing this."

DeCicco, 37, who has an MBA from Fordham University in New York, has been preparing for this challenge his entire life. "I've been working in the supermarket business since I was three years old. I've learned every aspect – financial, merchandising and marketing. And I have a passion for the engineering aspect as well. Now is the right time for me to put all my talents to use in doing this and making an example of this store."

DeCicco's, a tight-knit, family-owned and operated business was founded by DeCicco's Italian-born father, John Sr., and his father's two brothers, Joe and Frank in 1974. The stores have the feel of a traditional Italian market, offering a selection of prepared foods, cheeses and craft beers.

Among his duties, John DeCicco, Jr handles refrigeration and construction, and personally made the choice of the transcritical system for the Larchmont store. "I can't tell you how many case studies I've read about $CO_2$," he said. He was assisted by his refrigeration contractor, AAA Refrigeration Service and system supplier, Hillphoenix.

DeCicco actually considered selecting a transcritical system for the company's Armonk New York store, which opened in 2012, but he wasn't ready back then, nor did he think the technology was sufficiently tested.

He also considered going with partial-$CO_2$ systems like secondary or cascade, but ultimately decided he wanted to use just $CO_2$ and not any other refrigerant. "There's more energy consumption with the others," he said.

DeCicco's other supermarkets use R404A, except for its oldest store in Pelham, which is still on R22. Rather than retrofit it with an HFC, DeCicco is contemplating a conversion to transcritical, though that is something Hillphoenix has yet to do.

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Hillphoenix's Rusty Walker explaining transcritical system at DeCicco's Larchmont, N.Y., store.

DeCicco & Sons' transcritical system

To determine whether a conversion would be a viable option, DeCicco will be testing a conventional case in the basement of the Larchmont store, linking it to the transcritical rack and installing $CO_2$ case controllers and electronic valves in the case. "In theory it should work," he said. "I'm pretty sure the [evaporator] coils will hold the pressure." If it does, he could simply retrofit his R22 racks at the Pelham store and replace the current rack with a transcritical version.

### Evaluating efficiency

DeCicco will be submetering the energy consumption of the transcritical system at the Larchmont store and comparing it to that of his HFC DX system in Armonk, which is about the same size. He is studying how Hannaford Supermarkets went about evaluating the efficiency of its pioneering transcritical system in a Turner, Maine, store, which is detailed in a Department of Energy study. (See http://1.usa.gov/1jQxsad.)

"Our transcritical system will require a lot of fine-tuning so the [energy monitoring] will go on for quite a while," he said. But he expects the system to ultimately prove to be more energy efficient.

Unlike some other retailers that are installing transcritical systems, such as Dehaize America and Ahold USA, DeCicco decided to invest in two Trillium adiabatic gas coolers (from Baltimore Aircoil) instead of conventional condensers. The units will help keep the system from going into less efficient supercritical mode when ambient temperatures exceed 31.1°C, $CO_2$'s critical point. "That should get us an additional 20% to 30% energy savings over a traditional $CO_2$ system," he said.

He selected adiabatic gas coolers even though Larchmont is a relatively northern climate where transcritical systems are expected to function efficiently without them. "I think we are one of the first in the Northeast to use $CO_2$ with Trillium condensers," he said.

He also puts stock in the electronic expansion valves' ability to control the flow of $CO_2$ refrigerant in the cases, which improves efficiency. And over time DeCicco expects Hillphoenix to bring ejector and parallel compression systems – that will boost the efficiency of the transcritical system – into the equation.

Heat reclaimed from the transcritical system will be used for about 50% to 60% of the store's heating and hot water needs; the store's HVAC system will make up the rest.

DeCicco acknowledges that the first cost of the transcritical system is 10% to 15% more than that of a conventional system; this does not count the adiabatic gas cooler, which is about three times the cost of a traditional condenser MG

## CRAFT BEER HEAVEN

In addition to having many environmentally friendly features, DeCicco's new store in Larchmont will have a uniquely customer-friendly aspect: an encyclopedic variety of beer.

The six-store retailer has earned a reputation for having one of the most extensive selections of local and imported craft beers in the area. Its store in Brewster, New York, for example, has about 2,000 varieties. In addition to selling beer at retail, the stores are equipped with a bar that sells beer on tap.

"Anything that can be purchased or imported in New York State we probably have," said John DeCicco, Jr., president of DeCicco & Sons. "There are a lot of local, seasonal and limited editions."

DeCicco got the idea to expand his company's beer selection during a trip to London in the late 1990s. He worked on it for a few years and turned the responsibility over to his brother Chris, who travels the world in search of exotic brews.

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# JAPAN'S FIRST 'ALL-NATURAL' CONVENIENCE STORE SAVE ON INTRODUCING R290 PLUG-IN SHOWCASES

Japanese convenience store (CVS) chain Save On, headquartered in Gunma Prefecture, has opened the country's first store that is installed with natural refrigerant systems for all its showcases. Accelerate Europe takes a look at what the adoption of R290 refrigeration systems will bring to the market in Japan.

— By Yukari Sahashi

There are more than 53,000 convenience stores across Japan today, and refrigeration technology is, needless to say, an essential part of their daily operation. While the shift towards natural refrigerants is already taking place at Save On, which became the first company in February 2015 to open a store equipped with refrigeration showcases using only natural refrigerants, plenty of future developments loom.

The community-based CVS's endeavours at its Isesaki Ko-bayashi Minami branch located in Isesaki City are already drawing considerable media attention in and outside the prefecture, suggesting action from others CVS could be swift.

Save On, part of Beisia Group, operates over 600 convenience stores in Kanto and Tohoku regions, with Gunma and Niigata prefectures being the main areas of operation. Mr. Yoshiaki Kenjo, Store Construction Manager at Save On, was behind the decision to introduce the 'MANHATTAN' R290 showcases through REI-TECH, the appointed distributor of AHT Cooling Systems' plug-in refrigeration units for the Japanese market.

SAVE ON's decision is a positive one for many reasons. It will bring to light the energy and cost advantages associated with using R290 systems not only for the chain's other stores, but for the convenience store industry in Japan. Save On has taken on the challenge to generate momentum in Japan towards 'all natural' refrigeration for convenience stores and is ready to share safety and practicality advantages and help address lingering concerns about R290's flammability.

## EUROPEAN EXPERTISE AND FLAMMABILITY CHALLENGE

Unlike Europe, where hydrocarbons have been a standard in stand-alone light commercial equipment for some time, refrigeration systems using propane in Japan are not yet widespread..This is due to the fact that Japanese system manufacturers are still quite apprehensive about its flammability. Therefore, safety issues, how to handle accidents, and who bears responsibility, are genuine concerns in Japan.

In this sense Save On's decision represents significant value to the market. "The fact that propane is widely used in Europe provided a good indication of its safety as we made our decision," explained Mr. Kenjo. "The approved charge limit for propane is 150g, which our systems adhere to. Within this limit, if we look at it from the other way around, we believe its safety is guaranteed".

Save On will continue using the refrigerant while increasing the number of their stores installed with the systems. "The only way is for Save On to stick with the new refrigerant and push for wider adoption at more of our stores so that we can prove its safety based on our own experience."

Save On is projecting to increase the number of its stores installed with propane units to 20 to 30 every year, but is also looking at $CO_2$. "Moving forward, our ultimate goal is to achieve a 100% adoption of R290 showcases, but we are also interested in $CO_2$ systems. Combining these two, we aim to go 'all natural' at 10% of our new stores within the next five years."

## KNOWLEDGE SHARING CREATING NEW OPPORTUNITIES

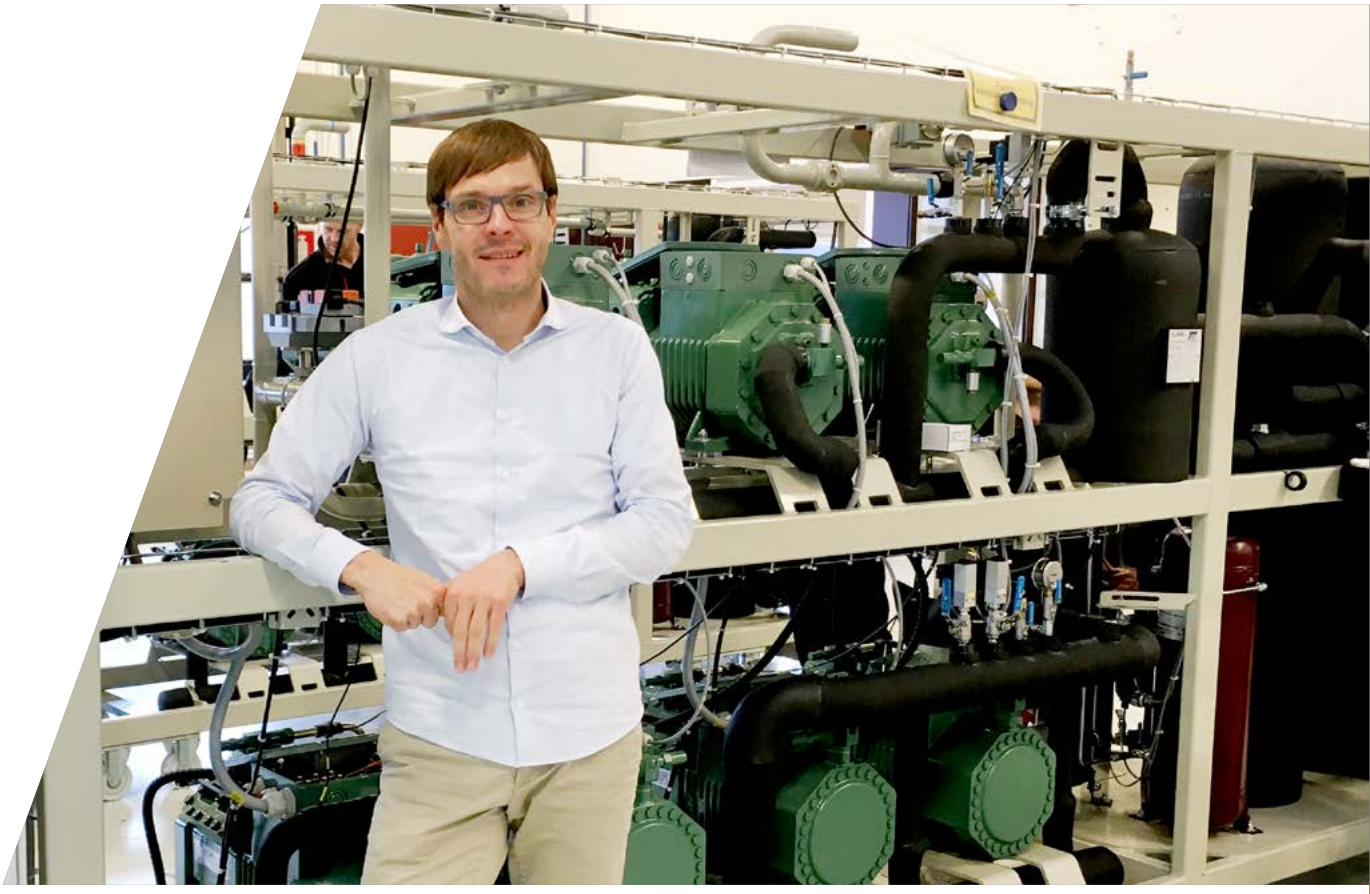
Japan's convenience store industry saw Lawson become the first to introduce $CO_2$ transcritical refrigeration systems on a large scale. The strong interest in natural refrigeration technology expressed by Mr. Kenjo and his supervisor led Lawson and Save On, despite being one another's biggest competitors, to share and exchange information and ideas about the technology.

It is a very rare case, given the increasing competitiveness in the industry, however, what it demonstrates is the power that industry itself has to green whole sectors by incorporating natural refrigerant technology, not just their own business. Both SAVE ON and Lawson are building their own experiences with natural refrigerants, but by acting together, they are paving a smoother path not just for themselves, but for others to follow.

## COST OPTIMISATION

In opening a new store with all natural refrigerant solutions, Save On did incur extra intitial costs, which may have thwarted their plans without the funding programme from the Japanese Ministry of Environment. "The initial costs did increase, and to be honest, yes, it would have been difficult if the funding was not available," said Mr. Kenjo. Even with the funding, the initial costs were roughly 50% higher but Save On's plan to cut down on running costs by reducing electricity consumption allowed it to achieve return on investment in no less than seven years' time.

The choice Save On has made to adopt natural refrigeration solutions will have an increasingly profound impact on the industry, as the company is now set to demonstrate the safety of R290 plug-in showcases, cut down on its energy use and costs in the long run, and importantly, grow into a business that is highly valued by its community for being more environmentally responsible. YS



# THINKING OUTSIDE THE BOX

After nearly a decade of development and the acquisition by Hillphoenix in 2011, changes are afoot for Advansor as co-founder and Commercial Product Director Torben Hansen sets sail.

— By Nina Masson & Suzi Lindquist

Accelerate Europe had the chance to talk with Hansen, before he departs the company at year's end, about Advansor's initial challenges, some breakthrough moments and just why radical ideas are needed for natural refrigerants to prevail.

Hansen describes how the company went full circle after its first foray into $CO_2$ water chillers and heat pumps after initially being warned away from the commercial refrigeration sector.

"The water chillers were too niche for $CO_2$, we probably sold five units in one or two years, when we should have been selling 20 just to [cover our costs]," Hansen said. "Heat pumps then looked quite promising until the government changed the rules overnight."

Hansen says the company was left "scratching its head" and at the time considered folding. Ironically, it was a call from a Danish contractor that may well have kept the company afloat.

"He asked us for a [retail food] solution with $CO_2$ but we said: 'no, we make heat pumps'. He asked again and this time we started doing some designs as we didn't actually have a choice. It was our last chance to turn the company around."

## Advansor Set to Blaze New Trail

As the team reorganises after Hansen's departure as commercial product director, Advansor's Managing Director Kim Christensen points to new opportunities to grow the business with an effective sales and marketing strategy in Europe.

In 2016, Advansor will invest in production sites outside Denmark, including a new facility in Poland. With $CO_2$ booster technology chosen as the preferred technology by many retailers, Advansor sees the new facility in Poland as a central part of itsendeavours to conquer the European market, says Christensen.

To tackle the demand, Advansor has developed the SIGMA range of integrated energy packs combining heating, refrigeration and air conditioning into one unit. Christensen believes the integrated packs "[are] definitely the future for $CO_2$ not only for refrigeration, but also [to be able to perform the other actions] within the same rack system."

Another growth area for Advansor will be convenience stores, where its ValuePack units, launched last year, offer an optimised solution for small stores with "very low footprint, easy installation, and flexible design," as Christensen states.

> "Heat pumps then looked quite promising until the government changed the rules overnight."

Accelerate Europe: Did you consider restricting your portfolio to only $CO_2$ to be a risk? You are still one of only a few companies to commit to this strategy.

**Torben Hansen**: That was a great risk but it was the only window open for us. We saw that cascade solutions were already covered, and in our opinion secondary refrigerants were not going to be the future. There are numerous applications suitable for $CO_2$, like the industrial systems entering the market now, so we didn't feel limited in any way just working with this refrigerant. We were 10 years ahead at that time in our minds.

It also allowed us to simplify in that we didn't have to look at six or seven technology platforms, but focus on just one and spread it. That allowed us to standardise our systems, to be flexible with the use of $CO_2$.

Accelerate Europe: Once you had a foot in the door what strategy did you adopt in order to become a recognised market player in the food retail sector – how did you convince partners and customers that your product would stand the test of time compared to that of bigger companies?

**Torben Hansen**: Even the established companies had to come up with something convincing. That actually gave us a blank sheet to start on. While everybody else was trying to make it magic, we said to our customers that it's not difficult. We adopted 3D modeling for our production and for presentations. People would come in and we would tell them: "This is what you would normally be looking at and this is what you will get with us", and they would be surprised about how similar it was. The contractors loved that.

For the first 2-3 years we had very good partners evolving with us. We listened to what they were saying since we knew that our product was not perfect.

continued on p.58

Accelerate Europe: When was that breakthrough moment when you realised that you had made it - that $CO_2$ was the right choice?

**Torben Hansen**: Maybe it was 2009, when we got a notice from Sainsbury's saying that they wanted to roll out $CO_2$ systems. They trialled our technology and that of two other companies. They ended up choosing us and as a result our production grew fivefold. We needed to convert their stores to $CO_2$ systems and we gave them our word that we wouldn't miss one single delivery.

The next big moment for Advansor was when we actually agreed with Carrefour to produce their systems in Europe. They took a great risk to go for $CO_2$ in regions where people said that it wasn't going to happen. People were waiting to see what kind of problems they would experience. Again, failure was not an option. That was around 2013, and at that time we had done more than 1,000 systems. From a technology perspective we felt safe about it, but it was exciting to roll it out in many countries.

Accelerate Europe: Four years ago there was another big change for Advansor when you were acquired by Hillphoenix. How has this changed the organisation?

**Torben Hansen**: It was a perfect acquisition. Hillphoenix wanted to be the number one technology leader in the USA and we had the industry-leading technology that they didn't. It also gave us the chance to enter the U.S., where we had no presence, no intention, and no ways to get in.

Furthermore, in our home market Europe we also saw several acquisitions in the industry taking place. We were looking to be a part of a strong organisation and also feeling the pressure from end-users. The success that we had during the last four years wouldn't be possible without the bigger reputation Hillphoenix brought.

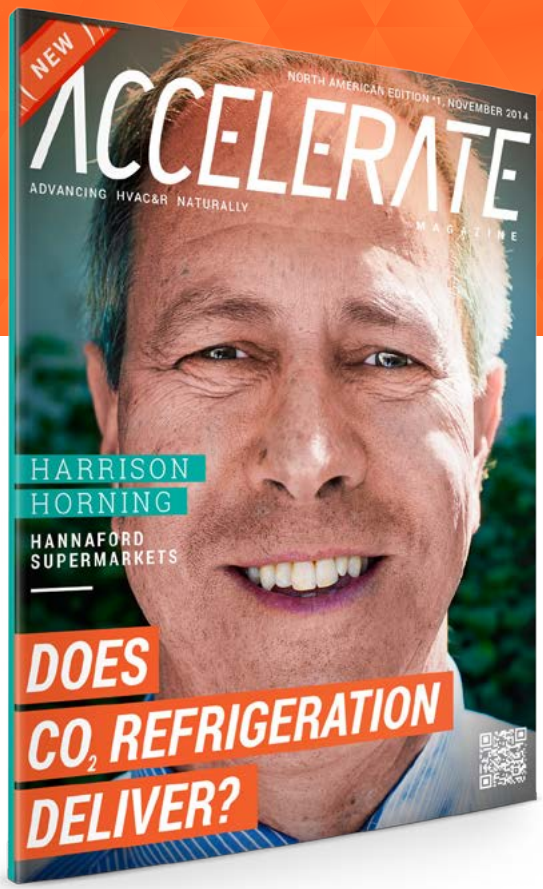
> "It's worth it because at some point you will be rewarded."

Accelerate Europe: Now, as one of the leading $CO_2$ transcritical system suppliers you've reached the goal you set out to in the beginning. What's the next challenge?

**Torben Hansen**: Continue growing, continue steering the market away from HFCs. We are still a niche player if you look at the total market impact we had in terms of the share from the total systems being produced. We achieved 1000% growth, but I strongly believe we are just about to take off now. For Advansor, the next challenge will be to maintain leadership and keep its market share percentage even in the event of an explosion of growth in Europe.

Accelerate Europe: What would you suggest for others that want to start with an idea or challenge the status quo? Your story suggests that it's certainly possible but is it worth the effort?

**Torben Hansen**: I would definitely say go for it but it's of course in my nature. If people have a good idea and its radical, I would always say it's worth it because at some point you will be rewarded. If we all sit back, we would still have R22 systems. We need to do something and it's worth it. Your idea has to be strong enough to be placed in public eye and challenged. It is the test that you will have to go through anyway. You will also have to accept that people may go and copy it. NM & SL




# ACCELERATE

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Anders Juul
Segment Strategy Manager

# DANFOSS TACKLES '$CO_2$ EQUATOR' WITH EJECTOR TECHNOLOGY

Danfoss' $CO_2$ technology for warm ambient climates heralding the end of the so-called "$CO_2$-equator".

— By Jana Topley Lira

As Segment Strategy Manager Anders Juul puts it Danfoss doesn't want to keep this technology a secret.

The company's latest innovation – ejectors – are helping to break down a previously mitigating factor for the efficiency of $CO_2$ technology – high ambient climates – but the company refuses to put the same limitations on the highly evolving market.

Developed through extensive lab testing and close collaboration with OEMs (Original Equipment Manufacturers), ejectors are predicted to sound the death knell for the $CO_2$ equator.

Focused on improving current technologies rather than on the next line of refrigerants, ejector technology is a clear reflection of Danfoss' tagline "Engineering tomorrow". Under this philosophy the company aims to deliver technologies that make current infrastructure more energy efficient.

During the development phase Danfoss' approach has been to work across the spectrum of industry stakeholders, and to share knowledge as widely as possible, respecting the need for competences and resources both internal and external.

By doing so, the company hopes to fully understand the best use of the technology, and ensure that this know-how is harnessed by end users, OEMs as well as Danfoss itself. In Juul's opinion, this will enable the creation of a durable, efficient solution.

"We have had a very open approach. We do not want to keep this technology a secret. Instead, we share it with OEMs, and try to work as closely as possible with them."

> "We have had a very open approach. We do not want to keep this technology a secret. Instead, we share it with OEMs, and try to work as closely as possible with them."

## So how do ejectors work?

According to Juul, an ejector is the optimum way to energy optimise transcritical $CO_2$ systems. This is because the technology, when properly controlled, allows for a high degree of energy recovery in the reduction of pressure from gas cooler to liquid line pressure. This energy recovery takes the form as an assistant to compressors by the means of lifting the pressure of the system, so that the compressors perform less work, to enable the transcritical $CO_2$ refrigerant system to meet the cooling demand.

For Danfoss they represent one of the most promising solutions for $CO_2$ refrigeration systems in hotter climates as they save manufacturers from having to dimension refrigeration racks for peak loads, whilst also reducing deployed compressor capacity, in turn providing energy savings. All of this yields significant potential for initial cost reduction on compressor capacity and long-term cost benefits for end users.

Currently, Danfoss ejectors are operating in six supermarkets, with another four coming online by the end of the year. Thanks to the ability to switch an ejector on and off remotely, Danfoss has been able to collate large amounts of data on the impact of running a refrigeration system with or without an ejector.

In one particularly successful field trial the use of an ejector led to energy savings for a very small cost. The customer involved was initially very surprised by the results. They did not understand how they could maintain the same cooling capacity with only the parallel compressors running.

"Normally they would expect MT compressors to run but in this case the ejector was lifting so much pressure that only parallel compressors were needed to run," explains Juul.

Whilst it is clear that ejector efficiency relies upon the application and how the system controls are set up, Juul openly admits that they still have a lot to learn. "We have begun to make what we believe is a winning ejector configuration, but we know there is still much to discover. It's an exciting technology and there is plenty more that we can achieve."

## Ejector technology spreading

According to Juul, OEM's and retailers have a key role in driving $CO_2$ technology innovation. In the last twelve months alone, Danfoss has been involved in around 2000 $CO_2$ transcritical installations. Interest in $CO_2$ is also growing in the industrial refrigeration arena.

What is more, this is a global trend with few exceptions. Although Europe remains their most important market when it comes to $CO_2$ solutions, thanks in part to the revised EU F-Gas Regulation, South Africa and North America are rapidly catching up.

Not keen to rest on their laurels Danfoss is already trying to solve the next challenge: making ejectors suitable for small systems.

Juul says that testing on a traditional booster system without a parallel compressor, where the ejector is lifting the discharge pressure from the evaporators and the compressor, is proving successful. "I see a lot of interest in small systems," he enthuses.

Particularly exciting, he believes, is the trend in the European market with $CO_2$ condensing units, which may have a significant impact inthe coming years.

Beyond ejectors, Danfoss has also investigated and deployed dynamic receiver pressure, while parallel compression, for example has a big role to play, as do more recent trends such as water loop chilled plug-in systems. "What makes sense for one retailer may not be the ideal solution for another, so we are continuously looking to broaden our portfolio," concludes Juul.

@ JTL

SECOP hydrocarbon compressor

# BULLISH ON HYDROCARBONS

German compressor maker Secop sees the European acceptance of hydrocarbon compressor applications expanding the market to China and the U.S.

— By James Ranson

While many manufacturers diversify their portfolio of HVAC&R solutions to include a number of refrigerants, German compressor maker Secop has boldly identified hydrocarbons as its refrigerant of choice.

In an interview with *Accelerate Europe* at the Innovation Forum for Household Refrigeration, held 21-23 September in Nitra, Slovakia, Secop CEO Mogens Søholm acknowledged the inherent risk associated with this approach, but pointed out the "huge potential payoff."

"In answer to your comment that it's risky do go down the hydrocarbon path – our clear vision is it's also pretty risky not to focus on it," Søholm says. "If you make only half the effort because you have to focus on five different refrigerants, you are not able to achieve the optimum results with five different refrigerants; there are a lot of compromises required there."

Given that the technology "is very silent" and highly efficient, the business case for hydrocarbon equipment makes sense – even more so upon further investigation. "It's a very efficient refrigerant compared to the synthetic blends we now have today," Søholm says. "At the same time you can use smaller components, for example compressors, to achieve the same cooling capacity. That means less steel, less copper, less aluminum during the production and a much lower carbon-emitting manufacturing process compared to, say, HFC R134a."

Adds Søholm: "If that has value for the end user then new demand exists and new manufacturers will be forced to move in that direction. It's not rocket science, the technology has been around for 20 years so it's doable."

Several market leaders in sustainable household refrigeration were privy to an off-site tour of Secop's factory in Zlaté Moravce, Slovokia, which produces 6 million compressors annually, including 60% of its hydrocarbon compressor equipment. Nearly all the components are produced in-house.

Here, at Secop's VDE- and UL-certified laboratories, the company conducts various performance, noise & vibration, safety and reliability tests. Recent demand

has called for a 30% increase in capacity of the lab for R&D and serial production monitoring.

Overall, Secop, which was spun off from Danfoss in 2010, produces 10 million compressors annually. The company has 2,200 employees, and had a turnover of €350 million in 2014.

## TAKING THE LEAD IN U.S. AND CHINA

Hydrocarbons such as propane (R290), Søholm stated, have been standard in domestic fridge and freezer applications for over 15 years in Europe. But due to differing regulations and safety concerns, this has not yet been translated to other regions around the globe with anywhere near the same sort of acceptance.

But big strides have been made in 2015 in both China and the U.S., suggesting that market acceptance is not far away.

In China, 2015 marked the year R290 air-conditioning manufacturers started to penetrate the market en masse, with the help of the "Green Carbon Label," designed to help accelerate the commercialisation of R290 AC units.

China's Ministry of Environmental Protection released "The First Catalogue of Recommended Substitutes for HCFCs" in June 2015, highlighting natural refrigerants as alternatives in almost every application. The document cited domestic AC, stand-alone refrigeration units (using R600a and R290), and water chillers as huge potential markets for hydrocarbon technology.

Meanwhile, in the U.S., 2015 marked an incredibly positive year for hydrocarbon equipment, with the Environmental Protection Agency (EPA) outlining four additional hydrocarbon refrigerants (R290, R600a, R170 and blend R441A) as acceptable alternatives under its Significant New Alternatives Policy (SNAP) programme.

The EPA ruling paves the way for the wider adoption of hydrocarbon refrigerants, predominantly in light commercial applications, such as stand-alone cabinets and vending machines, where there remains a level of trepidation in the U.S About hydrocarbon safety. But perhaps more importantly, it lays the platform for hydrocarbon's inclusion in the domestic sphere, where they are already broadly accepted in Europe.

"We (Secop) have to really take the lead and try to show the way," says Søholm. "I think Europe has shown the way in a lot of cases with hydrocarbons for domestic applications, China is the biggest market today and is following that trend."

Søholm believes that variable speed compressors, often highlighted for their very high efficiency, will be central to the market transition. Along with their low noise and compact size, they maintain the same level of efficiency as comparable technologies.

"Our vision really is to change that game to make variable speed also a viable option in the medium performance segment," he says. "We want to make this standard technology, affordable and efficient. I would very much like to see in 10 years time that the majority of the market, not only has higher efficiency, but is utilising variable speed." JR

Zlaté Moravce factory tour at Secop Innovation Forum

## SECOP'S FACTORY IN ZLATÉ MORAVCE, SLOVAKIA INCLUDES:

- Annual production capacity of 10 million units
- Accounts for 50% of Secop's annual compressor production and
- 60% of its hydrocarbon compressor production
- Five compressor production lines : NL x 2, DL, TL, XV, GS
- Domestic compressors: N, P, T, X and D-Series, DELTA, and KAPPA; DC-powered generation: BD Micro, BD P-Housing, BD T-Housing
- Light commercial compressors: N, F, S, G, D-Series

# DRIVING CHANGE IN AFRICA

Having established the first $CO_2$ transcritical refrigeration systems in Africa, CRS is following up with the inaugural $CO_2$ heat pumps and the first African $CO_2$ training facility, at its new Johannesburg base.

— By James Ranson

It's been a remarkable rise for Wynand Groenewald, Head of Engineering for Commercial Refrigeration Services (CRS), based in Johannesburg, South Africa.

A student of $CO_2$ refrigeration, Groenewald was the first African to complete a master's degree in the field, with a dissertation on "A techno economical analysis of a $CO_2$ heat pump." He collaborated with European experts he now calls mentors, among them Dr. Peter Neksa from NTNU/SINTEF and Enex's Dr. Sergio Girotto.

Initially unable to find a position with a company in South Africa, Groenewald turned his attentions to CRS after hearing of the completion of the company's first R134a/$CO_2$ cascade installation. At that stage, CRS was led by the late Mike Holt and the pair set about developing a cascade system, followed by the company's first transcritical booster system in 2010


Fast forward to early September 2015 and CRS had a remarkable 52 $CO_2$ transcritical installations in Africa to its name, increasing from five to 12-20 per year. Groenewald stated with confidence that the company will complete a further 25 in 2015.

## HERE COME THE HEAT PUMPS

Yet the milestones don't stop there. The company has already received an order for its first chiller installation and expects its $CO_2$ heat pumps to soon follow, having launched the new range of products in June.

CRS started development of its $CO_2$ heat pumps in early 2015 — the first technology of its kind set to enter the African market. The company built its first $CO_2$ heat pump for testing purposes at the Frigair conference in June 2015 before launching its 20kW-1000kW range to complement a new new chillers (20kW-1000kW) and condensing units (15-50kW).

Groenewald says the company already has eight heat pumps on tender and has received plenty of interest. "I see heat pumps taking off real quick — our prediction is to have 30-50 of these operational in the next year," he says. "Thus far it is looking very lucrative and favourable towards the expansion of $CO_2$ in the industry.

"The main attribute of $CO_2$ is the high water temperatures that can be reached while still obtaining favourable COPs," he explained. "Conventional heat pumps do not have this ability or when applied to these (high ambient temperatures) conditions operate under very low COPs. Therefore we see that our $CO_2$ heat pumps can open up a completely new market that cannot be infiltrated by conventional heat pumps."

The heat pumps, which are are manufactured entirely in South Africa, save energy by 65% to 75% compared to electric heating units. They also posess greater capacity, heating water up to 80°C compared to conventional heat pumps (60 °C). From preliminary testing and external opinion from European manufacturers, Groenewald concluded that the heat pumps stand up favourably, and in some cases, exceed those of leading global manufacturers. "It shows that new technology does not have to be imported and can be produced locally," he said. "I believe our heat pumps are of the same quality as can be found elsewhere in the world."


CRS is marketing its products to the rest of Africa, while the interest for its products from Australia and New Zealand, Groenewald puts down to the regions' "comparable climate conditions and logistics".

Of the company's transcritical refrigeration installations, one for major client Woolworths in Crowthorne, Johannesburg, stands out. In September, the store was commissioned with Africa's first $CO_2$ transcritical system using parallel compression and ejector technology. "We're hitting two birds with one stone," Groenewald says. "It is the first of its kind in Africa; there hasn't been one in a test facility or any installation of that sort."

The revamped store was retrofitted with a 140kW MT and 25kW LT $CO_2$ system, which replaced an old HFC (R404a) setup. Groenewald noted his close relationship with Kenneth B Madsen from Danfoss, who supplied the ejector for the installation. "These relationships have also helped a lot in improving us as a company and keeping up with the latest technology." JR

## AFRICA'S FIRST $CO_2$ TRAINING FACILITY

Central to CRS's distribution -- and Africa's acceptance of natural refrigerant technology -- is the company's new $CO_2$ training facility, which will be fully operational by January 2016.

The new 4700m$^2$ facility, located in Johannesburg, is over five times the size of CRS's current premises, with the training space mirroring the layout of a small supermarket and consisting of a cold room, freezer room, glass-door freezer and chilled cabinets.

The transcritical $CO_2$ system installed at the facility will be identical to that of a typical installation, with the added ability to operate as a booster system with parallel compression, as well as parallel compression in unison with an ejector. The system's versatile functionality will enable CRS to compare the energy efficiencies of each setup.

Wynand Groenewald, Head of Engineering for CRS, says Africa's first $CO_2$ training facility would give refrigeration trainees, as well as contractors and end users, the opportunity to gain invaluable theoretical and practical knowledge about $CO_2$ systems. "We believe that one of the most crucial role players with expanding $CO_2$ is education,"he says. "We want to use the facility to be a more reachable destination for African citizens, where they can learn and do practical work on an operating $CO_2$ system."

## IMPACT OF R22 BAN "HUGE"

As of 2015 it is illegal to use hydrochlorofluorocarbons, including R22, in refrigeration, heat-pump and air-conditioning systems in South Africa.

Africa is a unique case and although CRS is well developed as a natural refrigerant technology provider, Groenewald said the regulations were playing a significant role in accelerating the adoption of natural refrigerant technology and educating end users to make responsible business choices. "It [the HCFC ban in South Africa] has definitely had a huge impact," he said. "The industry is talking a lot more about taking up natural refrigerants.

"Africa is still a difficult market in which to produce cost-effective solutions therefore it is the contractors responsibility to design cleverly and make $CO_2$ technology as cost effective as possible. In the end it is more about convincing, or rather educating, the end user about phase out regulations and where the future of refrigeration is heading. Often, end users do not know what is going on in the refrigeration industry and focus only on cost."

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# Report on Natural Refrigerants Training in **Europe**


2016

**GUIDE TO NATURAL REFRIGERANTS TRAINING IN EUROPE**

— STATE OF THE INDUSTRY

THE reference tool for those looking for guidance on how to select the right training providers, knowledge sources and partners to build their business case around the use of $CO_2$, $NH_3$ and hydrocarbons.

# F-GAS CONSULTATION FORUM BREAKING BARRIERS FOR LOW-GWP ALTERNATIVES

For the first time since the adoption of the EU F-Gas Regulation in April 2014, the European Commission staged the Consultation Forum, highlighting some of the major barriers to the uptake of f-gas alternatives, including standards , a lack of training and the vital role of green public procurement.

— By Klára Skačanová and Justina Tamasiunaite

Traditionally, the standard-making process at EU level has been dominated by the HFC industry while placing overly stringent regulations on natural refrigerants. But there was hope that the winds of change would sweep through when representatives of Member States, EU-level associations and NGOs met to discuss these very issues on 10 September.

The role of the Consultation Forum is to provide its expertise and advice to the European Commission, especially on issues concerning low-GWP refrigerants, their availability, energy efficiency, safety and cost effectiveness. National and EU-level standards, codes and legislation, which make it difficult for HFC-free equipment to enter the market, were discussed at length.

The urgency of alleviating the regulatory barriers is becoming ever apparent, as the adoption of zero- and very-low GWP refrigerants is critical in order to ensure the full implementation of the EU F-Gas Regulation.

## HYDROCARBONS UNFAIRLY DISADVANTAGED

The Consultation Forum concluded that the most harshly treated refrigerants are hydrocarbons, both at national and EU level. Hydrocarbons have a great potential to be safely applied in charges higher than allowed by current industry standards, in refrigeration and air conditioning applications.

Suggestions were made to allow companies involved in producing and working with these fluids to develop separate hydrocarbon-specific standards, so as to objectively define conditions for their use. The European Commission is likely to create a mandate for the European Committee for Standardisation (CEN) to work along these lines. Participation of companies working with hydrocarbon-based technology will be instrumental in the process to amend the relevant European standards to allow for the wider application of hydrocarbon refrigerants.

## GOVERNMENT SUPPORT AND TRAINING

In regard to the lack of training on f-gas alternatives, industry stakeholders suggested that a proactive approach at Member State level was necessary. This includes setting up training centres as well as incentives for technicians to take up training on natural refrigerants.

The F-Gas Regulation makes it mandatory for technicians to hold f-gas certification, while no mandatory certification on f-gas alternatives is necessary. If necessary, the Commission could publish a proposal to ensure safe handling of equipment that does not rely on f-gases.

## THE TIME IS NOW

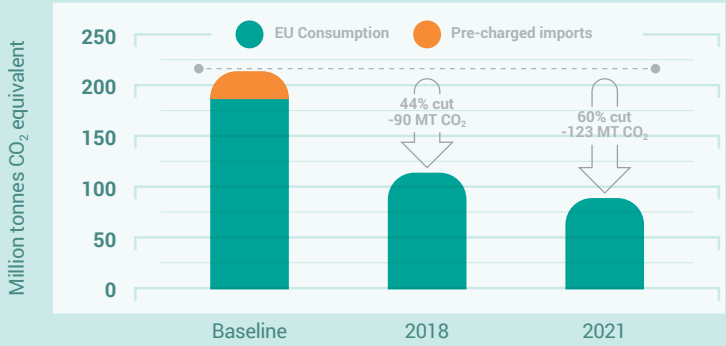
With the F-Gas Regulation looking to reduce 79% of HFC consumption by 2030 (measured in CO2eq) from current levels, it now is more pressing than ever to create fair conditions for f-gas alternatives and enable their wider uptake across different sectors.

While the effects of the HFC phase-down might not be notable for end users and manufacturers at this point in time, this will change within the next 3 years. The first significant cut of 37% in HFC quotas in 2018 is expected to have a great impact on the cost of HFCs, which will become less available.

Considering the fact that as of 2017 the phase down needs to incorporate HFCs pre-charged in equipment, the cut in 2018 becomes equivalent to 44%. Similarly, a major reduction in HFC quotas of 55% will come into force in 2021, which amounts to 60% when considering pre-charged equipment. Therefore, there is urgency to address regulatory and training barriers related to f-gas alternatives as early action is essential in order to be able to reach the targets

## ACTION IS REQUIRED URGENTLY

→ Changing standards and legislation is a slow process
→ But impact of EU HFC phase-down becomes very significant within 3 years
— major cuts occur in 2018 and 2021




Source: Ricardo-AEA Ltd

The European Commission is also looking into how green public procurement can encourage the market to accept environmentally friendly technologies. Currently, only a limited number of Member States include refrigerant criteria in their public procurement policies. However, going forward such a tool could be used to drive both energy efficiency and reduction of f-gas emissions ahead of the phase down schedule, especially in commercial air conditioning and catering refrigeration.

## NEXT STEPS

The consultant will consolidate the findings collected at the Consultation Forum and present a final report to the Commission in November, which will be made publically available by the end of 2015. On the basis of the consultant's study, the European Commission will publish reports regarding the three topics, as requested by the F-Gas Regulation.

In the future, the Commission plans to hold the Consultation Forum on F-Gas Regulation annually. KS & JT

# CARB CURBING HFCs

The Californian Air Resources Board (ARB) is taking regulatory action to control fluorinated gases as part of its draft Short-Lived Climate Pollutant Reduction Strategy.

— By Justina Tamasiunaite

California Environmental Protection Agency
Air Resources Board

The European Union has long been the world's leader when it comes to combatting climate change through reducing harmful fluorinated gases, a transition accelerated by an even stricter F-Gas Regulation brought into force on 1 January, 2015.

Europe's progress has, in part, encouraged other administrationss worldwide to follow the lead with the state of California setting the standard in the U.S.

This has involved taking decisive action to reduce short-lived climate pollutants (SLCPs), including HFCs. Californian legislation now dictates that ARB must create a comprehensive strategy to decrease SLCP emissions in California and present it to the board for final consideration in spring 2016.

Three of the foundations of California's action include reducing the use of HFCs in all applications, introducing incentive programs, and prohibiting the sale of refrigerants with very high global warming potential (GWP).

The draft strategy puts forward possible new measures that aim to reduce emissions of fluorinated gases in California by 40 percent before 2030. This signifies a very realistic pathway for California to eliminate fluorinated gases in the next fifteen years.

The strategy posits that "depending upon the outcome of the November 2015 Montreal Protocol meeting and stringency of the phasedown, if adopted, ARB may pursue a California HFC phasedown schedule that will meet the state greenhouse gas emission reduction goals".

ARB's strategy also considers developing bans and prohibitions on the use of high GWP refrigerants in applications where alternatives are available, and the sale of high GWP refrigerants with the exemption of those that are reclaimed or recycled. In addition, California will develop maximum allowable GWP levels after conducting supplementary research and consulting with relevant stakeholders.

In July, the U.S. Environmental Protection Agency adopted a ban on refrigerants with a GWP of 2500 and higher in new and retrofitted refrigeration installations for food retail, which will come into effect in the latter half of 2016.

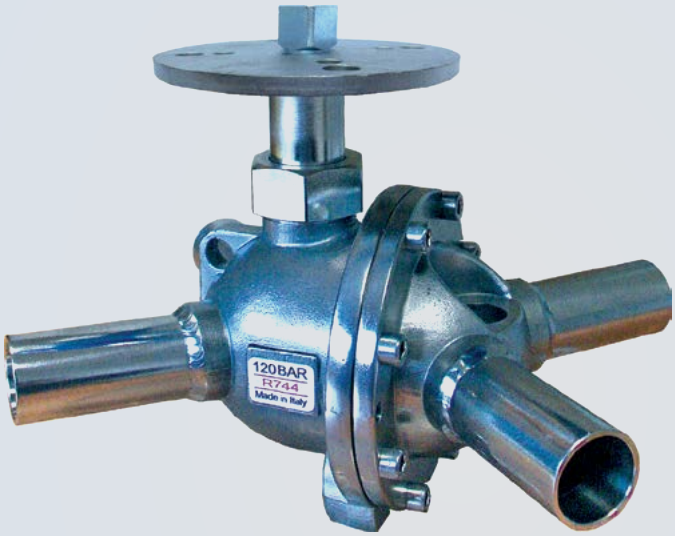
California is also considering developing an incentive program, to be implemented with local air districts and non-profit organisations to encourage the use of low GWP refrigerant alternatives in order to remove these barriers and build experience and knowledge regarding alternatives solutions.

The scheme would help offset initial costs incurred, one of two main obstacles preventing a more widespread adoption of low GWP refrigerants along with the relative lack of familiarity with newer alternative refrigerants.

## EU FACILITATING U.S. TRANSITION

A ban on the use of high GWP refrigerants in new commercial, industrial and residential stationary refrigeration and air-conditioning equipment would oblige manufacturers to sell only low GWP refrigerant technology in California.

As many U.S. manufacturers do business on a global scale, some of who are already transitioning their production facilities to manufacture lower GWP alternatives (in order to comply with the revised European Union F-Gas Regulation), the ARB reasons that this ban would not be an extra burden for companies that already comply with the European legislation. JT




# REFRIGERA'S GREEN REVOLUTION

## A full range of refrigeration valves for $CO_2$ and hydrocarbons

***The EU's 20-20-20 Goals:***

- Reduction of Green House Gas levels by 20%
- Increase share of renewables to 20%
- Reduce energy consumption by 20%

### Refrigera™ 4-way Reversing Valve the key component in Heat Pumps

By using the heat in the air, earth and water, heat pumps have the potential to significantly reduce the consumption of fossil fuels and $CO_2$ emissions.

The ***4-way Reversing Valve*** provides heating and cooling efficiency by reversing the flow direction of refrigerant. The cycle inversion needs no solenoid pilot valve and no slider movement, ***reducing the risk of mechanical seizures*** due to environmental conditions, the presence of dirt or particles. In comparison to the solenoid pilot valves, where the pressure differential regulates the movement of a slider, which changes the direction of the refrigerant, the ***ball-valve design guarantees minimum pressure drop and a very low risk of leakage***, therefore preventing the fault from completing the opening/closing cycle and ensuring a quick changeover, even without any pressure differential. The ball is suspended by 4 Teflon seats and is ***able to work at maximum temperature*** or even in case of ***total absence of pressure*** in the system. The valves are suitable for all P.E. Directive Group 1 or 2 refrigerants and operate under the full pressure of the heat pump system.

### Refrigera is Natural Refrigerant Ready

***Refrigera™ 4-way Reversing Valves*** offer a wide range of connection sizes and allow for special configurations for specific applications upon request. The valves could be supplied to be ***fully compatible with Natural Refrigerants***, which have both low Global Warming Potential (GWP) and zero Ozone Depletion Potential (ODP). Below the nominal diameter of 32, the valves have been designed to work in the transcritical $CO_2$ cycle, PS120 bar (90bar differential pressure).


# NATREFS CRUCIAL TO CHINA'S FUTURE POLICY

While the world is in the midst of discussions on phasing down HFCs and their viable low-GWP replacements, China is recognising the potential of natural refrigerants.

By Klára Skačanová

The 'Catalogue of Recommended Substitutes to HCFCs' published by the Foreign Economic Cooperation Office (FECO) underlines China's support for natural refrigerants, including $CO_2$, ammonia and hydrocarbons, while leaving little to no room for HFCs in China's medium to long-term vision.

The citation of only one HFC in the Catalogue – R32 (with a GWP of 675) for unitary air conditioners, water chillers, heat pump water heaters, and condensing units - is a clear indication of China's stance in promoting natural refrigerants in as many refrigeration and air conditioning applications as possible.

## THE CATALOGUE EXPLAINED

FECO, an agency attached to China's Ministry of Environmental Protection, worked closely with an expert team to establish the list. "A very important principle was that there should be some successful examples or demonstration projects using the technology in China," revealed Zhong Zhifeng, Vice Chief of Division III at FECO. "Even if it is used widely in other countries, if there are no examples in China we did not include it in the list. Moreover, technologies that have a good potential are not listed either."

$CO_2$ is recommended as a suitable alternative in commercial and industrial refrigeration, as well as heat pumps and mobile air conditioning. "I definitely think ($CO_2$ heat pump water heaters) will have a very, very good share of the market by 2020," underlined Zhifeng.

The use of propane in room air conditioners (RAC) is set to grow, following the conversion of 20 RAC production lines and four compressor production lines to R290. There is also a high potential for R290 water chillers.


While this application is not yet included in the Catalogue, Zhong is convinced that, "by 2020 manufacturers will have finished the development of R290 water chillers in China and the technology will be ready for production."

This technology has been widely used in Europe largely due to favourable European standards as compared to IEC and ISO standards, which are far more restrictive. "The precondition for adoption of natural refrigerant technology is that we need to have better standards to ensure the safety - this is the most important aspect," Zhifeng stressed.

As explained further, the intention is to regularly update the catalogue with additional applications as the alternatives are proven in an installation in China."We think HFCs, especially high-GWP refrigerants are relatively short-term solutions - or 'transition technology' - and this is why we did not put any high-GWP refrigerants in the list."

## NATURAL REFRIGERANT RECOMMENDED SUBSTITUTES FOR R22 BY APPLICATION

| | |
|---|---|
| R744 ($CO_2$) | » Residential heat pump water heaters<br>» Commercial & industrial heat pump water heaters |
| Ammonia ($NH_3$) | » Industrial refrigeration<br>» Transport refrigeration<br>» Condensing units |
| Hydrocarbons | » Residential AC (R290)<br>» Plug-in commercial refrigeration (R290, R600a) |

## TIME TO INVEST IS NOW

The Catalogue should serve as a guideline especially for domestic manufacturers, but also for consumers and policy makers in the long term. While there are no regulatory obligations resulting from the catalogue, the government has implied that policy actions to support the introduction of these technologies will follow.

This was the approach that the government took after announcing its support for promotion of R290 as a replacement for R22 in residential air conditioners in 2012. Besides helping air conditioner manufacturers overhaul their production lines, the government provided subsidies for the production and marketing of R290 air conditioners as well as introduced a new 'Environmental Protection and Low Carbon Label' in 2015 to incentivise consumers to choose green air conditioners.

"I think this is the best timing for investment in environmentally friendly technologies, such as those using natural refrigerants," Zhifeng emphasised. "Our government is now promoting eco-civilisation including the environmental protection and we also treat eco-civilisation as sustainable development."

There are a lot of policies to support this new concept. For example, only a few months ago the central government drafted a plan on the update of the manufacturing capacities until 2025, based on which more focus will be put on energy efficient technologies."

While fully understanding the complexities of opening up a business in China, Zhong noted that FECO has developed a scheme – the International Platform for Environmental Technology (3iPET.mepfeco.org.cn) – which provides comprehensive support to international organisations looking to invest in advanced sustainable technology in China. This includes services such as identifying willing investors and local governments to adopt the new technology. KS

# $CO_2$ TAKING BOOSTHEAT TO THE TOP


## Setting Global Standards for Heat Pump Efficiency

— By Robert Davidson

"Everyone is here to see the most efficient heat pump on show" states Celine Conrady, boostHEAT's Head of Business Development, at Interclima+elec, a trade show held in Paris on 2-6 November that was dedicated to comfort and energy efficient solutions.

The heat pump in question stands beside us, almost a monolith in terms of size and stature, and it has been attracting attention throughout the trade show and during our interview, with new faces popping up to check out the heat pump proudly branded with R744 on the side. Conrady explains what makes this heat pump so unique:

"The main principle of this compressor is that it is thermally driven and it transfers the heat from the gas into the direct compression of $CO_2$ and with this effect, we achieve an efficiency of up to 200%."

Since the compression is done without mechanical power transmission, the pressure cycle is the result of the thermal cycle. This means that the system undergoes very little wear, thereby achieving a long lifetime while running oil-free and maintenance-free. While currently a large system, there is a potential for the application range to be broadened but concrete plans are under-wraps for now.

### Transitioning from a premium product to an affordable luxury

One can't help but notice the size of the heat pump on display. When asked about this, Conrady notes its purpose:

"This is a very high-end product, everything has been selected inside the product to have a long-duration and to be very secure. We are targeting, at first, the high-end segment of the market, like consumers with big houses, as it has a power range of between 20-30kw, so large users of heating."

While R744 is noted for its environmental friendliness, Conrady explained how selling R744 to the public is a breeze, noting that as a refrigerant for this specific application, there is nothing better and that the benignity of $CO_2$ is an added bonus:

"$CO_2$ has very good properties at high temperatures and at very low temperatures, that's why it was chosen for our thermal compression method… Also by doing this, we are sure that we are anticipating future legislation."

### European technology innovation attracting interest from China

While the commercial launch is not until winter 2017, boostHEAT is already receiving foreign contracts.

"We have already signed contracts with two corporations in China…One corporation is the Centre for Building Research in China, the corporation who give approval for Chinese certifications and also to allow for access to Chinese subsidies. In China, the market for heat pumps is growing quickly."

This is supported by China's Foreign Economic Cooperation Office of the Ministry of Environmental Protection (FECO), which formally recommend R744 as a refrigerant for household, commercial and industrial heat pump water heaters in 2015.

shecco's own research suggest that there are currently 160 $CO_2$ transcritical commercial heat pumps installed in China with a clear indication that this will increase. RD

# SHORT TAKES

By James Ranson, Robert Davidson & Elke Milner

## EPA PLANS SNAP RULE IN RESPONSE TO NGOS

Following backlash from environmental organisations riled by its decision to push back many of its HFC delisting dates, the U.S. Environmental Protection Agency (EPA) plans to complete a new rule under its Significant New Alternatives Policy (SNAP) programme within the next year.

Organisations including the Natural Resources Defense Council (NRDC), the Institute for Governance and Sustainable Development (IGSD) and the Environmental Investigation Agency (EIA) filed petitions after the EPA was swayed by industry stakeholders in July to push back delisting dates of many HFCs and HFC blends by at least one year, despite predicting the use of HFCs in the U.S. to grow by 20% by 2020.

For instance, in retail food refrigeration applications, a number of HFCs in new supermarket systems are to be delisted from 1 January 2017 rather than the initial proposal of 1 January 2016, while 1 January 2018 is the revised date for new remote condensing units.

The petitions request the EPA to use SNAP to set deadlines for replacing HFCs with climate-friendly alternatives and remove high-GWP HFCs such as R404A, R134a, R410A from the list of acceptable substitutes in commercial, residential and industrial applications. JR

## EU HEATING AND COOLING STRATEGY MOVES FORWARD

Since it was proposed in 2014, the European Union's Heating and Cooling Strategy has grown in momentum.

The European Commission is using the EU Heating and Cooling Strategy as an opportunity to target and reduce energy wasted in heating homes and offices.

Early next year, the Commission plans to formulate recommendations on heating and cooling measures, including heat pumps, cogeneration units and other natural refrigerant solutions. Its aim is to update EU energy legislation, with the possibility of drafting new directives.

The necessity for change is clear. The Commission estimates that half of Europe's heating demand is in areas where population density is high enough for district heating infrastructures. Updating these areas with more efficient alternatives could cover 40% to 70% of EU heating demand.

The finalisation of recommendations was pushed forward when 27 representatives of 13 Member States and 143 represented associations met in Brussels to discuss the five issue papers released by the Commission in September. RD

## AMMONIA HEAT PUMP HEATS AND COOLS U.K. OFFICE BUILDING

Leominster, U.K.-based I-I-Ice Ltd recently received a RAC industry award for its first-of-its-kind (installation in the U.K. of an ammonia heat pump that heats and cools a commercial building.

The ammonia heat pump offers the AkzoNobel building a low-GWP heating and cooling solution that cuts operating costs by 96%, saving about £350,000 (more than €496,000) per year compared to the conventional chiller/boiler combination. The reduction in energy consumption and the effective use of heat recovery make this installation particularly innovative and, according to the RAC judges, an "exceptional project of its type."

The project is also on the 2016 National ACR & Heat Pump Awards shortlist. EM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- Premium product directory showcasing product launches and state-of-the-art technology on display at company booths

# SHORT TAKES

By James Ranson, Robert Davidson & Elke Milner

## GREEN & COOL CHILLS FOOD IN SCANDINAVIA'S LARGEST MALL

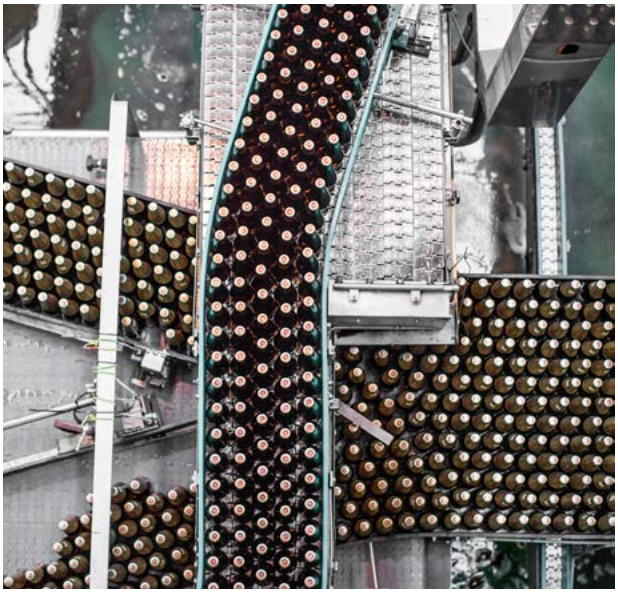
The largest shopping mall in Scandinavia officially opened its doors in November with many of its retail outlets choosing to install environmentally friendly $CO_2$ refrigeration systems from Green & Cool.

The mall - situated just minutes from downtown Stockholm and the Swedish national football arena - contains over 100,000m2 of retail space, including 250 stores spread over three floors, as well as a 15-theatre cinema complex.

To meet strict environmental requirements, food retailers, including ICA Kvantum, Max Hamburgers, SF Filmstaden Cinema, Unibail-Rodamco and Panini Internazionale, chose Green & Cool refrigeration systems, ranging from small split versions to larger booster units.

"We didn't have any active marketing input in this case," says Kent Hofmann, Sales Engineer,Green & Cool. "Many of the installers already knew of us, but in most cases it seems to have been the tenants themselves who came to the conclusion that our solutions are the best."

The Mall of Scandinavia is one of only a handful of shopping centres in Europe to have been given an Excellent rating for its design by BREEAM, the global environmental and sustainability standard. JR



## SABMILLER JOINS REFRIGERANTS, NATURALLY!

SABMiller, one of the world's leading brewers, is the latest major corporation to join the Refrigerants, Naturally! initiative, committing to reducing its emissions from refrigeration by 25% by 2020 and to stop buying new equipment using hydrofluorocarbons (HFCs) by the same date.

"With the United Nations Global Goals and the run up to the crucial COP climate talks in Paris, it is more important than ever that we demonstrate how business can make a meaningful contribution to reducing the impacts of climate change," says Anna Swaithes, SABMiller's Director of Sustainable Development.

Refrigerants, Naturally! is a global initiative of companies supported by Greenpeace and the United Nation Environment Programme.

It's committed to combatting climate change and ozone layer depletion by substituting harmful f-gases with natural refrigerants, particularly in point-of-sale cooling applications. Its members include the Coca-Cola Company, PepsiCo, Red Bull and Unilever. JR

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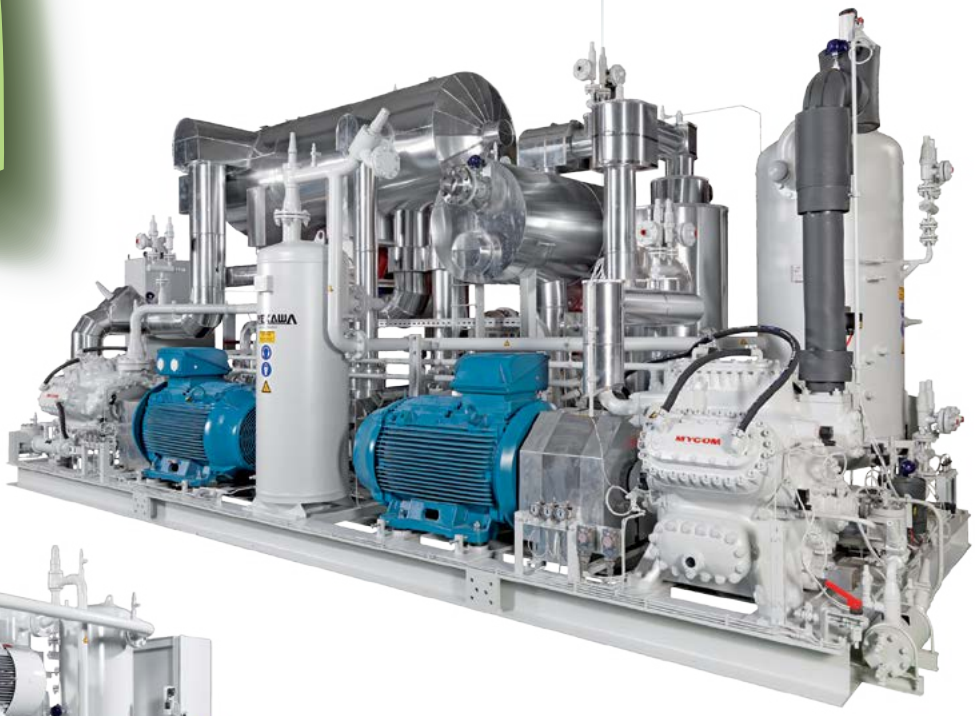

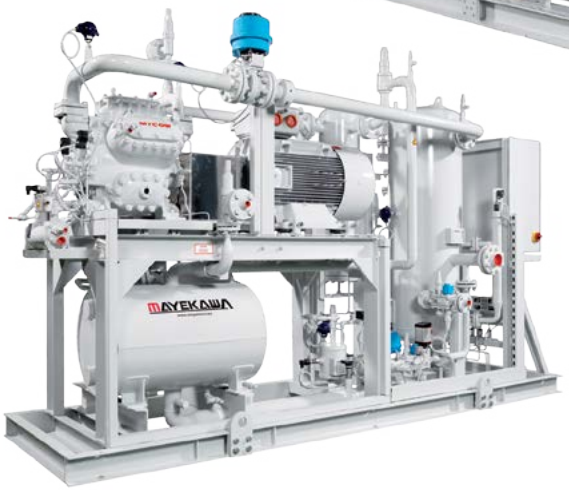


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