

SPECIAL EDITION: 2018-2019

# ACCELERATE

ADVANCING HVAC&R NATURALLY

C O R P O R A T E

## GREEN



&

## GLOBAL

NATURAL REFRIGERANTS AROUND THE WORLD

This issue of *Accelerate Corporate* was  
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**BEIJER REF**

**About**  
***ACCELERATE CORPORATE***

*Accelerate Corporate* captures the efforts of market leaders in advancing the use of natural refrigerants across different applications, industry sectors and continents.

Each issue of the magazine is prepared in partnership with an influential corporation, organisation or group of entities striving to accelerate the uptake of climate-friendly, natural refrigerant-based technologies.

*Accelerate Corporate* seeks to showcase end users' experiences working with natural refrigerants and to highlight the underlying market, policy and technology trends driving their uptake.



# Investing in a greener future

– Editor's Note by Andrew Williams



Andrew Williams  
Editor

**A**ll over the world, forward-thinking end users of HVAC&R technology are looking for future-proof solutions that will help them to comply with the requirements of the Kigali Amendment to the Montreal Protocol – which compels countries to phase down their use of HFCs according to different national timescales.

Natural refrigerants CO<sub>2</sub>, ammonia and hydrocarbons are proven alternatives that have been used in different HVAC&R applications for many years. Companies that can today provide natural refrigerant-based technology worldwide stand to benefit as the HFC phasedown begins to create new market opportunities for it.

As the adoption of HFC-free systems increases worldwide, so does the competition between different natural refrigerant-based options. Our special feature looks at how the global HVAC&R market is evolving (p. 20).

Beijer Ref's twin status as a wholesaler and manufacturer of HVAC&R technology puts it in a unique position to stay ahead of its competitors by

adapting to these global trends. We sat down with CEO Per Bertland to find out the company's vision for the future (p. 6).

Italy-headquartered multinational SCM Frigo, meanwhile, began producing hybrid CO<sub>2</sub> systems back in 2004. Today, it is reaping the benefits of its early-adopter status as the market for CO<sub>2</sub> transcritical systems takes off. We spoke to the firm's managing director, Nicola Pignatelli, about the market prospects for different natural refrigerants (p. 10).

For commercial refrigeration, SCM Frigo systems installed in Spain, Italy and Chile are helping to demonstrate the efficiency of CO<sub>2</sub> in warm climates (p. 14).

METRO China, meanwhile, opened its pilot CO<sub>2</sub> transcritical store in Beijing earlier this year – the first in China's food retail sector to use the technology. The food wholesale specialist is aiming to fit transcritical systems in all its new Chinese stores by 2025 (p. 18).

In industrial applications, natural refrigerants are also progressing.

South African butchery Meat World has opted for CO<sub>2</sub> transcritical to improve efficiency – for a new meat processing plant in Johannesburg (p. 19). Moreover, the ice rink at Sparta Amfi youth centre in the Norwegian city of Sarpsborg was retrofitted with a CO<sub>2</sub> chiller system (p. 16).

New technology developments are helping to broaden the market for natural refrigerant-based HVAC&R solutions around the world.

To reduce ammonia charges and simplify the installation process, Dutch firm SCM Ref BV will start making a low-charge ammonia packaged unit in 2019 (p. 28), while a unique, propane-based compact chiller from Sweden's SCM Ref AB is already helping HVAC customers to go green (p. 26).

I would like to take the opportunity to thank Beijer Ref, whose support made this special edition of *Accelerate* possible. Some of the group's technologies will be on display at Chillventa – one of the world's most important HVAC&R tradeshow – in October 2018 (p. 30). I hope to see many of you there.

Enjoy the issue!

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// Market

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# WHAT PROJECT DRAWDOWN CAN TEACH HVAC&R

**The industry should come together to maximise its potential as the No. 1 Project Drawdown solution to climate change.**

– By Phil Wilkinson



**In** April 2017, '*Project Drawdown*', a research project that included more than 65 researchers and scientists from 22 countries, ranked refrigerant management as the No. 1 solution out of 80 existing (and 20 emerging) climate-change mitigation solutions for reversing global warming between 2020 and 2050.

The project's findings were described in a book, *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming*, edited by Paul Hawken. It found that refrigerant management – that is, containing (or destroying) 87% of the refrigerants likely to be released over 30 years – would avoid emissions equivalent to 89.70 gigatons of atmospheric CO<sub>2</sub> (compared to business-as-usual). This would come at a cost of \$902.8 billion under a 'plausible scenario'.

Refrigerant management thus represents 8.5% of the total global emissions reduction enabled by all 80 existing solutions under Project Drawdown.

Phasing out HFCs under the Kigali Amendment to the Montreal Protocol – not included in the original analysis – could avoid additional emissions equivalent to 25 to 78 gigatons of CO<sub>2</sub>e.

The refrigerant-management chapter in Drawdown cites the market availability of natural refrigerants as

substitutes for HFCs, noting the need for "addressing the refrigerants coming out of use, as well as transitioning those going in".

Project Drawdown confirms that our industry has a massive role to play in reducing, and potentially reversing, global warming. It has inspired me to work with others to create a cross-sectoral HVAC&R Project Drawdown approach.

In Australia, operating refrigeration and air conditioning systems consumes some 23% of all the electricity generated in the country, and is responsible for more than 12.5% of total national emissions. Indirect emissions (driven by electricity consumption) from HVAC&R systems typically represent 90% or more of total emissions, so HVAC&R energy consumption clearly has a significant sustainability impact.

We do not have these figures for the rest of the world, and part of the reason for this is that the worldwide industry is fragmented. Yet the climate-control solutions developed in one country are generally applicable to other countries.

The Project Drawdown model would help galvanise collaborative efforts and provide a way of gathering global information.

An effective international knowledge hub would make it easier to share ideas and innovations that could help make

Phil Wilkinson, chief executive of AIRAH from 2010 to 2016, is now its executive manager – government relations and technical services.

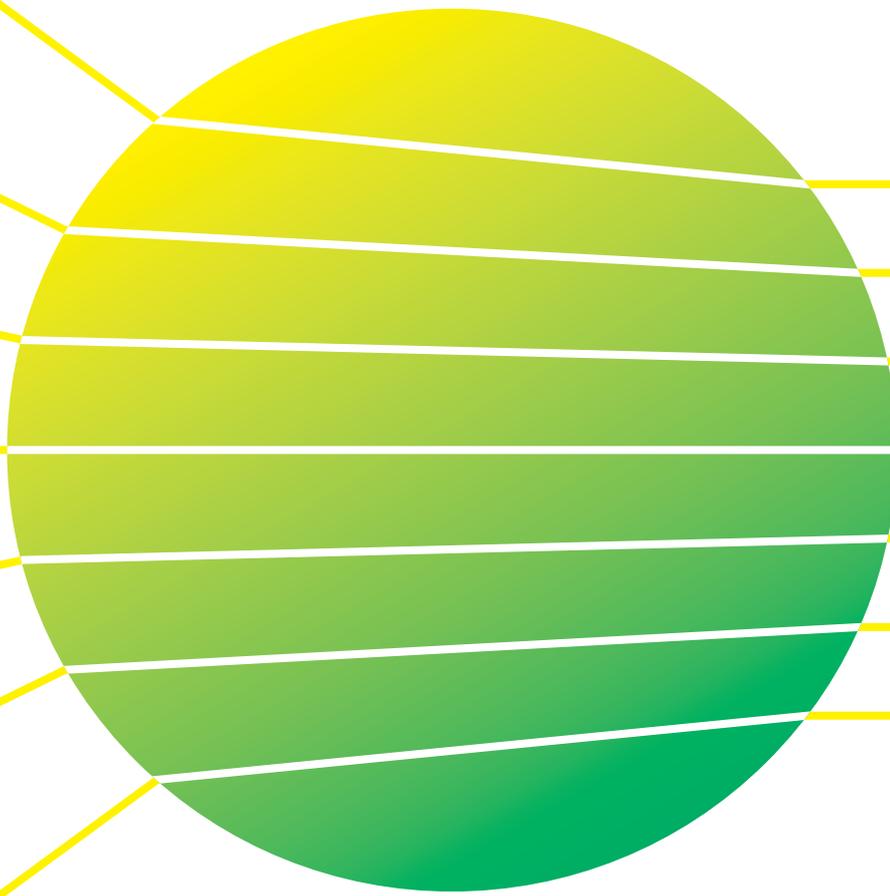
the sector more sustainable. It would also highlight knowledge gaps, which could then help prioritise research.

HVAC&R has sustainability impacts through energy consumption, water consumption, indoor environment quality, and refrigerant-related atmospheric changes, all of which are interrelated. And it affects everything from keeping our food fresh, to enabling health and digital infrastructures, to the design and maintenance of high-performing buildings, and to the industrial and commercial refrigeration services used in manufacturing, production and agriculture.

Technical or organisational solutions will only work if people take them up. So we need to encourage behavioural change in the HVAC&R industry and its users and clients.

We have already reached out to some organisations/projects to involve them in a global initiative, and we have started a LinkedIn network (Humans of HVACR) with a tool called Mighty Networks.

If you'd like to join the HVAC&R Project Drawdown project, contact me at [phil.wilkinson@airah.org.au](mailto:phil.wilkinson@airah.org.au). ■ PW



## INSPIRED BY SWEDEN

**Beijer Ref's twin status as a wholesaler and manufacturer of HVAC&R technologies puts it in a unique position to stay ahead of the competition as different parts of the world transition to natural refrigerants. *Accelerate* sits down with CEO Per Bertland to hear about the company's vision.**

– By Andrew Williams

**T**he Beijer Ref group, headquartered in Malmö, Sweden, is one of the world's biggest distributors of HVAC&R technologies. Its 416 branches and 1,200 suppliers offer some 200,000 products to 100,000 customers around the world.

The company's expansion strategy is twofold. "One aspect is to enlarge our geographical landscape. The other is to harmonise our product portfolio and our production," Beijer Ref CEO Per Bertland told *Accelerate*. "The idea is to produce as an OEM in several sites around the world, and to sell the portfolio everywhere."

At first, Beijer Ref focused its expansion on Sweden and the wider Nordic region, only later extending its acquisitions to the rest of Europe. Today, its outlook is global.

"We see Italy as our R&D hub. We specialise on CO<sub>2</sub> there. In the Netherlands, it's ammonia, and in Sweden, we focus on propane. The idea is to have three main manufacturing centres, specialised for each natural refrigerant," Bertland explains.

Beijer Ref also has manufacturing operations in Sydney, Auckland, Wuxi, Bangkok and Johannesburg. "We want to take our European knowhow to other parts of the world," Bertland explains.

Beijer Ref first observed that Scandinavian food retailers were taking an interest in CO<sub>2</sub> as a means of reducing their carbon footprint in the early 2000s. "In Sweden then, being seen as a green retailer was already considered a commercial advantage. It wasn't just a sustainability topic," Bertland says.



Per Bertland,  
Beijer Ref CEO

"We saw the market changing, and decided we also needed to offer CO<sub>2</sub> transcritical systems," he explains.

One option would have been for Beijer Ref to develop CO<sub>2</sub> technology itself.

Another option was to buy a company that already had the knowhow. Beijer Ref acquired 51% of SCM Frigo, an Italian OEM, in 2011. It acquired the remaining 49% in 2014.

"This was a big step for us, from being treated primarily as a distributor to being considered a manufacturer too," Bertland says.

Many governments around the world are either already implementing or working to put in place HFC phasedown policies in the framework of the Kigali Amendment to the Montreal Protocol.

As CEO of a global company, Bertland is acutely aware that this will herald significant market opportunities for alternative HVAC&R technologies.

"I'm convinced that the rest of the world will follow the path that Europe is taking towards natural refrigerants," he declares.

Asked how backing natural refrigerants will help his business, he replies: "There are two reasons to do it – one, purely commercial, if that's a direction the market is going. Two, it's good to contribute to creating a greener world."

"We already have the technology knowhow. We already have the product portfolio. We already have the market distribution. And we already have the production facilities. To be successful, we simply need to implement all this around the world," he explains.

Bertland is optimistic that natural refrigerants will grow. "I expect them to take a bigger market share worldwide. Europe will be the leader, and the rest of the world will follow. That's our conviction," he says.

Beijer Ref is therefore keen to enlarge its natural refrigerant portfolio. It is this desire to be at the forefront of new technology development that drives the company's expansion.

"Acquisitions are arguably the most important pillar of our strategy," Bertland says. "We'll continue to make them."

The acquisition of Heatcraft Australia in March 2018 is a typical example. "We were in Australia before, but not China or Singapore. So Heatcraft

*“I’m convinced that the rest of the world will follow the path that Europe is taking towards natural refrigerants.”*

– Per Bertland,  
CEO, Beijer Ref

Australia fitted both aspects of our strategy – we enlarged our geographical reach, and we added new production facilities to harmonise our product offer around the world.”

Indeed, Bertland describes Australia as Beijer Ref’s biggest emerging market for natural refrigerant technologies.

“We’re successful in Europe with our CO<sub>2</sub> transcritical booster solutions, where we’re one of the market leaders,” the Beijer Ref CEO explains. “Now we’re bringing that technology and our expertise to our factories in Australia.”

This desire to offer natural refrigerant solutions worldwide is also driving Beijer Ref to expand elsewhere.

“We have the same idea for China, for Thailand and the rest of Southeast Asia, and for Africa,” Bertland says. “We think [natural refrigerants] will come, and we’re ready now.”

Yet natural refrigerants are not the only alternatives to HCFCs and HFCs currently on the market. What is Beijer Ref’s position regarding the new generation of synthetic refrigerants, hydrofluoroolefins (HFOs)?

“Natural refrigerants will grow strongly, regardless of the future place of HFOs in the market,” Bertland says. “It’s important for us to be a full-service supplier to our customers, and to be able to provide them with the solutions they want.”

Asked about competition between natural refrigerants themselves, the Beijer Ref CEO replies: “In supermarkets and hypermarkets, CO<sub>2</sub> will surely continue to take the biggest market share. But in smaller stores, solutions like propane water loops also have a role to play.”

“Once the charge limit is increased, it will also be possible to achieve bigger capacities with propane. It’ll be CO<sub>2</sub> for bigger stores, but propane might win in smaller stores,” Bertland predicts.

As natural refrigerant systems become more widespread, it is essential to ensure that end users, contractors, installers and service technicians around the world have the expertise to work with them.

With its global reach, Beijer Ref understands the importance of providing such training. It opened the Beijer Ref Academy, its new training centre in Italy, in March 2018.

“Educating people on CO<sub>2</sub> technology is a crucial part of our strategy. We want our customers to understand our offer,” Bertland explains.

“Our vision is to open similar such academies in Australia, Asia and Africa one day. We fully believe this technology will take a bigger market share everywhere,” he says.

When Bertland started working for Beijer Ref 28 years ago, the group was a conglomerate of around 20 different entities – everything from dentistry to trucking.

Sweden was experiencing an economic crisis at the time. “But despite the recession, our Swedish refrigeration wholesale business – Kylma AB – was performing well,” Bertland recalls.

“We drew the following lesson from this – refrigeration is often food-related. People must eat, even in a recession. It’s a very stable business. So we started to acquire HVAC&R firms,” he says.

Bertland took over as CEO in 2013. Under his watch, turnover has increased from 6.6 billion SEK to 13 billion. “We have great people working for the Beijer Ref family – who espouse our four key values – committed, engaged, straightforward, and united,” he says.

Yet he is perhaps most proud of the company’s leadership on green solutions. “Sweden is quick to follow new market trends. It’s in our culture to care about protecting the environment. As a Swedish company, we defend these values in our industry,” he says. ■ AW

# THE BEIJER FAMILY

1,200

suppliers

Committed

Engaged

416

branches

100,000

customers



## Straightforward

United

200,000

products



# PIONEERS OF CO<sub>2</sub>

Italy-headquartered SCM Frigo began producing hybrid CO<sub>2</sub> systems back in 2004. Today, it is reaping the benefits of its early-adopter status as the market for CO<sub>2</sub> transcritical systems takes off.

– By Andrew Williams

**N**icola Pignatelli, managing director of Italy-headquartered multinational OEM SCM Frigo, is proud of the role the Beijer Ref-owned company has played in bringing to market CO<sub>2</sub> transcritical refrigeration systems around the world.

SCM Frigo's natural refrigerant journey began in 2004, when it designed its first hybrid CO<sub>2</sub> systems. "Initial demand came from Scandinavia, where supermarkets immediately started to go for natural refrigerants," Pignatelli told *Accelerate*.

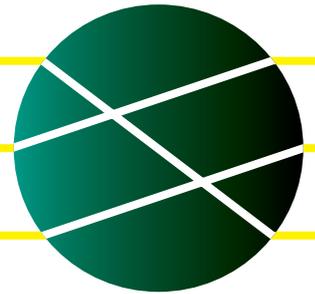
"These systems were subcritical hybrid systems," Pignatelli explains. "We started with CO<sub>2</sub> transcritical systems immediately after that. The market began to demand CO<sub>2</sub> transcritical in 2006 – and we were ready."

Returns were modest at first. "The business improvement didn't come immediately," Pignatelli admits. "CO<sub>2</sub> was more the technological choice of a few companies in Europe, one of which was SCM Frigo. In the beginning, I wouldn't say that the business grew because of CO<sub>2</sub>," he says.

The market began to pick up as end users became more familiar with the technology. "Then it started to help the business very much. When supermarkets started to approach CO<sub>2</sub>, they were looking for players who had already been using it for a few years," Pignatelli explains.



Nicola Pignatelli,  
managing director, SCM Frigo



*“We want to train people, to make CO<sub>2</sub> easier to manage and the systems easier to build.”*

– Nicola Pignatelli, managing director, SCM Frigo

### INVESTING IN TRAINING

Confident in the future market prospects for CO<sub>2</sub> transcritical, SCM Frigo has invested heavily in training, for both its own staff and its customer base. “This has helped us to improve our production process,” Pignatelli says.

In March 2018, SCM Frigo’s parent company Beijer Ref opened the Beijer Ref Academy.

“We want to train people, to make CO<sub>2</sub> easier to manage and the systems easier to build,” Pignatelli explains. “We’re particularly training field engineers – the people who start up the systems out there in the field. The target is contractors and installers.”

SCM Frigo has also invested in training within the company, to readapt its production methods to CO<sub>2</sub>. “We’ve also taken on board experienced people, especially in servicing,” Pignatelli says.

With natural refrigerants becoming increasingly mainstream HVAC&R options to help Europe’s food retail sector to comply with the HFC phasedown taking place under the EU’s F-Gas Regulation, end users are becoming more familiar with the technology, installers are more comfortable with it, and suppliers are more supportive.

“For supermarket refrigeration, CO<sub>2</sub> is now business as usual. The EU F-Gas Regulation doesn’t offer many alternatives,” Pignatelli says.

### NEXT STOP...INDUSTRIAL

With CO<sub>2</sub> already well established in the commercial refrigeration market, SCM Frigo is turning its attention to the industrial sector.

“We’re now developing the industrial segment,” Pignatelli says.

In the industrial refrigeration market, CO<sub>2</sub> faces competition from another natural refrigerant – ammonia. Does SCM Frigo intend to add ammonia equipment to its portfolio?

“SCM Frigo used to make ammonia chillers. Today they’re made in Beijer Ref’s Dutch subsidiary SCM Ref BV,” Pignatelli says. “We think the numbers will favour CO<sub>2</sub> in future. We’re focusing on our CO<sub>2</sub> business for now.”

Today the business case for CO<sub>2</sub> is compelling. Yet at the outset, the situation was not quite as clear-cut. “Back in the early 2000s, CO<sub>2</sub> was a bit of a gamble for everybody,” Pignatelli says.

Lack of available components and a paucity of experience among technicians and installers were among the reasons for this. “Suppliers of compressors, valves, heat exchangers – they weren’t really convinced that the market was booming,” Pignatelli recalls.

At that time, component manufacturers were focused on making prototypes to test in the field. “We were the testers of many components for our suppliers,” says Pignatelli.

“Today, when suppliers come out with a new component, we’re still one of the first companies they ask to test it,” he says. “I’m talking about the big market players. Their CO<sub>2</sub> knowledge grows together with ours, because they’re testing in real applications,” he adds.



SCM Frigo's CUBO<sub>2</sub> Smart condensing unit (l) and a CO<sub>2</sub> transcritical rack (r) at the Beijer Ref Academy.

SCM Frigo serves customers all over the world. Asked whether he sees differences between European countries, in terms of natural-refrigerant adoption, Pignatelli replies, "in the Nordic countries the skill level is very high".

"In the Nordics, finding components was never a problem. In Central Europe, it was a little problematic for a while, but today they are very skilled," he says.

Pignatelli continues: "Customers in some countries adopted natural refrigerants because they really think that they are better, more efficient, and more environmentally friendly, fitting their green image."

"In other countries, they moved because legislation forced them to. In southern European countries, it's like this. In Spain and Italy, they only started last year," he says.

Historically the world of HVAC&R manufacturing is based in Italy. Companies like SCM Frigo are therefore used to exporting to Europe and the rest of the world. "We're forced to look to the world, not just domestically," Pignatelli says.

## CO<sub>2</sub> RIPE FOR GROWTH IN CONVENIENCE STORES

Europe is estimated to be home to 110,000-115,000 supermarkets, according to figures from sheccoBase, the market development arm of *Accelerate* publisher shecco.

Most still appear to be using HFCs. Yet the commitment of major retailers such as Carrefour, METRO AG, Sainsbury's and Ahold Delhaize to adopting natural refrigerants is helping to boost the market for natural refrigerants in Europe's commercial refrigeration sector.

Today, sheccoBase estimates that there are around 14,000 supermarkets in Europe fitted with CO<sub>2</sub> transcritical systems (February 2018 figures).

"Food retail remains a huge opportunity," says Pignatelli. "We've only just started. It will continue to be our biggest market for at least the next three to four years," he predicts.

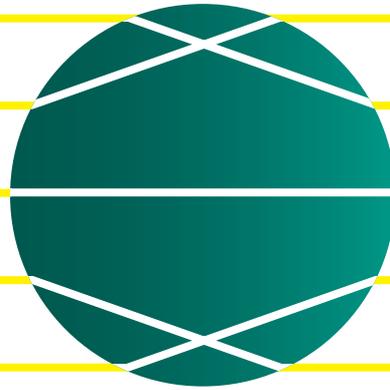
The SCM Frigo boss highlights convenience stores as a promising future growth area for natural refrigerants in Europe.

"In Europe, there are a huge number of smaller stores and convenience stores that still need to transition in the right direction because of the EU F-Gas Regulation," Pignatelli says.

He is optimistic about the growth prospects for CO<sub>2</sub> in the broader market too.

*"Today, when suppliers come out with a new component, we're still one of the first companies they ask to test it."*

– Nicola Pignatelli, managing director, SCM Frigo



## COMPETING WITH AMMONIA

“My opinion has changed in recent years. We thought there would be a sector more for CO<sub>2</sub> (more commercial), and a sector where ammonia would expand a lot (industrial), so we wanted to have both,” Pignatelli says.

“But growth for ammonia in recent years has been flat. Whereas CO<sub>2</sub> is taking some of the place of ammonia, with larger compressors bringing CO<sub>2</sub> to applications that were for ammonia a few years ago,” he says.

How significant is the competition from propane – another natural refrigerant – in the commercial refrigeration sector?

“Propane is also growing, but there are still some restrictions in terms of legislation,” Pignatelli says.

The present international standard for hermetically sealed commercial refrigeration

equipment (IEC 60335-2-89) – set by the International Electrotechnical Commission (IEC) – limits the use of flammable refrigerants to 150g. Efforts are underway in the IEC to increase this.

“The increase in charge limits is a good thing because hydrocarbons are natural refrigerants,” Pignatelli says.

Yet he is keen to focus on the rise of CO<sub>2</sub> as a serious competitor to ammonia in industrial applications. “Today we’re doing plants of 2-3 MW with CO<sub>2</sub> units, whereas until a few years ago this was absolutely just ammonia, in those capacities,” he says.

As for plug-in systems with propane, he argues that, “they have their positives and negatives”.

“The negative is flammability. Not everyone wants a flammable refrigerant. There will be a lot of growth, but hydrocarbons will never reach the larger scale applications like CO<sub>2</sub>,” Pignatelli says. “So there is plenty of room for everybody.”

■ AW

SCM Frigo  
Managing  
Director Nicola  
Pignatelli (l) and  
Beijer Ref Group  
CEO & President  
Per Bertland (r)  
at the opening  
of the Beijer Ref  
Academy.



# LET'S TAKE A COLD SPIN AROUND THE WORLD

Commercial refrigeration systems from SCM Frigo installed in Spain, Italy and Chile are helping to demonstrate the efficiency of CO<sub>2</sub> transcritical in warm climates.

– By Charlotte McLaughlin

**T**he natural refrigerant carbon dioxide has long been a promising environmentally friendly option for the commercial refrigeration industry due to its low global warming potential (GWP) of just 1. HFCs, on the other hand, have comparatively high GWPs (R134a, for example, has a GWP of 1430).

Yet despite its environmental credentials, some potential customers have disregarded transcritical CO<sub>2</sub> for fear of its low critical temperature, which in warm regions used to deliver a poorer energy-efficiency performance compared to HFCs (leading to higher indirect emissions). In northern climates, CO<sub>2</sub> transcritical systems have long succeeded in the market as they work more efficiently than their HFC-based counterparts when the outdoor temperature is below 25°C.

Thanks to recent technical innovations like more efficient booster systems and condensing units for CO<sub>2</sub>, smarter controls, parallel compression and multi-ejectors, CO<sub>2</sub> is fast becoming a future-proof solution even for commercial refrigeration in warm regions.

## GOING HOME

SCM Frigo, an Italian multinational company based in Padova (and owned by Beijer Ref), has been making subcritical CO<sub>2</sub> systems since 2004. It built its first CO<sub>2</sub> transcritical system in 2005, installed in a supermarket in Scandinavia. Today, customers in warmer climates like Italy are using its innovative CO<sub>2</sub> technology.

The '*Fresco & Vario*' frozen food supermarket in Conegliano – close to Treviso, Italy – is equipped with an SCM Frigo-designed CO<sub>2</sub> system utilising parallel compression, installed in March 2016.

"This fully integrated system installed at the frozen food supermarket chain '*Fresco & Vario*' in Conegliano was reported by the supermarket to have had an energy saving of 10%," SCM Frigo Technical Director Mirko Bernabei said in December 2016.

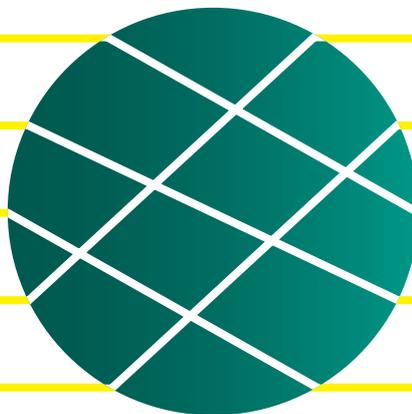
The 600 m<sup>2</sup> supermarket, fitted with 23 cabinets and a cold room, "uses parallel compression, providing a better performance during the summer," Bernabei explained.

The CO<sub>2</sub> system provides 71 kW of air conditioning for the supermarket. In the colder months it operates as a heat pump.

"The gas cooler is equipped with a built-in evaporator that is producing the false load for the heat pump. One parallel compressor is connected to the external load to operate as a heat pump," Bernabei explained.

"When the cooling demand is low and heating is required, the system activates heat pump mode to provide sufficient heating (51 kW of water at 50/60°C)," he said.

SCM Frigo also has begun to sell its CO<sub>2</sub> transcritical condensing units in Spain. A supermarket in Tarragona, eastern Spain and a butchers shop in Grenada, southern Spain, are two recent examples.



The Tarragona supermarket uses two low-temperature CUBO<sub>2</sub> Smart condensing units (-25°C) to provide 6 kW of cooling power to the supermarket freezers.

Alessandro Franchin – area export manager at SCM Frigo for Central Europe, Spain, Portugal and Ireland – says the supermarket has been operating fine since it was installed a few weeks ago. In August 2018 outside temperatures in Tarragona went up to 40°C, averaging the mid-20°C mark during the day.

The supermarket operates with a standard unit with a standard gas cooler, controlled by the Hecu control system from CAREL (another Italian multinational). It is also fitted with an expansion valve, Franchin told *Accelerate*.

In the Grenada butchers shop, SCM Frigo will install three CO<sub>2</sub> condensing units running at medium temperature, providing 25 kW of cooling for the cold room and some store cabinets.

Franchin notes that CO<sub>2</sub> is increasing in popularity. “This is mainly due to the refrigerant price,” he says. Spain has an HFC tax in force. Companies there are also subject to the HFC quotas under the EU’s F-Gas Regulation, which has led to substantial HFC price increases in the last few years.

### MOVING TO SOUTH AMERICA

Having seen such success in Europe, SCM Frigo is also active further afield in markets such as South America, Australia and China.

Chile’s first transcritical CO<sub>2</sub> system, from SCM Frigo, was installed at a Jumbo supermarket in the southern city of Valdivia in January 2017. The project was implemented by the Ministry of Environment’s Ozone Unit and was funded by the Climate and Clean Air Coalition (CCAC). The 5,300 m<sup>2</sup> store opened on 12 January 2017.

The supermarket boasts 100% LED lighting and an integrated building energy management system, alongside the CO<sub>2</sub>-only refrigeration system.

CCAC was launched in 2012 by the United Nations Environment Programme (UNEP) and brings together governments, civil society and the private sector to help reduce short-lived climate pollutants (SLCPs) such as black carbon, methane and HFCs.

Claudia Paratori, a coordinator in the Chilean environment ministry’s Ozone Unit, said that this was the first instance of transcritical CO<sub>2</sub> refrigeration in Chile. She sees it as an opportunity to promote natural refrigerant technology, eliminate HCFCs and minimise the use of HFC-based systems in the country.

“This project will connect the different actors in the cold chain supermarket sector, promote the adoption of this technology, and help minimise the introduction of HFC-based systems in Chile,” Paratori said.

“The implementation of this project will generate multiple benefits for the environment and society. The Ministry of Environment also hopes it will contribute to local environmental management in the city of Valdivia,” she added.

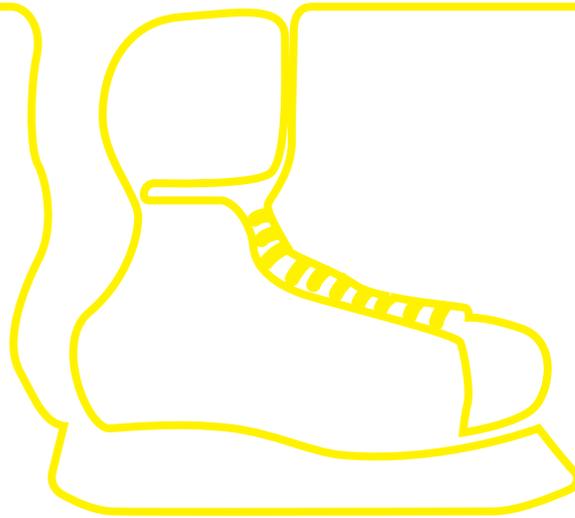
The supermarket industry was identified as the largest user of HFCs in Chile in a CCAC and United Nations Development Programme national inventory of HFC consumption and emissions.

The project leaders claim that the Valdivia system delivers energy savings of about 20% compared to standard HFC systems. ■ CM

# YOUNG SPARTANS TRAIN ON CO<sub>2</sub>-CHILLED ICE

The ice hockey rink at Sparta Amfi youth centre in the Norwegian city of Sarpsborg was retrofitted with a CO<sub>2</sub> chiller system.

– By Charlotte McLaughlin



**T**aking inspiration from the success and passion for innovation of the Sparta Warriors, a three-time Norwegian Championship-winning ice hockey team and the first to open an indoor ice hockey arena in Norway in 1963, the Sparta Amfi youth centre has retrofitted its old HFC system with a CO<sub>2</sub> transcritical chiller system.

“The arena is owned by the municipality of Sarpsborg (near Oslo),” Rune Grytnes, managing director of Beijer Ref’s Norwegian wholesale business ECOfrigo AS, told *Accelerate*. “The youth centre is used as a training facility for the younger hockey teams, but also as an ice rink for the local figure skating club.”

In August 2018, the ice rink owners decided to retrofit the previous chiller, based on R507 (an HFC blend with a high global warming potential (GWP) of 3,985), with a CO<sub>2</sub> system. “The system was formally handed over on 21 September 2018, but the ice rink had already been used by the hockey teams,” Grytnes said.

This did not give Norwegian installer Eptec AS (headquartered in Oslo), product seller Beijer Ref and ice rink designer Norconsult AS (based in Sandvika, near Oslo), much time to complete the project.

## SCM FRIGO CO<sub>2</sub> CHILLER:

- ▶ Total capacity: 300 kW @ -8.5/-11.5°C
- ▶ Gas cooler outlet: 28°C @ 85 bar
- ▶ Evaporation temperature: -14°C
- ▶ Compressors: 4 x Bitzer 6CTE-50K piston compressors (one with an inverter)
- ▶ Evaporator: Vahterus Plate & Shell
- ▶ Gas cooler: LU-VE, air cooled
- ▶ Controls: Danfoss

“Eptec AS has done many CO<sub>2</sub> transcritical and ammonia systems. They’re thus prepared for a time-critical installation such as this, even though this was their first ice rink with CO<sub>2</sub> as the refrigerant,” Grytnes said.

Italy-based SCM Frigo (a Beijer Ref company) manufactured the new CO<sub>2</sub> transcritical chiller. It comprises two units: one with a compressor module (containing four CO<sub>2</sub> piston compressors by Bitzer) and one with a chiller module (featuring a low-pressure receiver and a Vahterus shell & plate evaporator).



The chiller is an indirect system that uses a calcium chloride solution as the secondary fluid to cool the approximately 450 m<sup>2</sup> Sparta Amfi youth centre.

Ice rinks consume an enormous amount of energy. The average Swedish rink uses around 1,000 MWh of electricity per year, according to Jörgen Rogstam, managing director of Swedish refrigeration engineering consultants Energi & Kylanalys (EKA). Typically the refrigeration system – whose cooling capacity is usually 300-350 kW – is the main culprit, consuming about 43% of total energy, Rogstam told *Accelerate Europe* in December 2016.

Reclaiming the heat given off by the refrigeration system for use elsewhere can help mitigate these costs, according to EKA, a leading designer of such solutions.

ECOfrigo's Grytnes agrees with Rogstam. "The main benefit of using CO<sub>2</sub> compared to ammonia in these applications is the possibility to get big capacity heat recovery with high temperatures, for example for tap water," Grytnes says.

Three heat recovery systems reclaim heat from the Sparta Amfi installation. One system heats tap water and pre-heats air for the ice arena's absorption de-humidifier. The second heats the building, and the third pre-heats tap water

#### HEAT RECOVERY:

- ▶ 70 kW for hot water at +45/+70°C for tap water and pre-heating air for the arena's absorption de-humidifier.
- ▶ 180 kW for hot water at +25/+50°C to heat the building.
- ▶ 45 kW for hot water at +25/+30°C to pre-heat tap water and protect permafrost under the ice rink.

and provides heat for permafrost protection underneath the ice rink.

For Grytnes, the competition between ammonia and CO<sub>2</sub> is a more nuanced debate. "If the customer is not using the whole potential of the CO<sub>2</sub> system, an ammonia chiller could be an equal choice. The Energy Efficiency Ratio (EER) normally gets better with ammonia, and the total installation cost is pretty similar. One of the main reasons for choosing CO<sub>2</sub> in this instance was the area classification and less strict regulation on the machine room." ■ CM

# CHINESE RETAIL'S FIRST TRANSCRITICAL CO<sub>2</sub> SYSTEM

**The installation of China's first transcritical CO<sub>2</sub> system in the retail sector, in a METRO wholesale store in Beijing, is just the first step in a journey that will see the German multinational fit transcritical systems in all its new Chinese stores by 2025.**

– By Devin Yoshimoto, Jan Dusek & Yingwei Tao



SCM Frigo CO<sub>2</sub> transcritical rack in METRO China's Beijing Lishuiqiao store.

**By** installing the Chinese retail sector's first transcritical CO<sub>2</sub> refrigeration system – in its Beijing Lishuiqiao wholesale store – METRO China hopes to demonstrate the potential of natural refrigerant-based HVAC&R systems to benefit both businesses and the environment.

*Accelerate* toured the store, which opened on 17 January 2018, with key members of the METRO China team – led by Head of Facility Management Alan Lin – alongside the main installation contractor, Shanghai Fute Refrigeration & Electrical Engineering Co., Ltd. (FUTE), to learn more.

METRO China's parent company, Germany-based METRO AG, is an international food wholesale specialist. In place since 2013, the company's F-Gas Exit Program aims to replace f-gases with natural refrigerants in all METRO stores worldwide by 2030, where it is technically and economically feasible to do so.

In China, METRO had previously been installing subcritical CO<sub>2</sub> systems instead of f gas-based ones. It is now beginning to transition towards using transcritical CO<sub>2</sub> technology as well.

"2020 will be the end of R22 for us," says Alan Lin, METRO China's head of facility management, who oversees the installations. "It is planned that starting in 2025, all our new stores in China will be equipped with transcritical CO<sub>2</sub>."

For this pilot transcritical CO<sub>2</sub> project in Beijing Lishuiqiao, METRO China decided to use the simplest version of the technology currently available on the market: a transcritical CO<sub>2</sub> booster system.

"Our goal is to first gain a better understanding of how the transcritical system works for ourselves. We'd like to find out how suitable it is for China's environment and how it can be improved," Lin says.

The system itself consists of two separate transcritical booster racks, provided by Italy-based CO<sub>2</sub> system manufacturer SCM Frigo.

"The lack of local knowledge of CO<sub>2</sub> transcritical during both installation and commissioning were definitely barriers," SCM Frigo's technical director, Mirko Bernabei, told *Accelerate*. "Other problems were finding specific components suitable for the application, and ensuring

compliance with local legislation for vessels and electrical compartments," he says.

With a total cooling capacity of 334 kW, the centralised system supplies the cooling requirements for the entire store, including its fresh sales areas, freezer room, cold room, and preparation room.

"Strict collaboration between SCM Frigo, the installer FUTE and the main component suppliers Bitzer and CAREL were the basis of this installation's success," Bernabei says.

In collaboration with their suppliers and contractors, METRO China is conducting training on a constant basis for the first two years.

"Together with SCM Frigo and FUTE, we created a training programme for our store," says Lin.

"Training for this system cannot be a one-off. We need to prepare our people," he explains.

METRO China will surely benefit from the experiences gained with this first CO<sub>2</sub> transcritical store for future installations.

■ DY, JD & YT



# SOUTH AFRICAN BUTCHERY CAPITALISES ON CO<sub>2</sub>

**South African butchery Meat World opted for a CO<sub>2</sub> transcritical system to improve efficiency at its new meat processing plant near Johannesburg.**

– By Andrew Williams

Until recently, the HVAC&R operations at Meat World – a wholesale and retail butchery group with 11 meat shops across South Africa – had been based on HFCs. Keen to improve the efficiency of its industrial operations, the firm chose a CO<sub>2</sub> transcritical refrigeration system for its new meat processing plant in Johannesburg.

Beijer Ref companies SCM Frigo and Metraclark – the largest refrigeration and air-conditioning wholesaler in southern Africa – provided the CO<sub>2</sub> transcritical system, which was installed by Coolcare and commissioned in April 2018.

The Johannesburg plant treats 80-160 tonnes of fresh meat and 1,000 tonnes of frozen meat every day.

The CO<sub>2</sub> system keeps the plant's 7,500 m<sup>3</sup> processing area at a constant temperature of 10°C. It also serves 18,000 m<sup>3</sup> of freezing space and a 720 m<sup>3</sup> pull-down freezer, cooling both to -20°C. The system maintains 2,500 m<sup>3</sup> of cold rooms at 0°C.

"Since the commissioning, the customer has been very satisfied in terms of the system's operation and its efficiency," Mirko Bernabei, technical director at SCM Frigo, told *Accelerate*.

The system comprises two SCM Frigo outdoor CO<sub>2</sub> transcritical units, each equipped with four Bitzer medium-temperature compressors, four Bitzer low-temperature compressors, and two Bitzer parallel compressors. The units, installed as walk-in boxes, also feature one Danfoss vapour multiejector and one Luvata gas cooler.

"The hot gas defrost on the low-temperature evaporators provides an additional efficiency improvement," Bernabei says. "It is very fast and effective compared to traditional electrical defrost."

The CO<sub>2</sub> system provides air conditioning up to a total load of 60 kW. Heat recovered from the system provides the plant with hot water at 50°C for production operations.

With parallel compression, Bernabei expects the CO<sub>2</sub> transcritical system to save 6% on energy consumption compared to the R404A solution typically installed in such plants. The vapour ejector delivers energy savings of another 7% in high ambient temperatures. The total energy saving vs. the R404A option is therefore 13%.

The Meat World project was Coolcare's first experience of CO<sub>2</sub>. "SCM Frigo, together with Metraclark, supported them throughout," Bernabei says.

"In the process, we had several technical training sessions via web conference, as well as face-to-face meetings," he adds.

Meat World did not have any prior experience of CO<sub>2</sub> either. How did Bernabei convince the firm to take the natural refrigerant route?

"Meat World was looking for an efficient and reliable solution. We used our extensive experience of CO<sub>2</sub> applications, matured in Europe, to show them the benefits of using CO<sub>2</sub> as a refrigerant compared to HFC plants," he says.

After considering factors such as power consumption, installation costs and maintenance, Meat World opted for CO<sub>2</sub>.

Beijer Ref's new 'SCM Ref Africa' OEM segment in South Africa gives the group the ability to manufacture SCM products locally. ■ AW

# From niche to mainstream

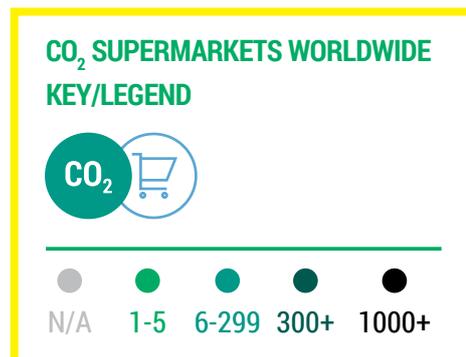
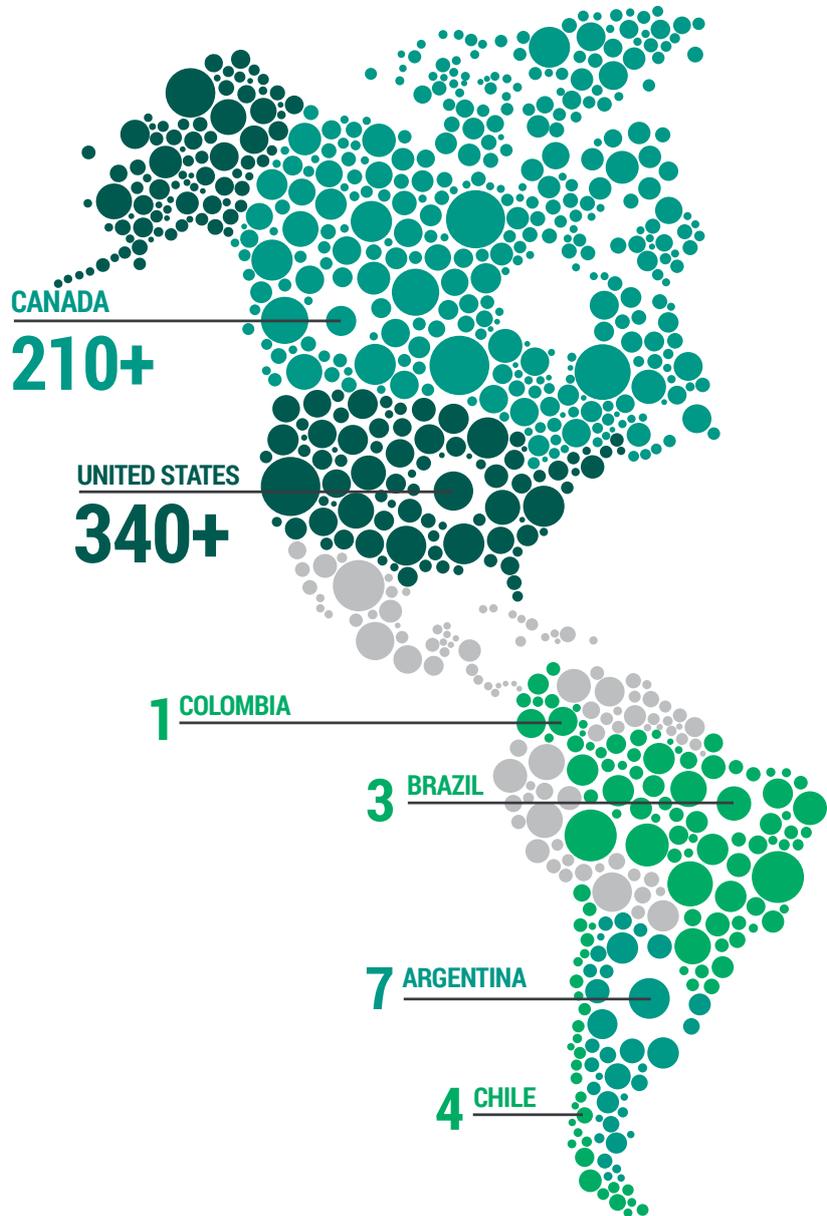
Natural refrigerants CO<sub>2</sub>, ammonia and hydrocarbons have been used in different HVAC&R applications for many years. With the exception of a few sectors, their market penetration has remained relatively low. Today this is changing fast, as an evolving legislative landscape for fluorinated refrigerants, the proactivity of influential end users and falling technology costs drive wider natural refrigerant uptake worldwide.

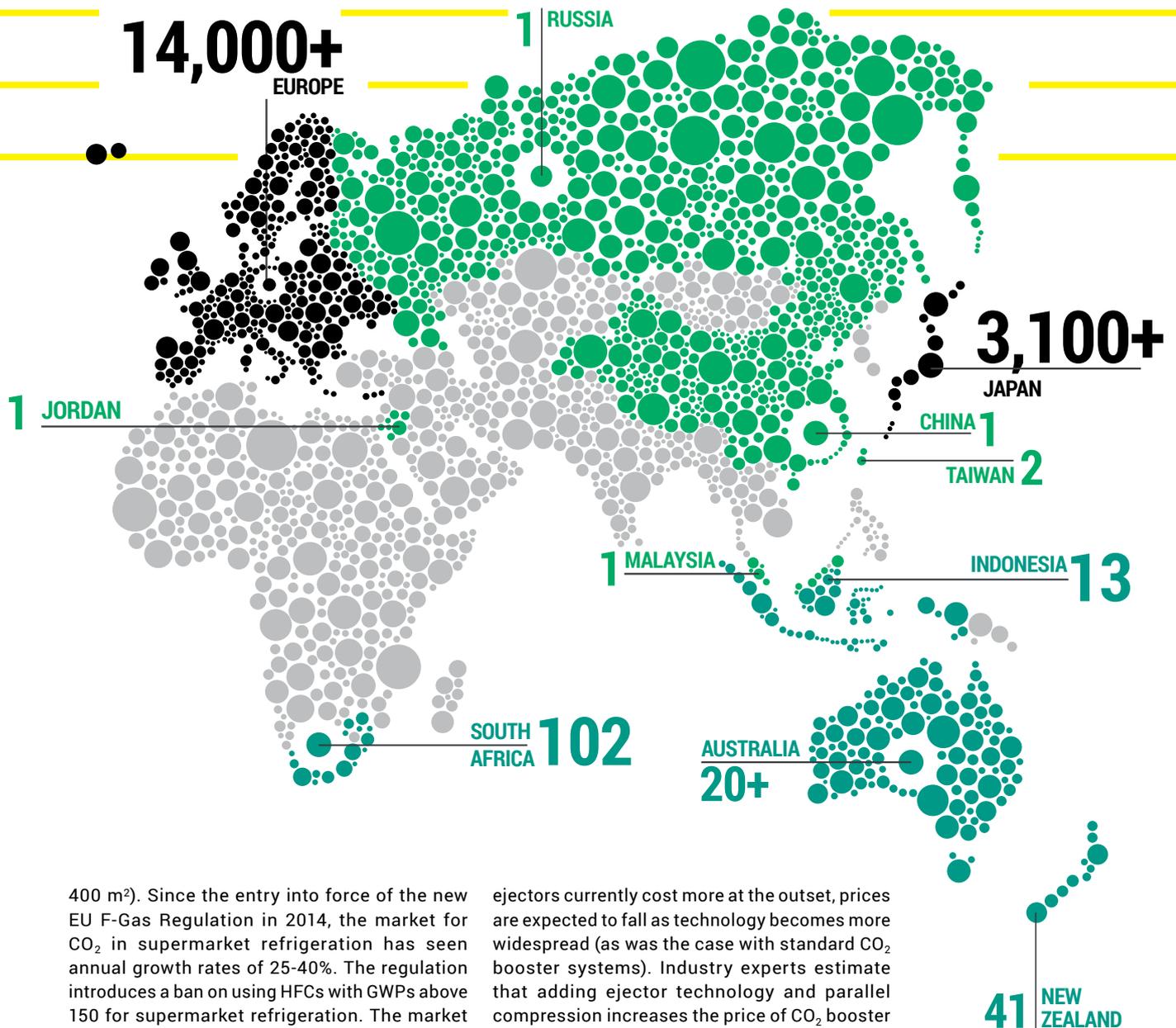
– By Klára Zolcer Skačanová

**W**ith their excellent energy-efficiency performance and low environmental impact – guaranteeing compliance with future legislation – natural refrigerants are quickly becoming the preferred option for a growing number of end users of HVAC&R technologies. As this adoption of HFC-free technologies grows, so does the competition between different natural refrigerant-based systems.

In recent years, commercial refrigeration has been the most dynamic sector in terms of the shift to natural refrigerants around the world. CO<sub>2</sub> has become the preferred option for new HVAC&R installations and refurbishments for a number of major retailers, whose adoption of the technology is encouraging more manufacturers to add it to their portfolios.

sheccoBase, the market intelligence arm of *Accelerate* publisher shecco, estimates that there are at least 18,000 stores in the world using CO<sub>2</sub> transcritical technology. The majority of these (around 14,000) are located in Europe, where they represent about 12% of the food retail market (understood as food retail stores in the EU, Norway and Switzerland bigger than





400 m<sup>2</sup>). Since the entry into force of the new EU F-Gas Regulation in 2014, the market for CO<sub>2</sub> in supermarket refrigeration has seen annual growth rates of 25-40%. The regulation introduces a ban on using HFCs with GWPs above 150 for supermarket refrigeration. The market for natural refrigerants in this sector in Europe, therefore, is expected to see particularly strong growth in the period 2020-2022, just before the entry into force of the HFC ban.

### Ease of use

On the technology side, CO<sub>2</sub> refrigeration systems are becoming more compact and easier to install, and their design more service-friendly. Growing commercial availability from a larger number of suppliers and increased standardisation of CO<sub>2</sub> boosters has pushed down the price of the technology in the last few years. CO<sub>2</sub> compressors now cost the same or less than equivalent HFC compressors. Depending on the market and technology, the total installation price of a CO<sub>2</sub> booster system is currently at the same level as conventional systems or around 5-10% higher.

Although CO<sub>2</sub> transcritical systems for warmer ambient climates using parallel compression and

ejectors currently cost more at the outset, prices are expected to fall as technology becomes more widespread (as was the case with standard CO<sub>2</sub> booster systems). Industry experts estimate that adding ejector technology and parallel compression increases the price of CO<sub>2</sub> booster systems by no more than 10%.

Accelerated by a subsidy scheme run by the Japanese Ministry of the Environment, Japan is the world's second-largest market for CO<sub>2</sub>-based food retail stores, boasting more than 3,100 by early 2018. In contrast to other regions, in Japan the technology has predominantly been adopted in small stores, using condensing units. Yet with Japan's revised High Pressure Gas Safety Act enabling the use of CO<sub>2</sub> in larger installations, a number of Japanese manufacturers debuted CO<sub>2</sub> transcritical racks in 2018.

Australia and New Zealand are following the global upward trend, with the number of CO<sub>2</sub>-based stores currently at 20+ and 41 respectively. Although the market is still insignificant in China, it is beginning to grow – due in part to international retailers including Carrefour and METRO AG adopting CO<sub>2</sub> technologies for some of their stores in the country.

ABOVE  
Share of CO<sub>2</sub> transcritical stores in selected markets (Feb. 2018).



The first CO<sub>2</sub> transcritical system in China's food retail sector was installed in a METRO store in Beijing (Lishuiqiao). The installation includes two indoor racks, both with parallel compression, two-stage gas cooling and heat reclaim. The high-temperature rack has a cooling capacity of 184.04 kW. In 2018, China will see a number of additional CO<sub>2</sub> transcritical installations in supermarkets.

### CO<sub>2</sub> becoming competitive in smaller...

After becoming standard for several retailers in new supermarkets, CO<sub>2</sub> is also fast becoming an interesting option to fulfil the cooling needs of smaller store formats. A growing number of manufacturers are offering solutions for this market segment, including condensing units and mini-boosters.

CO<sub>2</sub> condensing units are a well-established technology in Japan, with more than 8,500 running in the market by the end of 2017. In Europe and other parts of the world, retailers that have gained experience with CO<sub>2</sub> in supermarket refrigeration are pushing manufacturers to commercialise and reduce the cost of CO<sub>2</sub> condensing units and mini-boosters.

In the small store segment, competition is growing between CO<sub>2</sub> and another natural refrigerant option – hydrocarbons. Hydrocarbon plug-in systems, in particular combined with water-loop technology, are gaining presence in the global market. sheccoBase estimates that over 1,500 stores globally are using hydrocarbon water-loop technology. Water-loop systems remove the heat generated by cabinets from the store, thereby reducing the need for air conditioning. This technology is therefore particularly suitable for regions with warmer

climates. An on-going review of international standards to allow higher hydrocarbon charge limits per refrigeration circuit can be expected to accelerate market uptake of this technology.

### ...and bigger applications

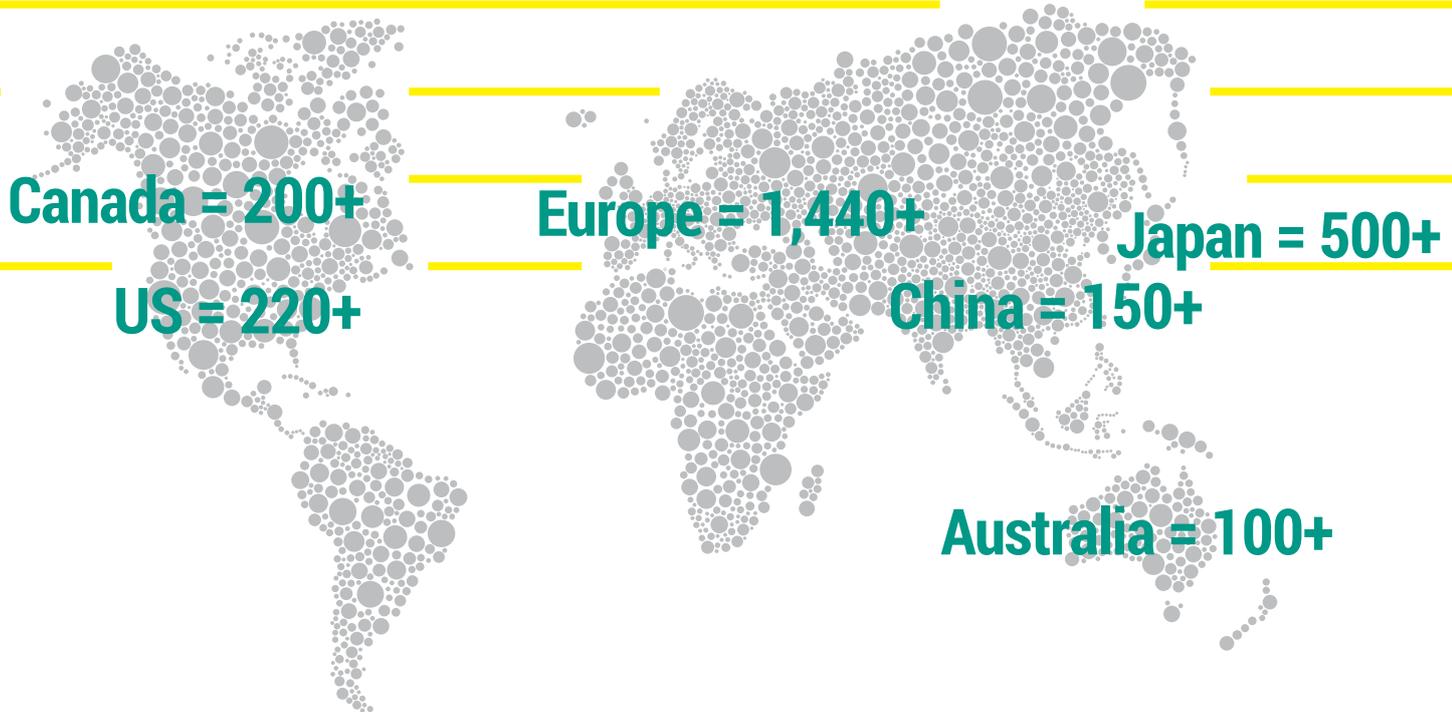
CO<sub>2</sub> is also becoming increasingly prevalent – and competitive – in industrial refrigeration applications, especially in small and medium-sized installations. The industrial refrigeration sector has traditionally been dominated by ammonia (in larger applications) and HFCs (in smaller-sized applications).

New technological developments, particularly for compressors, have allowed CO<sub>2</sub> transcritical systems to reach higher capacities and capture a part of the industrial refrigeration market. Some customers in this market are moving towards CO<sub>2</sub>-only systems, partly due to the safety and technical challenges of using traditional ammonia systems (with their higher refrigerant charge). According to engineering experts, CO<sub>2</sub> compressors can have as equally long lives as ammonia ones, without the need for special components.

Opting for CO<sub>2</sub> in industrial applications gives more flexibility in terms of regulatory compliance compared to traditional HFC-based equipment, as well as other natural refrigerants. In addition, low maintenance costs make this an attractive option for end users.

### Growing market presence of low-charge ammonia

Alongside CO<sub>2</sub>, low-charge ammonia is also growing in the industrial refrigeration market around the world. Low-charge ammonia technology has been developing at an increasingly fast pace over the past

**ABOVE**

Low-charge ammonia installations around the world.

\*The data presented is part of ongoing research for shecco's 'World Guide to Low-charge Ammonia'.

decade, with the market now seeing competition between more technology providers. This trend will continue to spur innovation, to the overall benefit of the global marketplace.

On a component level, the development of optimised heat exchangers, advanced controls and novel system architectures is driving innovation in this newly formed and competitive market. Manufacturers are taking advantage of this to develop modular, packaged ammonia systems as well as optimised, distributed systems with a variety of designs.

The proliferation of low-charge ammonia systems in North America is evident. In the US market in particular, the advent of low-charge, packaged ammonia systems is seen as the ideal solution to the ongoing R22 phase-out. For the many facilities still using R22 rooftop packages, switching to modern, low-charge ammonia packages can provide a solution that is efficient, cost-effective and reliable. Most importantly, the use of ammonia means that facility owners can bypass the intermediate step of using HFCs, which are already being phased down, and go straight to a natural refrigerant, which will not be subject to future restrictions due to environmental concerns. This makes low-charge ammonia a very attractive option for replacing R22 systems.

Moving to another part of the globe, Australia's uniquely remote landscape and strong agricultural sector have produced a long history of large-scale industrial plants using ammonia. In modern times, the focus has been on optimising energy efficiency and reducing the ammonia charge – and as a by-product, carbon emissions – by harnessing cutting-edge technology. It is no surprise that the convergence of these two goals has given rise to the proliferation of low-charge ammonia technology in Australia.

In China, NH<sub>3</sub>/CO<sub>2</sub> secondary and cascade refrigeration systems that reduce the ammonia refrigerant charge have become increasingly popular since 2013, when the technology was developed and tested by a Chinese manufacturer for the first time. Today, there are estimated to be around 150 such projects. The installations vary, from ice-making facilities to cold storage, and from ski halls to ice cream production facilities. They are also used in food processing, for example, of meat and aquatic products and prepared food.

The increased popularity of low-charge ammonia systems requires their clearer distinction from traditional ammonia systems. An on-going study conducted by sheccoBase (*World Guide to Low-charge Ammonia*) aims to answer this question by analysing a number of case studies and surveying expert engineers in the field.

The study will deliver a concise definition of low-charge ammonia, and outline the benefits it offers, as well as outline the current policy framework impacting wider market uptake. It will also portray the level of adoption of low-charge ammonia systems across the globe. Initial results of this ongoing research indicate that more than 2,610 installations are already operating today worldwide, with cost being identified by many experts in the field as the biggest barrier to wider adoption of low-charge technology.

For each natural refrigerant, then, new technology developments are expected to help increase uptake worldwide. ■ KS



# Natural refrigerants ripe for growth across Asia Pacific

Inderpal Saund, APAC business development manager, Beijer Ref Australia

With close to a decade of experience working with natural refrigerants in Europe, Beijer Ref is now bringing its technology expertise, training and best practices to the Asia-Pacific region – where it is reporting rapid uptake of its product offering amid growing market awareness of these environmentally friendly options.

– By Devin Yoshimoto

**In** the second quarter of 2018, Beijer Ref acquired Heatcraft Australia. This significant acquisition sets a strong precedent for the company's expansion plans in the Asia-Pacific (APAC) region.

The acquisition is the first of many steps the company is taking to strengthen its APAC presence and expand its local manufacturing capabilities. It is particularly focused on natural refrigerant-based systems, and the opportunity to supply them to a region that is only just beginning to transition away from f-gases.

"This acquisition is in line with our strategy to also grow outside Europe," says Per Bertland, CEO of Beijer Ref.

"In addition, we strengthen the Original Equipment Manufacturer (OEM) segment through the acquisition of the Wuxi production plant in China, which in the long term could provide further opportunities to continue expanding our European green technology to the rest of the world to a much greater extent," Bertland adds.

## **CO<sub>2</sub> USE GROWING IN AUSTRALIA & NZ**

Inderpal Saund (better known as Indy) is Beijer Ref's business development manager in the Asia Pacific. He is one of the region's leading experts on CO<sub>2</sub>-based refrigeration technology.

Saund told *Accelerate* of the significant growth in demand for CO<sub>2</sub> systems that the company has seen in Australia and New Zealand over the past few years.

"We have been supplying transcritical CO<sub>2</sub> systems in New Zealand since about three or four years ago," says Saund.

"Within the Asia-Pacific region, the transcritical CO<sub>2</sub> systems supplied to date have mainly been for food retail applications."

For Beijer Ref, Australia and New Zealand together represent one of the fastest-growing markets for natural refrigerant technology outside Europe.

With forward-thinking end users, a technology-savvy industry, and favourable climatic conditions – particularly to the south – the region's food retail sector has seen a rapid rise in the number of CO<sub>2</sub> cascade and fully CO<sub>2</sub> transcritical systems.

In April 2018, a transcritical CO<sub>2</sub> system from SCM Frigo – a Beijer Ref company – using ejector technology was installed in a supermarket in the Australian town of Beechworth, Victoria.

The ejector system is the first of its kind to be used in Australia. It signals the ever-growing number of natural refrigerant technology options from which end users can choose, no matter what climate conditions they face.

"Today, in Australia, we have a few projects. One recent project has been with ejector technology, and so far, the results are proving to be very positive," Saund says.

## NATURAL REFRIGERANTS COMING TO CHINA, SOUTHEAST ASIA

On the other side of the equator, the nascent market for natural refrigerant technology in China is picking up. Beijer Ref aims to play a leading role there as well.

In 2017, Beijer Ref company SCM Frigo supplied the Chinese food retail sector's first transcritical CO<sub>2</sub> system, for a METRO store in Beijing ([see story on page 18](#)).

In July 2018, a second transcritical CO<sub>2</sub> system was installed at CSF Market, also in Beijing. As China begins to focus more seriously on environmental sustainability, uptake of natural refrigerant technology is expected to increase rapidly over the next few years.

In Southeast Asia, natural refrigerant systems are attracting the attention of some of the biggest names in the food retail and cold chain sectors, an area where Saund sees big future growth potential.

"Within Southeast Asia, there is awareness of natural refrigerants but mainly from an ammonia aspect," says Saund, referring to natural refrigerant use in cold chain and industrial applications.

"When it comes to CO<sub>2</sub> things are still very new. We see that CO<sub>2</sub> is the upcoming trend in plants where ammonia may not be a viable choice."

With the recent debut of Beijer Ref's line of outdoor CO<sub>2</sub> condensing units – SCM Frigo's CUBO<sub>2</sub> Smart system – food retailers now have several options for natural refrigerant use.

"Now we have a CO<sub>2</sub> solution for smaller refrigeration applications," says Saund.

"I see this as one of our biggest opportunities within the Asia-Pacific region."

Saund and the Beijer Ref Singapore team recently presented at the ATMOsphere Asia 2018 conference, held in Singapore in September 2018. The move represents the first major step the company is making towards bringing its CO<sub>2</sub> solutions to the region.



SCM Frigo's CUBO<sub>2</sub> Smart CO<sub>2</sub> condensing unit.

Certain challenges remain, however, in Southeast Asia. Awareness and the level of training in the industry and government are still limited.

"Today within Southeast Asia, there are no real clear guidelines for moving towards lower GWP refrigerants, and industry knowledge regarding this topic is still quite low," Saund says.

"In addition, with the Asia-Pacific region, there are only a handful of options when it comes to training," he adds.

"This subject is ongoing, but Beijer is committed to training its customer base on CO<sub>2</sub> technologies. We are also working on promoting natural refrigerant solutions to the market by creating awareness and providing short training sessions on our product range," Saund says.

As one of the world's leading suppliers of natural refrigerant systems begins to focus its efforts on one of the fastest-growing economic regions of the world, there is little doubt as to how much Beijer Ref can contribute to efforts in the Asia Pacific to reduce CO<sub>2</sub> emissions and become more environmentally sustainable. ■ DY

# PROPANE (R290): THE GREEN FUTURE OF HVAC



A unique propane-based (R290) compact chiller is helping customers to harness market-ready, natural refrigerant-based HVAC technologies and go green.

– By Charlotte McLaughlin

*“The CCU has really taken off this year, and now we have sold quite a lot of those.”*

– Simon Karlin,  
COO, Beijer Ref

**S**CM Ref AB (a Beijer Ref-owned manufacturer of HVAC&R equipment based in Sweden) manufactures a wide range of products for natural refrigerants CO<sub>2</sub> and propane (R290), as well as small HFC-based units.

The company is seeing its biggest growth in sales for its R290-based compact chiller unit (CCU) for high-temperature (HT) and medium-temperature (MT) operations, according to Fredrik Hamrin, managing director of SCM Ref AB (a subsidiary of Beijer Ref).

First put on the market in 2010, the CCU was originally designed for supermarkets in Scandinavia as a remote refrigeration system, according to Hamrin. But it soon became clear that its real future lay in HVAC.

Now, 90% of the CCU's uses are in HVAC applications such as space heating and cooling. The unit is reversible, so it can be used as a heat pump in winter and an air conditioner in summer. The chiller has a special heat exchanger that combines the condenser, evaporator and sub-cooler (heat exchanger) in one, keeping it compact in size.

The CCU has been used to heat and cool commercial buildings and hospitals, and for process cooling and large ground-source heat pump projects. “It’s mainly been installed in Scandinavia, but we also see that in France, Belgium and the Netherlands, we’re starting to move the CCU,” Hamrin says.

Each unit provides a cooling capacity of 20 kW, with an R290 charge of only 1.45 kg. The technology’s uniqueness is that it can be built up to whatever capacity the end user requires, by using each CCU unit in rack format.

“The idea with this R290 unit is to put it in a rack where you can have two, four or six in one rack, and you can build up to as many as you like,” Hamrin explains.

“We had one project this year, to air condition a hospital, that had 48 units in different racks. They were all connected to water hoses on the back of the units, to provide cooling,” he says.

If one of the units breaks down, the system will continue to function.



"If you have a breakdown on one compressor, you can slide parts of the system in and out," he says. "You just take one of those 48 units, and replace it with an exchange unit."

### EU F-GAS PHASEDOWN PICKS UP PACE

End users have always appreciated the modular nature of the system, according to Hamrin, and more customers are turning to such technology as the phasedown of f-gases under the EU's F-Gas Regulation begins to bite – leading to price increases for HFCs throughout the European Union.

"The price of HFC-based HVAC chillers is increasing somewhat. If you ever need to replace the refrigerant, you'll face quite big costs at the moment," he says.

The f-gas phasedown appears to be making the R290 CCU more popular. "All this about the F-Gas Regulation is supporting this," Simon Karlin, Beijer Ref's COO responsible for the ARW division (Air-conditioning, Refrigeration, Wholesale), told *Accelerate*.

"The CCU has really taken off this year, and now we have sold quite a lot of those," Karlin says.

SCM Ref AB reports growing demand for green technology among the contractors to which it sells. "They want CO<sub>2</sub> or they want R290, and for the chillers at the moment, we have more projects with R290," Hamrin explains. "It's not more expensive to build an R290 unit, depending on system design."

R290 installations have to be followed by a risk assessment. "Each country in Europe has their own laws. To simplify matters, we're putting ventilation and gas leak detection inside the CCUs," he says.

The Swedish factory of SCM Ref AB is set to focus on R290 in the future, according to Beijer Ref COO Karlin, and also increase its training on this refrigerant.

"We currently provide training. We have a special key account manager for training, who also helps out with commissioning," says Karlin's colleague Hamrin.

*"It's not more expensive to build an R290 unit, depending on system design."*

– Fredrik Hamrin,  
managing director,  
SCM Ref AB

SCM Ref AB intends to sell the R290-based CCU as part of its overall natural refrigerant strategy in a modular manner so that can be used in a range of capacities.

Udo van der Meer, managing director of ECR Nederland BV (a sales company owned by Beijer Ref in the Netherlands, which now encompasses manufacturing company SCM Ref BV), says Beijer Ref's idea is to focus on R290 for large commercial and small industrial applications. "I'm talking about 200, 250 or 300 kW for racks and chillers with R290. R290 is more interesting price-wise than ammonia" in these capacities, Van der Meer argues.

Beijer Ref also manufactures and sells another R290 innovation that heats, cools and stores energy – the TripleAqua – through Beijer Ref-owned companies such as ECR Belgium BVBA, Kylma, Coolmark BV, Charles Hasler AG and H. Jessen Jürgensen A/S. "It's a real innovation," says Van der Meer, adding that the TripleAqua will soon move into mass production. ■ CM

# PACKAGED AMMONIA IN 2019

Recognising the need to reduce ammonia charges and create simpler systems for installers, SCM Ref BV – a Beijer Ref company – will start manufacturing a low-charge ammonia packaged unit in 2019.

– By Charlotte McLaughlin

**H**aving long focused on the commercial refrigeration sector (in addition to HVAC products), Beijer Ref is increasingly active in industrial refrigeration too. Next year it will offer a new line of packaged ammonia units and custom-made ammonia racks. The products will be manufactured by SCM Ref BV, a Beijer Ref company active in the Benelux countries and based in the Netherlands.

“This ammonia pack will be a new business for us,” Simon Karlin, COO of Beijer Ref’s ARW (Air-conditioning, Refrigeration, Wholesale) division, told *Accelerate*. “We don’t usually do much ammonia in our company, but this will grow. It’s growing already,” Karlin says.

Traditionally, Beijer Ref has focused more on the commercial refrigeration sector, but plans to increase its activities with ammonia in the industrial sector too. “We can grow this segment a lot,” Karlin says.

SCM Ref BV is located near Eindhoven and shares premises with ECR Nederland BV, a wholesale company that is also part of the Beijer Ref family. ECR Nederland will sell the ammonia racks, according to Udo van der Meer, ECR’s managing director.

“SCM Ref BV is a Beijer Ref company. This means that Beijer Germany, for instance, can ask SCM Ref to assemble a rack,” explains Van der Meer. “BV’s purpose is to develop ammonia industrial refrigeration for Beijer,” he says, helping Beijer to acquire the expertise it needs to become more active with natural refrigerants in the industrial refrigeration space.

ECR has over 30 years of experience working with ammonia. Van der Meer stresses the importance of working closely with customers to deliver the specific solutions they need. “It is important for sales people who are in contact with contractors – and increasingly with end users – to develop a specific tailor-made rack. ECR is very strong at that,” he says.

The new packaged ammonia line manufactured by SCM Ref will include two low-charge products – a chiller and a refrigeration rack for light industrial projects, always using glycol or another secondary fluid to deliver cooling to a space.

“Our standard ammonia line starts from 250 kW up to 850 kW. Above that, we can make custom units up to three, four or five MW,” Van der Meer says.

By offering packaged units, the company does not need to redesign systems each time it gets a new order. Contractors can also simply plug in the systems, as they are easier to install.

## PREVENTING KNOWLEDGE FROM EVAPORATING

In the HVAC&R sector as a whole, Van der Meer fears that technical knowledge has been decreasing. He observes that HVAC&R technicians are increasingly leaving the sector early in their careers, before they have accrued enough experience. “I feel like their knowledge is evaporating,” he laments.

This problem is compounded by the difficulty of attracting new blood into the industry. “It’s the most interesting job you can have. But it’s not a nine to five job,” Van der Meer says.

“We educate our customers when we sell an ammonia rack. They have a consultancy contract with us,” he says. “When one of their service engineers has a problem in the middle of the night and is too inexperienced to solve it, they can call us for support,” he explains.

In the third quarter of 2019, Beijer Ref will open a new training academy for ammonia at ECR/SCM Ref BV in Eindhoven. It will train customers including technicians, end users and contractors, as well as non-customers.

The new packaged and custom ammonia units can be installed on the roof, eliminating the need for an engine room. “When you have a chiller or a rack in capacities of up to 500-680 kW, it’s possible to have an air-cooled condenser without a machine room,” Van der Meer says. “In capacities above 700-750 kW, you nearly always have a machine room,” he explains.



SCM Ref BV is located near Eindhoven.

## INNOVATIVE CUSTOMISATION

The advantage of installing custom-made installations is that SCM Ref BV in the Netherlands can experiment with innovative ammonia technologies and optimise the components used in the system. The company opened a remodelled office complex in Eindhoven in September, complete with two ammonia heat pumps to heat and cool the offices.

"We are installing an 800 kW [heat pump system] now. It is charged with 180 kg [of ammonia] with two twin screw compressors," Van der Meer says. "This is a very unique unit. I don't think there is another one like it in Europe, as this unit has two semi-hermetic twin screw compressors running on ammonia."

"The semi-hermetic [compressor that we have made] is very unusual, as you usually have open-type [compressors]," he says. An ammonia compressor is typically open-type due to the inclusion of the shaft ceiling, which a semi-hermetic compressor does not contain, he explains.

The advantage of the new compressor is that it is smaller and contains electronic motors.

Van der Meer argues that the packaged units can help open up ammonia to new areas of application, including HVAC and supermarkets. The fact that ammonia smells, meanwhile, helps to mitigate the safety risk of a leak, he believes. Unlike with other refrigerants, people are likely to vacate the area before the ammonia reaches a dangerous concentration.

"People do not have to be afraid of ammonia," he says, "Once it's in a well-designed packaged unit with safety valves, there are no issues. By using a water curtain, once a leak has been detected, ammonia can also be dissolved before it becomes toxic."

"It's the only refrigerant with zero ozone-depleting potential and zero global warming potential. It's the best," Van der Meer concludes. ■ CM



*"It's the only refrigerant with zero ozone-depleting potential and zero global warming potential. It's the best."*

– Udo van der Meer, ECR Nederland, on ammonia.

# INNOVATION COMES TO CHILLVENTA



Source:  
NürnbergMesse

## **Accelerate presents a round-up of the most important natural refrigerant-based HVAC&R products on offer from Beijer Ref companies at the world's biggest HVAC&R show.**

— By Charlotte McLaughlin

**T**he Chillventa tradeshow, the next edition of which takes place in the German city of Nuremberg from 16-18 October 2018, is the world's biggest gathering of HVAC&R technology manufacturers and enthusiasts. Attendance figures for this year's edition of the biannual show are set to surpass the 981 exhibitors and over 30,000 visitors from around the world who attended the last Chillventa in 2016.

"I think natural refrigerants will be the big news at the show, when we talk to suppliers," Per Bertland, CEO of Beijer Ref, told *Accelerate*. "I'm convinced that will be the lead at Chillventa."

Bertland expects to see "a huge difference" this year, with many more natural refrigerant-based products on display at this year's show. "The market is moving so fast at the moment," he says.

Yet Beijer Ref is not just excited about seeing all the new natural refrigerant products on display. It

is also there to showcase its own. "At Chillventa we will bring our latest units, and more of them will be on natural refrigerants," says Simon Karlin, Beijer Ref's COO, who is responsible for ARW (Air-conditioning, Refrigeration and Wholesale). "Almost everything will be on natural refrigerants."

The company will showcase a new addition to its CO<sub>2</sub> transcritical product range, namely a CO<sub>2</sub> system for small convenience stores, and another new product – a CO<sub>2</sub> chiller for industrial applications from SCM Frigo, a Beijer Ref company based in the Veneto region of northeast Italy.

"We have two new CO<sub>2</sub> products. One is for convenience stores. We're seeing a lot of customer requests from this sector," says SCM Frigo Managing Director Nicola Pignatelli. "They're pushing for CO<sub>2</sub> solutions that are effective and cheap enough for small shops. It will be a multi-system, not a condensing unit, because we already have condensing units on the market."

Indeed, SCM Frigo will also be showcasing its CUBO<sub>2</sub> Smart condensing unit at Chillventa.

"The second [new product] is for industrial. We receive many requests for industrial chillers, and we're coming out with a very nice product at Chillventa," Pignatelli says. ■ CM

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# ACCELERATE

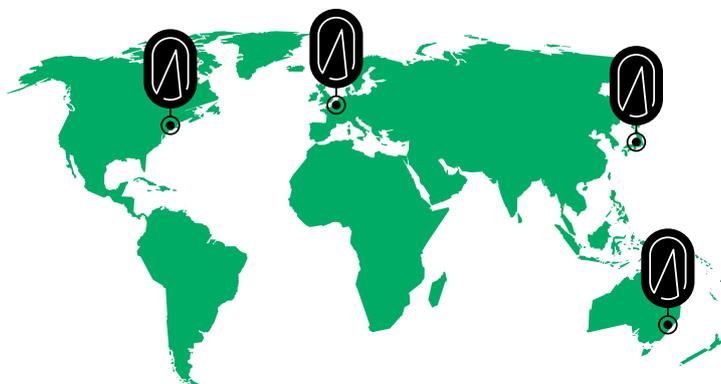
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