

WINTER 2018

ACCELERATE

ADVANCING HVAC&R NATURALLY

AUSTRALIA & NZ

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**A man
with a plan**

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A PIONEERING SPIRIT

— Editor's Note by Andrew Williams



Andrew Williams
Editor

The history of natural refrigerants is often a story of individuals. Of scientists and engineers pushing the boundaries of what these technologies can achieve. Of legislators making a place for natural refrigerants in the future policy landscape. And of strong personalities in the end user community driving natural refrigerant adoption within their companies.

Petar Lujic is one such personality. Lujic is the CEO of Kamen Group, a business involved in developing supermarkets, liquor outlets, hotel accommodation and various other types of property. The opening of IGA Market Central at Wentworth Point, western Sydney, marked his entry into Australia's independent retail sector. His decision to use natural refrigerants there is inspiring to others (p. 14).

IGA supermarkets are independently owned. In this issue, we take a look at two more IGA stores that have decided to adopt natural refrigerants – in Beechworth, Victoria (p. 36) and in Melbourne (p. 54). Woolworths, meanwhile, has opened its second CO₂ transcritical supermarket, in Wadalba, NSW (p. 58).

Internationally, Heineken is committed to hydrocarbons for all its new fridges and draught beer equipment (p. 22). Hydrocarbons are also at the heart of a sustainable new hotel in the Belgian town of Lommel (p. 28). Swiss retailer Migros,

meanwhile, is pioneering propane-based water-loop technology in some of its stores (p. 64).

What brings these diverse end users together is the business case they can make for adopting natural refrigerants. With the HFC phasedown triggering growing demand for future-proof HVAC&R systems, participants in this year's ATMOSphere Australia conference in Sydney's Luna Park heard how technological innovations – and a commitment to sustainability – are helping to make the economics of NatRefs even more compelling (p. 40).

This was particularly evident at ARBS, which kicked off at the ICC in Sydney's Darling Harbour the day after ATMOSphere. The tradeshow marked the Australian debut of several new natural refrigerant technologies for end users (p. 46).

In the United States, ammonia showed itself to be an innovative and ever-evolving refrigerant at the ATMOSphere America 2018 conference in Long Beach, California (p. 50). And in the Chicago area, Liberty Cold Storage has invested in a low-charge ammonia DX system for both low and medium temperatures (p. 32).

What unites all these stories is the commitment of individuals to bring about change. I hope to see more of this pioneering spirit going forward.

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A U S T R A L I A & N Z

About *Accelerate Australia & New Zealand*

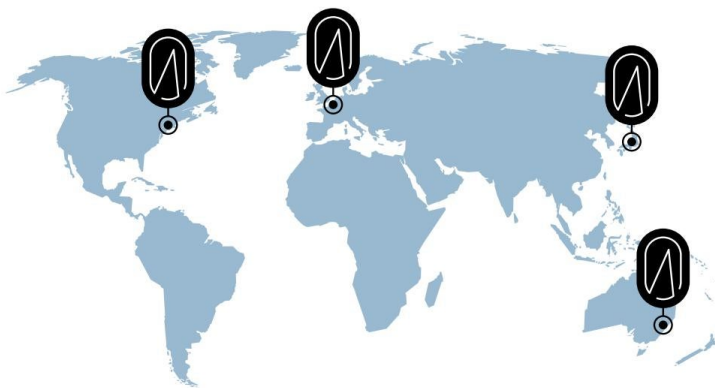
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The *Accelerate* family of magazines includes editions in Europe, America, Japan, China, Asia, and Australia & New Zealand.

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16-17.08

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16-18.08

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**ATMOsphere Asia 2018
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The event, organised by *Accelerate* publisher shecco, brings together industry, end users and policymakers to discuss natural refrigerant trends in Southeast Asia.



www.atmo.org/asia2018



5-7.09

**MCE ASIA 2018
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www.mcexpocomfort-asia.com/ExhibitionInfo/AboutMCEAsia

4-7.09

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refindustry.com/events/conference/jsrae-annual-conference-2018

7-9.09

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12-13.09

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www.airah.org.au

26-28.09

Refrigeration & HVAC Indonesia 2018 Jakarta, Indonesia

The largest refrigeration and climate control exhibition in Indonesia, focusing on HVAC&R technology, power and renewable energy, and food cold chain technology.



www.refrigeration-hvacindonesia.com

16-18.11

MIVAR'18 Expo Yangon, Myanmar

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www.mivarexpo.com

22-24.11

REFCOLD India Gandhinagar, India

REFCOLD, an initiative of ISHRAE & NürnbergMesse India, is India's first event on refrigeration and the cold chain.



www.refcoldindia.com/event

28-30.11

Asia Cold Chain Show 2018 Bangkok, Thailand

The 4th Asia Cold Chain Show (ACCS) is an exhibition and conference on the cold chain, cold logistics, cold transport, cold storage, material handling and cold supply chain sectors.



www.asiacoldchainshow.com



AUSTRALIA & NZ IN BRIEF

Güntner, BITZER sign distribution contract for Australia, New Zealand

Güntner, a manufacturer of heat exchangers for refrigeration and air-conditioning applications, and compressor specialist BITZER have signed an exclusive long-term distribution contract for the New Zealand and Australian markets.

The agreement covers both firms' commercial and industrial refrigeration business lines in Australia and New Zealand.

Güntner will manufacture heat exchangers and BITZER will oversee their distribution. The product range will include both brands' products: heat exchanger units from the commercial refrigeration segment will be marketed under BITZER's Buffalo Trident brand, while those from the industrial refrigeration segment will be branded Güntner.

Units from the firm's EPC business line (Energy & Process Cooling) are not covered under the agreement and will continue to be marketed by the Güntner Asia organisation.

The agreement was signed with the joint aim of offering customers a broader product range and combining the know-how and expertise of both companies. The units will be manufactured at Güntner's production site in Surabaya, Indonesia, and delivered to a new warehouse.

Buffalo Trident's manufacturing operations at Sunshine Victoria will cease by the end of 2018. ■ EI

ALDI Süd now has 1,496 CO₂ transcritical stores worldwide

A 2017 sustainability report released in July by German multinational ALDI Süd reveals that the discount food retail giant now has 1,496 stores using CO₂ transcritical systems worldwide.

Most of the CO₂ transcritical systems are in German stores (1,324). Worldwide, CO₂ transcritical refrigeration technology is now installed in 25% of ALDI Süd's store portfolio, with five located in Australia.

Natural refrigerants are at the heart of the retailer's strategy to reduce its emissions of greenhouse gases. "Compared to carbon dioxide, the potential of these f-gases to contribute to the greenhouse effect (global warming potential, GWP) is up to 4,000 times higher," the report notes.

"For this reason, refrigerants with a significantly lower GWP, such as carbon dioxide (GWP of 1) or ammonia (GWP of 0), are increasingly used," it says.

One of the retail giant's key environmental goals is to replace refrigeration systems with a GWP greater than 2,200 with a lower-GWP refrigerant. Since 2017, 75% of the group's refrigeration systems have operated on lower-GWP refrigerants.

The group uses ammonia-based refrigeration systems in most of its regional distribution centres (2016: 83%), while "all new free-standing chest freezers within our stores which are not connected to the central refrigeration system operate on propane, which possesses a low GWP," the report says.

The company is also successfully employing heat recovery in nearly 50% of its stores (44.82%). ■ CM

Motor racing goes CO₂

Glaciem Cooling Technologies provided a CO₂ transcritical system for a freezer and cold room at the Bend Motorsport Park, a 7.7 kilometre bitumen motor racing circuit, in Tailem Bend, South Australia (near Adelaide) in April.

"We will be proudly cutting the ribbon on our integrated cooling system at 'The Bend' motorsports park outside Tailem Bend," Rohan Wighton, operations manager at Glaciem Cooling, wrote in a LinkedIn post in April.

The company uses a highly efficient CO₂ technology called 'Dew Point Cooled CO₂ Only Refrigeration' or DP CO₂. DP CO₂ works by integrating indirect evaporative cooling, which air-cools the condenser coils, even in extreme ambient temperatures. Pre-cooling means the CO₂ system can operate in subcritical mode, improving efficiency in warmer ambient climates like Australia's.

"The installation at the Bend demonstrates the inherent flexibility in finely tuned technology integration and is a great example of [Southern Australia's] manufacturing pedigree," Wighton noted.

This installation by the Adelaide-based company also incorporates thermal storage, increasing efficiency still further. "Integrated with ThermCOLD thermal storage technology, this refrigeration system is set to lead the global transition away from synthetic refrigerants, reducing direct and indirect CO₂ emissions while dramatically reducing operating costs for end users," he said.

In developing this technology, the company received support from the Peregrine Group, the University of South Australia, TechInSA, Carbon Neutral Adelaide, and others. ■ CM

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AUSTRALIA & NZ IN BRIEF

Australian firm to deliver 50,000 evaporative coolers to Saudi Arabia

Australia-based Seeley International will supply 50,000 evaporative coolers to the pilgrimage tent city of Mina Valley in Saudi Arabia.

The tent city is an area of 20 square kilometres with 100,000 tents and houses, home to approximately three million people during the Mecca Pilgrimage.

"Our Breezair evaporative air conditioner was found to outperform more than 200 other air conditioning brands and delivered spectacular results against a comprehensive set of criteria that included energy efficiency, reliability, performance and low environmental impact," said Seeley International Founder and Executive Chairman Frank Seeley.

The technology uses only natural refrigerants air and water. "The harsh summertime temperatures in the Mina Valley, which can easily reach more than 45°C, were overcome by the capability of Breezair evaporative air conditioners, which kept people comfortable and provided them with fresh naturally cooled air," Seeley said.

The company was awarded the contract by the Saudi Government in 2015 and is aiming to deliver the 50,000 evaporative coolers this year.

"The three-year tender evaluation process saw Breezair and other contenders tested on site over several months, in all conditions and seasons, including comparative tests done during a pilgrimage to assess performance under real-world conditions," Seeley said. "The in-built safety mechanisms, economical use of water, ease of control and compact design were critical in Breezair being successfully selected." ■ CM

Heatcraft to carry out CO₂ training

The systems manufacturer and supplier Heatcraft Australia and New Zealand will run CO₂ transcritical systems training in August 2018 in its New South Wales facility.

Beijer Ref formally acquired Heatcraft Australia in May 2018.

The company's training facility is located in Milperra, Australia (near Sydney).

Douglas Herkess from Heatcraft Australia, who will run the training and coordinate the course, said: "Whilst there will be a significant focus on transcritical CO₂ technology, our goal is to position this training allowing knowledge building for all levels of contractor that are considering the use of CO₂ refrigeration systems."

The training is open to refrigeration contractors and consultants who are interested in specifying, selling, installing, commissioning and servicing CO₂ systems.

"We are in a unique position at Heatcraft to be able to reach out to facilitate training through our extensive customer base of contractors," Herkess notes. "We have a local manufacturing facility where we can demonstrate processes and configurations and we have local experts to share the knowledge."

"We are excited to be embarking on our first training session and will schedule ongoing courses dependent upon customer interest," he adds.

The course will cover how to install, start up and operate CO₂ systems.

Contractors interested in attending should forward their expression of interest to training@heatcraft.com.au. ■ CM

Australia government initiative to tackle skills shortage

According to 2017 reports by the Department of Jobs and Small Businesses, air-conditioning and refrigeration mechanics are still in short supply in Australia.

To address these and other skills shortages in the Australian economy, Minister for Vocational Education and Skills Karen Andrews said the government is investing in skills programmes.

"The announcement of the government's \$1.5 billion Skilling Australians Fund aims to deliver up to 300,000 more apprenticeships and traineeships, pre- and higher-level apprenticeships and traineeships Australia-wide over the next five years," Andrews, a member of parliament for the Liberal Party, told HVAC&R news outlet *Climate Control News*.

Andrews called on industry to provide feedback on the Australian Apprenticeship Support Network (AASN) by July 2018. Based on this, the government will work on reforming the AASN to support employers in getting the staff they need.

Stephen Smith, head RAC teacher at New South Wales-based Technical and Further Education (TAFE), told *Climate Control News* that more visibility could help get more people involved in HVAC&R. "The world needs to know that we build and maintain the machines that keep them comfortable, [and] keep their food fresh and [their] ice-creams frozen," Smith said. ■ CM

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ONE MAN'S VISION

Petar Lujic, owner of IGA Market Central, opted for a natural-refrigerant HVAC&R system to secure his business for the future and gain a competitive advantage.

— By Devin Yoshimoto

Petar Lujic is the CEO of Kamen Group, a business involved in developing supermarkets, liquor outlets, hotel accommodation and various other types of property.

With over 25 years of experience in various segments of the retail industry, Lujic established the Kamen Group in 2012 and entered Australia's independent retail sector, opening IGA Market Central at Wentworth Point, western Sydney, in November 2017.

Independent Grocers of Australia (IGA) is an Australian chain of supermarkets. Metcash owns IGA itself, but individual IGA stores are independently owned. The Kamen Group owns the IGA store at Wentworth Point.

As an independent retailer, Lujic's decision to use natural refrigerants at the IGA store is instructive to others. Though thoroughly experienced in the retail and property development industries, Lujic's knowledge of refrigeration technology was limited at the outset of his work on IGA Market Central.

Starting nearly from scratch, Lujic learned about the current state of HVAC&R technology, its impact on the environment, and ultimately its future impact on his business.

This resulted in an opportunity to future-proof his business – with the help of trusted partners – while at the same time reducing the energy consumption of the HVAC&R side of his operations.

COMPETITIVE ADVANTAGE

For any small and medium-sized enterprise, taking the opportunity to secure a competitive advantage over larger-sized companies is crucial for business success. Using natural refrigerants for HVAC&R is one way to do so – and Lujic found it.

"It's simple," said Lujic, telling the story to an audience of some 220 people at ATMOSphere Australia, an annual natural refrigerants conference organised by *Accelerate* publisher shecco and held this year at Sydney's Luna Park on 7 May.

"Being a small player in the pack here, as we've tried to expand, what we've tried to look at is to say, 'well, we can't compete with the size and what not. But what we need to do is to try and be smarter, not only about the way that we operate our existing business, but by trying to expand our business, where possible'," Lujic said.

His journey began by identifying what is traditionally the largest portion of a food retailer's operating costs: the refrigeration system.

PHASING DOWN HFCS

Lujic, by his own admission, has little technical knowledge with respect to refrigeration systems. As he conducted his own research, however, he found that certain types of refrigerant gas were going to be phased down, possibly exposing his business to the risk of costly equipment replacement in the near future.

As he looked into the current situation further, it became clear that there was an opportunity to be gained from selecting the right type of new system for the Wentworth Point store.

“It means that we can focus far more on running our business as opposed to worrying about the efficiency or replacing the equipment and changing refrigerants. That's it.”

— Petar Lujic, IGA Market Central



Petar Lujic
CEO, Kamen Group
/ IGA Market Central

“Both the owner and AJ Baker wanted the store to be future-proofed, so CO₂ was the only real choice.”

— Mike Baker, AJ Baker

WILL HFC PRICES SKYROCKET IN AUSTRALIA?

Prices of hydrofluorocarbons (HFCs) in the European Union have increased substantially since the new EU F-Gas Regulation was enacted.

The new European F-Gas Regulation, finalised in 2014 and in force since 2015, aims to reduce the European Union's HFC use by 79% by 2030. It has already been having a pronounced impact on prices, according to a study by Öko-Recherche, an organisation dedicated to environmental research and monitoring.

Average purchase prices of R134a, R410A and R404A were under €2 (AU \$2.4)/tCO₂e (tonnes of CO₂ equivalent) in 2014, but jumped to between €7 (AU \$8.3)/t CO₂e and €23 (\$27.2)/t CO₂e in the first quarter of 2018, the study said.

In a webinar entitled 'Monitoring of refrigerant prices against the background of the F-Gas Regulation (EU)', Öko-Recherche's Barbara Gschrey described the price increases for R134a, R410A and R404A throughout the supply chain (gas producers, OEMs, and service companies).

For instance, Gschrey said service companies' selling price for R134a has increased by €23.29 (AU \$36.8)/tCO₂e since the EU F-Gas Regulation was adopted, while their selling price of R410 is now €22.04 (AU \$34.9)/tCO₂e higher.

On 1 January 2018, the quota of HFCs available was cut by 37%. Öko-Recherche is monitoring the price of HFCs on behalf of the European Commission, to evaluate the effectiveness of the EU F-Gas Regulation and its quota system.

With Europe currently experiencing such dramatic increases in HFC prices, Australia can also be expected to experience HFC price changes in the near future as a result of its own legislation.

"There's no crystal ball obviously," Lujic stated, "but I think ultimately it's about how much you can invest today to offset for the future".

On 1 January 2018, the Australian government began implementing a phasedown of HFCs under its Ozone Protection and Synthetic Greenhouse Gas Management (OPSGGM) programme.

The OPSGGM limits imports of HFCs to 8.0 million tonnes CO₂e per year, to be gradually reduced to 1.6 million tonnes CO₂e over the next 18 years.

The Kigali Amendment to the Montreal Protocol, to which the nations of the world agreed in October 2016, initiated a global phasedown of HFCs.

The Montreal Protocol, which dates back to 1987, originally aimed to phase out the use of ozone-depleting refrigerant gases – starting with CFCs and later incorporating HCFCs. HFCs replaced CFCs and HCFCs. While not harmful to the ozone layer, HFCs do contribute to global warming.

For businesses that are heavy users of refrigeration in Australia, the cost of HFC-based systems will inevitably rise over the next several decades as supplies become scarcer.

Lujic saw an opportunity to gain a first-mover advantage here.

TECHNOLOGY ALTERNATIVES AND TRUSTED PARTNERS

Lujic investigated the natural refrigerant-based HVAC&R technologies available today, and looked for reliable and knowledgeable companies able to provide these solutions in Australia.

"A lot of people have avoided [natural-refrigerant technology] because it's a higher cost and it's the unknown," said Lujic during his ATMOSphere Australia presentation.

"You don't have the R&D to be able to manage it or improve it, so you're guided."

Finding the right partner was key for Lujic, who could only dedicate limited resources to the implementation, management, and maintenance of new technology.

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"In this instance, it was Baker Refrigeration," said Lujic, referencing Perth-based installation contractor AJ Baker & Sons Pty Ltd. The company has been very active with natural refrigerant system installations in Australia over the past few years, especially with transcritical CO₂ systems.

"They have assisted us and guided us to give us the direction of where we should go and how we should approach this."

In November 2017, the IGA Market Central store opened at Wentworth Point. One transcritical CO₂ rack system provides the refrigeration and freezing needs for the entire 1,460 m² of store trading area.

Lujic is proud of the installation and encourages his staff to communicate this pride in harnessing natural refrigerants to customers as much as possible.

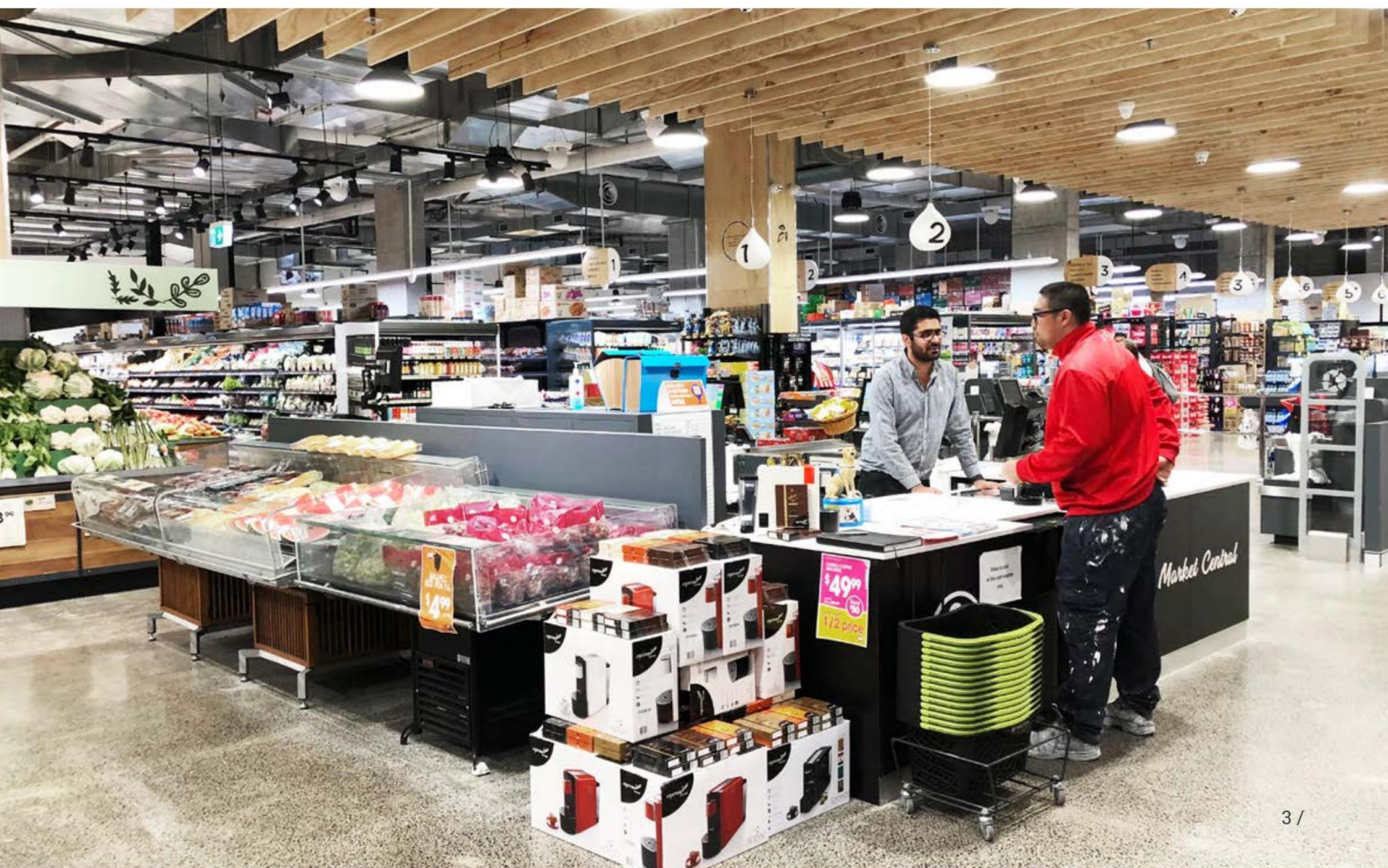
"Natural refrigerants are being used across the whole store," Lujic said in an interview conducted at ATMOSphere Australia.

"For every component of refrigeration, from back of house to front of house in our signature pieces like the delicatessen, we are encouraging our staff not only to reinforce the message but also to educate the customer that we are doing the right thing for the environment by making sure that we implement and execute the delivery of natural refrigerants."



1 / IGA Market Central, Wentworth Point, western Sydney.

2, 3 & 4 / Refrigerated display cabinets, IGA Market Central.



3 /



4 /



INSTALLATION DETAILS

Store Name:

IGA Market Central at Wentworth Point

Location: Pierside Shopping Centre, Burroway Rd., Wentworth Point, NSW

Store size: 1,460 m² trading, 2,560 m² total

Store opening: November 2017

SYSTEM SPECIFICATIONS:

CO₂ transcritical booster rack systems: 1

Features: Parallel compression and evaporative pre-cooling on gas cooler

Low-temperature capacity: 26 kW

Low-temperature modules: 8 cases and 3 rooms

Medium-temperature capacity: 170 kW

Medium-temperature modules: 38 cases and 7 rooms

Design and installation:

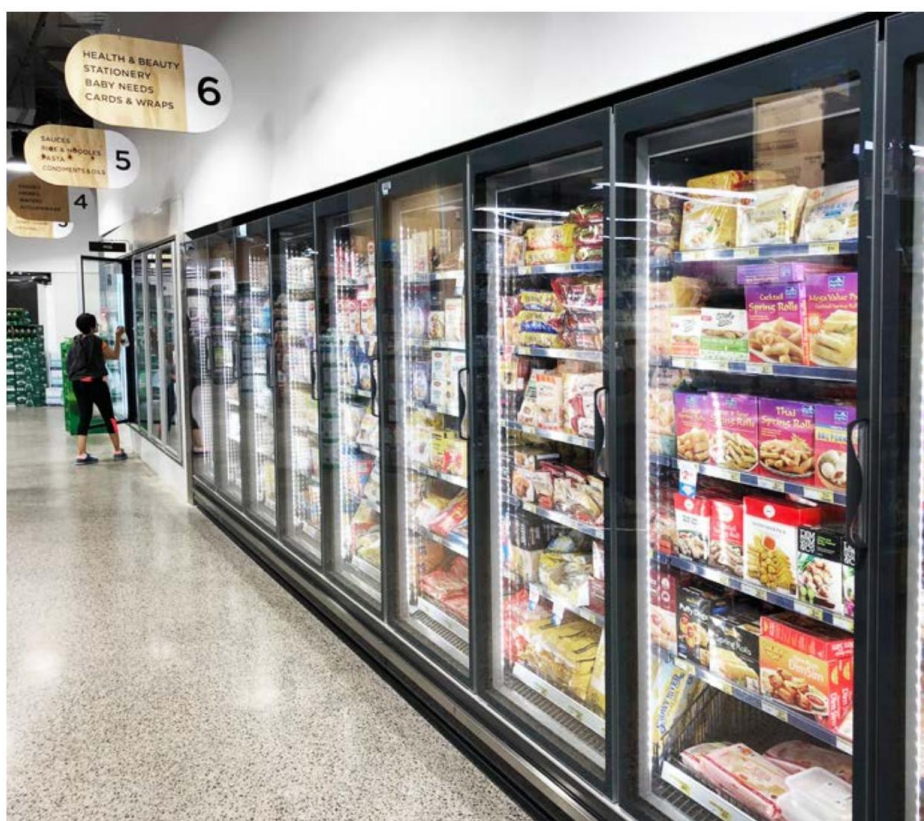
AJ Baker & Sons Pty Ltd.

Control system: CAREL

Case and rack manufacturer: Epta

“The only way to try and counter attack that is to be proactive and do what we've done. That's why we've gone down the path of natural refrigerants.”

— Petar Lujic, IGA Market Central



CONTRACTOR'S VOICE

AJ Baker is one of the leading installers of transcritical CO₂ systems in Australia. It currently has 14 installations and is installing them at a rate of 3-4 every six months.

Mike Baker, managing director at AJ Baker, details some of the challenges that were overcome with this particular installation:

The design was based on transcritical CO₂ due to the uncertainty of the phasedown of HFC refrigerants in Australia, and the potential cost implications of these gases into the future.

Both the owner and AJ Baker wanted the store to be future-proofed, so CO₂ was the only real choice.

There were also restrictions with plant room size and pipe routes, so the efficiency of CO₂ allowed for a compact rack size, and smaller pipe sizes than HFC gases. Noise was also a concern, so the rack was designed with acoustic housing. Low-speed gas cooler fans ensured the installation did not interfere with the residential apartments located in the building.

The challenges included fitting a 10-metre discharge plenum on the gas cooler outlet, so that air was discharged completely off site, and not inside the loading bay/multi-storey car park.

Plus the plant room location was on a mezzanine floor in the car park, so fire wall penetrations had to be resealed accordingly. Interface issues with the main high-rise construction builder were important to resolve quickly.

The store contains some of the latest designs of display cases, with fully transparent medium-temperature composite doors that can withstand the full front-on impact of a trolley without breaking, and full-height freezer door cases with no top canopy. These have one of the largest front displays available.

The technology of the freezer cases allows them to be defrosted once a week, instead of once or twice a day. This results in power savings and more constant product temperatures for a longer-lasting product.

However, Petar reflects, continuing changes in external circumstances are inevitable.

"The reality is that there's always going to be constraints, changes of government, and there probably will be a reintroduction of a carbon tax at some point," he said.

"The only way to try and counter attack that is to be proactive and do what we've done. That's why we've gone down the path of natural refrigerants."

"It means that we can focus far more on running our business as opposed to worrying about the efficiency or replacing the equipment and changing refrigerants. That's it."

FUTURE-PROOF

For food retail businesses, installing, operating and maintaining the refrigeration system generally represents the largest portion of operating costs.

Owners of these businesses, from the largest multinationals to the smallest independent retailers, are becoming increasingly aware of this item on their statements, and asking themselves why refrigeration is becoming more expensive.

As this awareness grows, CEOs and independent owners as well as managers and engineering bosses are starting to peel back the layers to answer this question. And the answer involves elements of science, global policy and technology.

For food retailers, not only is adopting natural refrigerants the right thing to do for the environment; it is also consistently proven to be a smart business decision. ■ DY

CHEERS TO A GREENER WORLD!

Convinced of the role that natural refrigerants can play in reducing its carbon footprint, Dutch multinational brewing giant Heineken is adopting hydrocarbons for all its new beer fridges worldwide. *Accelerate Europe* reports from the company's global headquarters in Amsterdam.

— By Andrew Williams

An important stop for many visitors to the bike-mad city of Amsterdam is the canal-side brick structure that housed the original Heineken brewery, which closed in 1988 and is preserved as the Heineken Experience museum. Founded by Gerard Adriaan Heineken in 1864, today Heineken is the second-largest brewer in the world by revenue. It owns more than 165 breweries in over 70 countries and its beers are available in 192 nations.

The firm – whose brands include Heineken, Amstel, Strongbow, Red Stripe and Bulmers – is proud of its long history at the forefront of innovation.

In 1886, for example, Dr. H. Elion – a pupil of French chemist Louis Pasteur – developed the 'Heineken A yeast' in the firm's laboratory. The yeast remains the most important ingredient in Heineken beer to this day. During his tenure from 1917-1940, meanwhile, the founder's son Henry Pierre Heineken developed transformative techniques to maintain consistent beer quality during large-scale production.

Today, a team of modern-day pioneers are proud to be following in the footsteps of their innovative predecessors. In 2010, Heineken International CEO Jean-François van Boxmeer gave his team the target of reducing the energy consumption of beer fridges. Thus began Heineken's hydrocarbon journey.

Accelerate Europe was at Heineken's Amsterdam headquarters next to the former brewery to meet two of the people responsible for making this vision a reality – Graeme Houghton, Global Category Leader – Commercial Equipment

& Servicing, HEINEKEN Global Procurement and his colleague Hans Donker, Global Category Buyer – Fridges & Draught Beer Equipment.

"I got the briefing, 'you need to buy green fridges'. That's what we said, so I asked, 'what's a green fridge?' It took them a few months to say, 'best in class'. That wasn't very specific," recalls Donker.

"So we thought about it ourselves, and we said, 'a green fridge is a fridge that has a hydrocarbon refrigerant, LED illumination, and a smart thermostat (energy management system)'," he says.

Once the decision had been taken to opt for hydrocarbons, things moved quickly.

"A letter was sent out by our corporate relations director to the regional presidents of Heineken saying, 'we need to buy green fridges'," Donker says. "It said, 'if you don't understand, call Hans! I've still got the letter somewhere.'"

“We've got to the point where the green way – with hydrocarbons – is an accepted part of the Heineken way of life. And it's reflected in our logo!”

— Graeme Houghton, Heineken

"In that first year, we saved 30% on energy consumption," he adds.

A resident of Eindhoven, Donker has enjoyed a long and varied career in several different sectors, ranging from plant heating to X-ray design. He first entered the brewing industry as a technical manager working on innovation. "Then I moved to Heineken – I've been here eight years," he says.



Hans Donker (l) and Graeme Houghton (r),
HEINEKEN Global Procurement

“ We adopted hydrocarbons for two reasons – one, because they help to deliver the energy efficiency that we want; and two, because of their significantly lower GWP. ”

– Graeme Houghton, Heineken



All Heineken's new beer fridges use hydrocarbons.

'Drop the C'

Heineken's overall climate strategy is driven by the 'Drop the C' programme, which aims to "significantly reduce" carbon emissions across the business. By 2020 the company is targeting 40% lower emissions in production, 50% lower emissions from fridges, and 20% lower emissions from distribution in Europe and the Americas.

In early 2018, 'Drop the C' was extended to renewable energy, with the target of growing renewable energy usage to 70% by 2030.

Surpassing the 2020 commitment, Heineken achieved a 41% reduction in relative CO₂ emissions in 2017 (2016: 37%). Emissions have also decreased in absolute terms; even though production volumes were 57% higher than in 2008, emissions were down 7%.

This was primarily achieved by improving breweries' energy efficiency, using more renewable energy, and replacing high CO₂ fuels with lower-emission alternatives.

Proud to be green

Targeting 50% lower emissions from fridges by 2020, Heineken provides 'green' fridges whenever a fridge needs replacing and tests fridges against the Heineken Energy Efficiency Index (HEEI).

The brewer defines green fridges according to the following four principles: the use of hydrocarbon refrigerant, LED illumination, an energy management system, and energy efficient fans.

"We discovered hydrocarbons as part of our 'Brewing a Better World' programme. We adopted them for two reasons – one, because they help to deliver the energy efficiency that we want; and two, because of their significantly lower GWP compared to the existing refrigerants we used in our fridges," Houghton says.

"So that was the pairing of it. We work with a number of cooling partners. We use an independent cooling advisory group, which helps us with the technology side of things, plus our cooling partners – the fridge manufacturers," Houghton says.

To facilitate the optimal serving of Heineken and the other brands, whether in cans, bottles or draught, the company itself provides the infrastructure. "In the majority of cases, we own the fridges and draught beer equipment. We place it with our customers to help them serve the perfect Heineken," Houghton says.

Currently a resident of Amsterdam, Houghton's Heineken career began in his native UK, where he was responsible for procuring draught beer equipment. "Six years ago now, I moved to the centre to cover that globally," he says.

He became leader of the team that manages both draught beer and fridges a year ago.

In 2017, almost 100% of the 137,818 new fridges Heineken bought had one or more (and in many cases all four) green features. CO₂ emissions per fridge were 48% less than in 2010 (2016: 46%). Since the beginning of 2018, 100% of the fridges Heineken is purchasing are 'green'.

"Because of the lifecycle of fridges, which we expect to be around about eight years, we anticipated that in order to reach our target in 2020, we needed to start immediately," Houghton says.

The company started to use fridges based on hydrocarbons in 2010. "We expect that by 2020, the majority if not all of our fridge population will be green, with natural refrigerants," Houghton says.

"It's a lifecycle thing. The policy is 'all new fridges,'" he explains.

In Australia and New Zealand, the company buys 100 new fridges per year. In Southeast Asia, the figure is 6,000, while the brewing giant buys 600 new fridges annually in Japan. Their typical lifespan is seven to eight years, meaning that Heineken currently has a total of around 50,000 hydrocarbon-based fridges in the region.

Adopting natural refrigerants is helping Heineken to improve the energy efficiency of its fridge portfolio. "When we started, we made enquiries with our fridge suppliers, asking them how many energy savings introducing hydrocarbon refrigerant, LED illumination, and a smart thermostat (energy management system) would deliver," Donker says.

"They said, if you do hydrocarbons, you'll get 7% more efficient fridges; if you do LED, you'll save 15%; and the energy management system gives another 15%. That's how it was described to us," he explains.

"It's about the overall tuning of the system, all of the components coming together to produce energy savings," adds Houghton.

From Amsterdam to the world

With operations in so many countries, Heineken is mindful of the large contribution that adopting greener cooling practices can make to reducing its overall climate impact.

"Cooling is a significant part of our CO₂ footprint. We've got over a million fridges out there in the field. We're reducing their energy consumption by half," says Donker.



ABOVE
The Blade

BELOW
The David XL Green,
Heineken's propane-based
draught beer dispenser



Donker and Houghton are responsible for procuring Heineken's fridge fleet worldwide. "We have the power to change things. It takes time, model-by-model and area-by-area, until it becomes standard," Donker says.

"We buy roughly 140,000 fridges a year," says Houghton. "All the fridges we buy are hydrocarbons. We're on a journey. It's about changing our entire fleet."

"The average lifetime of our fridges is about eight years, and we're currently about eight years in. So if you do the maths – allowing for a bit of a dropout rate, it's probably fair to say that we have about a million fridges in the market with natural refrigerants," he estimates.

Heineken's decision to use proprietary technology is an integral part of its wider strategy for reducing its carbon footprint. The company works with different fridge suppliers around the world.

The Blade – Heineken's latest draught beer dispense innovation – has a keg volume of eight litres and is capable of chilling beer to 2°C, delivering beer at 3°C in the glass. It uses isobutane (R600a) as the refrigerant. "It's already live in selected markets and will go further," Houghton says.

The propane-based David XL Green draught system, meanwhile, stores and chills 20-litre kegs in a fridge directly below the counter so the beer does not have to travel far to the tapping point. Over 12,000 of the systems have been installed in 25 markets across Europe, Africa & the Middle East, Asia and the Americas.

David XL Green (double tap of beer) is the line extension of David Green (single tap of beer), the world's first 'green' draught beer system.

"It's about deploying the right equipment in the right outlet, and applying the right technologies to make sure you're as efficient as possible," Houghton explains. "It's a holistic approach."

What challenges has Heineken faced in adopting hydrocarbon-based fridges and draught beer equipment?

"It was quite a smooth process. The apprehension, and the pushback from some of our markets, was that this is different technology," Houghton says. "We sometimes see this resistance when we introduce new technologies."

Today, Heineken uses hydrocarbon equipment all over the world. "At first we didn't do it in Central Africa," Donker says. "We assessed the risk and we didn't want to introduce hydrocarbons there. But we have done so now."

Initially, the maturity of the service organisations posed challenges in some parts of the world.

"It was a gradual thing. Europe was phase one, in terms of the maturity and pushing this through, followed by the Americas," Houghton says.

"Asia and Africa followed afterwards. We were familiar with the suppliers present in those markets from working with them in Europe and the Americas, but they took time to develop the service agents who could look after the equipment," he explains.

The equipment suppliers themselves provide Heineken's customers with training on how to work with hydrocarbons.

"We went through a change process, to get our clients and our sub-contractors on board," Houghton says. "We were pleasantly surprised by the robustness of the technology. We've had no misery. It proves that we've done the right thing."

"It's been a great story for everyone," he says.

Does Heineken want to be recognised as a global driver for natural refrigerants? Houghton replies with an emphatic, "yes".

As a global company, Heineken is aware of the responsibility it shares to reduce the environmental impact of making cold beer available the world over. "We know our carbon footprint, and we're actively trying to reduce it," Houghton says.

What's next for Heineken?

"We're up to date regarding the latest technologies and the latest thinking for how we can achieve our targets and push ahead," Houghton says.

Yet the company continues to push boundaries in order to maximise energy efficiency. In Mexico this year, for example, "we launched fridges with variable-speed compressors, which we'd never done before at Heineken, in order to achieve that next step," Houghton says.

"We need to know where the next energy efficiency boost will come from, and we look to the market for the latest innovations that will do that," he explains.

Houghton does not see major differences between doing business in different countries of the Heineken universe.

"Other than the speed of change and the speed of adoption, it's pretty much the same. We're one of the few global departments in a very decentralised company," he says.

"It's about persuasion and about commitment from the top. This came from the CEO, which helps, because then it's on everyone's radar," Houghton says.

"We've got to the point where the green way – with hydrocarbons – is an accepted part of the Heineken way of life. And it's reflected in our logo!" he grins. ■ AW

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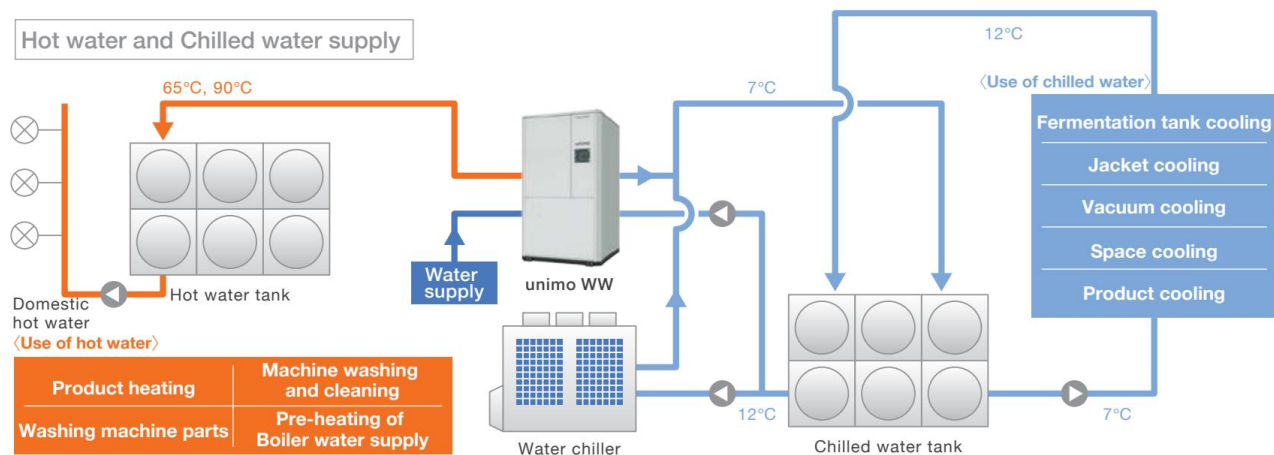
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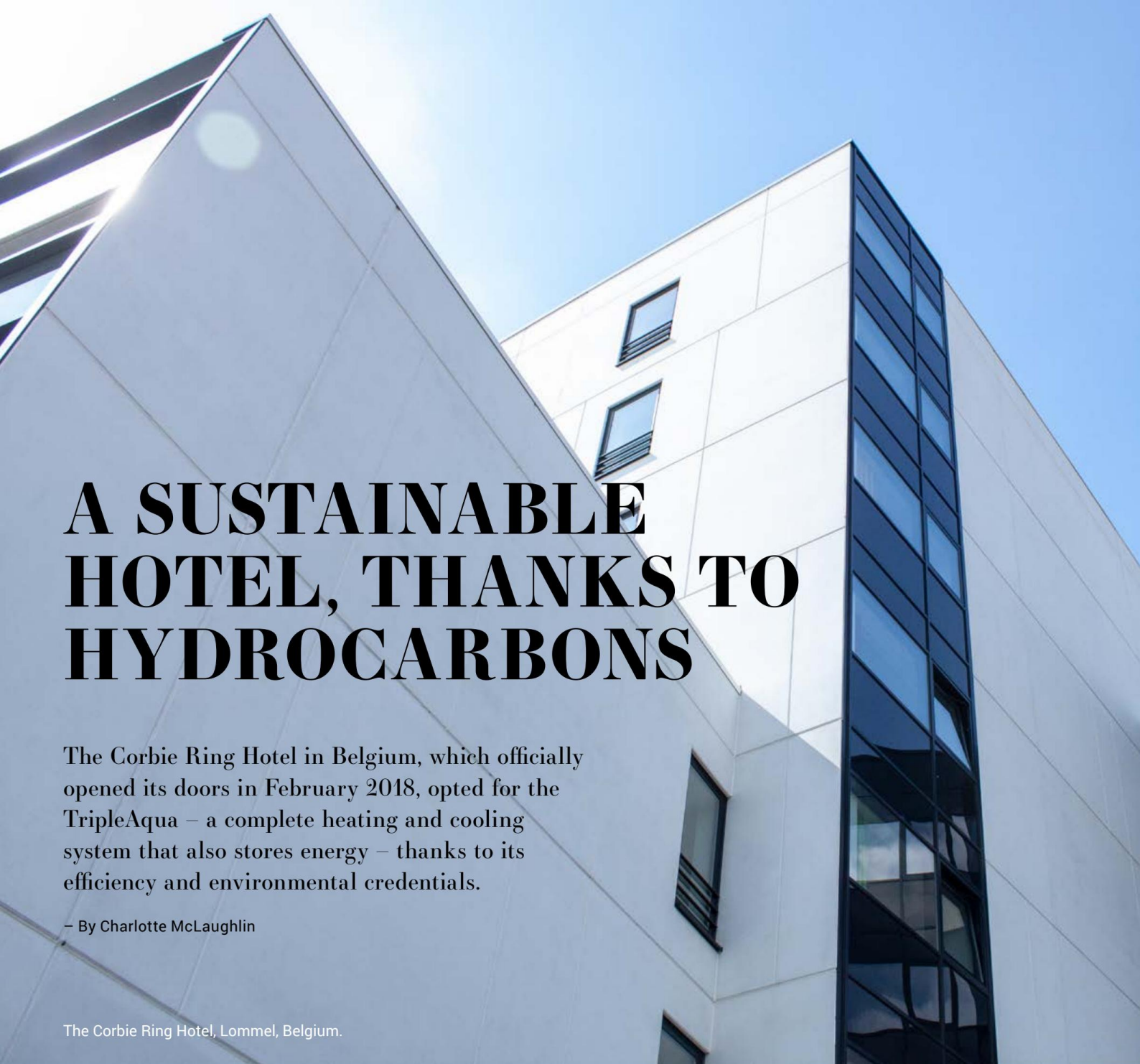
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A SUSTAINABLE HOTEL, THANKS TO HYDROCARBONS

The Corbie Ring Hotel in Belgium, which officially opened its doors in February 2018, opted for the TripleAqua – a complete heating and cooling system that also stores energy – thanks to its efficiency and environmental credentials.

– By Charlotte McLaughlin

The Corbie Ring Hotel, Lommel, Belgium.

Photography by: Charlotte Georis

The Belgian town of Lommel – a jewel of the Flanders region – is rich in the quartz sand that forms the basis of the high-quality glass for which the area is famous. It is also home to the largest solar park in Belgium, which produces energy for over 24,000 households in the region.

The town now has another claim to fame – the Corbie Ring Hotel, arguably the most sustainable hotel in Belgium. During construction of the hotel, which is now partially open, the owner opted to install the TripleAqua: an energy-efficient heat pump employing natural refrigerant propane (R290), a hydrocarbon, with a global warming potential (GWP) of three.

“This is the most sustainable hotel in Belgium thanks to the TripleAqua,” Bart Beerten, owner of HVAC contractor Willems-Diels – which installed the unit at the Lommel hotel – told *Accelerate Europe*.

Jan-Baptist Koch, the hotel's owner, nods in agreement. He has a passion for sustainability, and has even installed solar panels in his home. “We asked [Beerten] to look for a good technique to put savings in our pockets, of course, [and one which] is environmentally sound.”

Koch is also owner and manager of two other Corbie hotels – one in Lommel and one in Mol, where his parents first started the business. A further Corbie hotel is run by his sister Pauline Koch, who is also an artist and is responsible for the design and decoration of Lommel's Corbie Ring Hotel, which incorporates the local area's high-quality glass in its aesthetic.

The hotel has 27 hotel rooms and 20 business flats, with a small reception area and a breakfast area. It generally caters for business guests.

1/ The hotel's breakfast area.

2/ Hotel owner Jan-Baptist Koch and ECR Belgium's Filip Van Hulle converse alongside the TripleAqua.

The TripleAqua, an invention of *Accelerate Europe's* 'Person of the Year' for 2017 Menno Van der Hoff (of TripleAqua Licensing Limited), is an outdoor 113 kW unit. It has been placed on the roof of the hotel.

The unit provides the hotel's entire space heating and cooling throughout the year. It is connected to 54 internal HVAC units and a floor heating circuit, allowing guests and staff to adjust the temperature in individual rooms and common spaces according to their needs.

Van der Hoff explains, "this the perfect place to install it, as hotels have different customers with very different needs. One may wish to heat, another may want to cool".

"This is the first TripleAqua in Europe in a hotel," he says. "I am convinced that this application will take hold."

Many ideas, one solution

In choosing the right heating and cooling system in the hotel, HVAC engineer Beerten – who has run the Willems-Diels business with his wife since taking it over from his father-in-law over 20 years ago – went through several options.

He needed an environmentally sound, cost-effective and long-lasting solution. "The market is getting to more environmentally friendly [solutions]. People expect long-lasting and ecological" products and places to stay, Koch told *Accelerate Europe*.

Most hotels install a boiler and a separate VRF split air-conditioning (AC) system that traditionally uses high-GWP HFCs. The heat in the other Corbie hotel in Lommel, with solar panels on the roof, is produced by solar energy. Beerten installed that hotel's HFC-based VRF AC system only later, as air conditioning was not as popular in 2005 when the hotel first opened.

"With VRF you need multiple copper piping and leak detectors in every room," Beerten explains. "[With the TripleAqua] water just goes through, also in the underfloor heating" – a simpler design for the installer, he argues.

"I also explained [to the owner of the hotel] that f-gases will be more expensive in the future," Beerten adds. "Prices of R410A are increasing."

He first met Van der Hoff at an HVAC&R show where the latter was exhibiting the TripleAqua. He approached Filip Van Hulle, sales manager at ECR Belgium (part of the Beijer Ref Group) – who is responsible for TripleAqua sales in Belgium – to discuss various sustainable HVAC&R options.

Van Hulle proposed the TripleAqua, to produce all the building's space heating and cooling in combination with a

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2/



condensing water heater to produce hot water, as an extremely energy-efficient solution. The other option was to install a separate heat pump to provide hot water to serve the hotel's entire demand, including the showers.

Beerten also looked at integrating solar energy into the hotel's energy picture. In the end he decided on the TripleAqua together with a separate condensing water heater for hot water production, with no solar panels because the heat pump takes up too much space on the roof. The solar park and wind turbines close to the town serve the hotel's energy needs.

According to Beerten's calculations, the current setup was the best option, as space heating and cooling is generally responsible for the majority of a building's energy consumption. It also had the highest payback for the end user and was the most environmentally friendly solution, Beerten argues.

For Koch, trust played a key role in following Beerten's recommendations. "I looked over it and said [to Beerten], if you say this is the best option, I will go for it," he says.

The return on investing in the TripleAqua will be four years, according to Van Hulle. Beerten has made a theoretical calculation comparing it to his work in the other Corbie hotel, where he installed a different heating and cooling system. "It's [around] 50% more efficient," he told *Accelerate Europe*.

Beerten also praises the uniqueness of the system. “We can take heat from the south [which has glass windows that warm up the reception area] and [redistribute] it to the north side,” he says, which does not get as much sun during the colder winter months.

“We [also supplied] the hotel [with a balanced] ventilation system,” Beerten says. In a balanced ventilation system, a network of ducts throughout the building supplies air to vents in each room without the different airflows crossing each other and recovers air through a heat exchanger.

“This allows us to recover warm air during the winter and cool air during the summer,” Beerten says. Also, “during the winter the water is stored to be used later for heating,” he notes.

An important aspect of the system is its low-temperature lift. Most heating systems use radiator pipes at temperatures of up to 70°C, according to Beerten, but rooms can be heated efficiently with under-floor water pipes at lower temperatures.

The TripleAqua generally heats and cools the three water pipes to return ambient temperatures ranging from 28-36°C and 12-16°C.

“We told [Koch] to keep the rooms at 18°C as standard, and then let the customer change the temperature through a small panel in their room to what they want,” Beerten says.

This system is not the only environmental technology employed in the hotel. Beerten recommended collecting rainwater to use in the toilets and elsewhere.

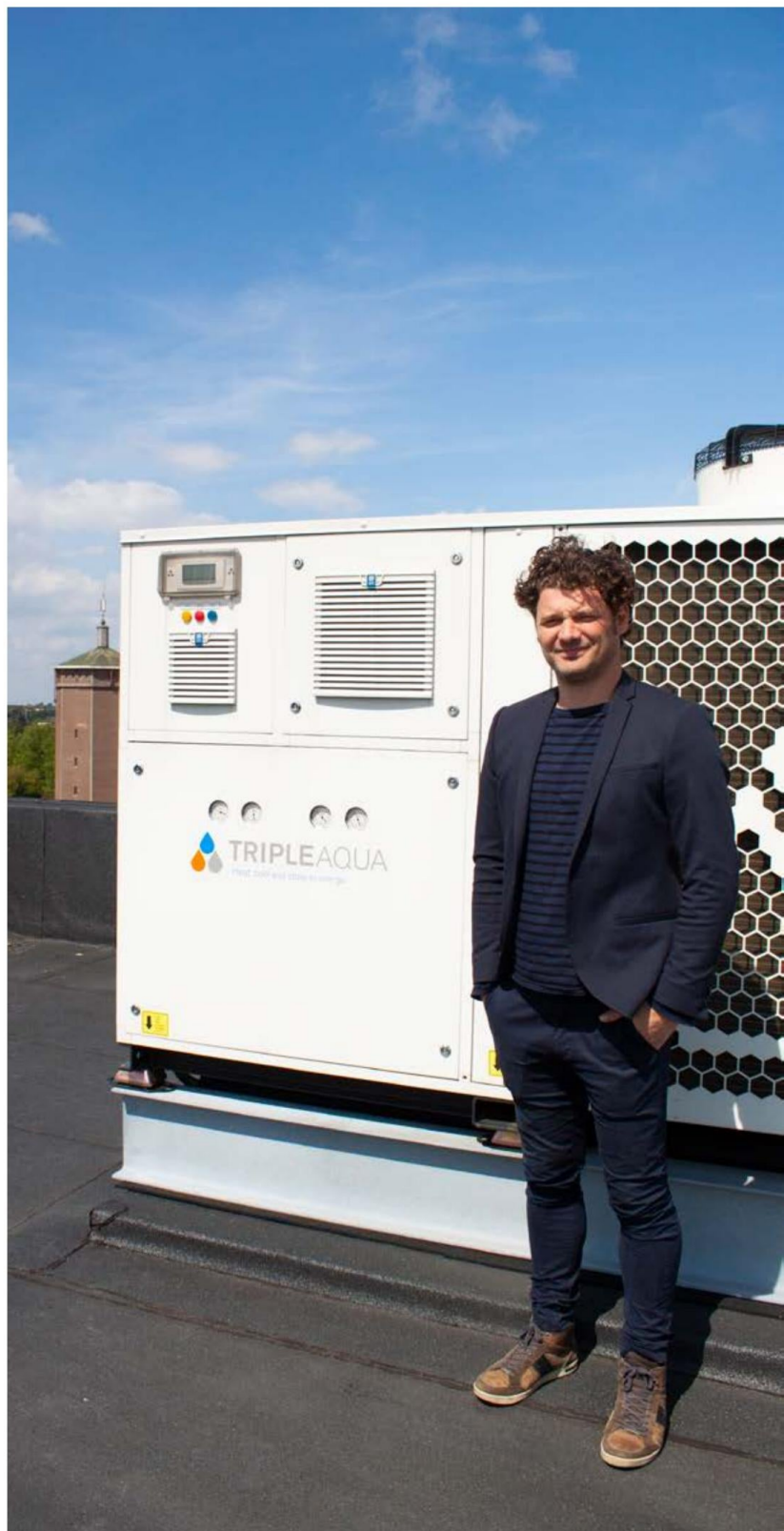
Another installation?

Koch is also expanding the family business: “We [may start building] a new hotel in the summer.” The TripleAqua could also be installed there. Koch has been pleased with it so far and plans to add a page on the system’s environmentally friendly credentials to the hotel guide that he is writing.

“We will convince them to install the TripleAqua [again],” Beerten says. “We think it’s the best solution for a hotel.”

■ CM

Hotel owner Jan-Baptist Koch



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HOW LIBERTY COLD STORAGE GOT ITS AMMONIA CHARGE DOWN



The Chicago-area operator invested in a low-charge ammonia DX system configured to use less than 10,000 lbs. (4,535.92 kg) of NH₃ for both low and medium temperatures. *Accelerate America* reports.

– By Michael Garry

When Western Liberty Foods, an Iowa-based meat processor, opened a cold-storage facility in Illinois in 2015, it decided to use a lot less ammonia for refrigeration than it employed at its four processing plants.

Those plants have vast quantities of NH₃ in a liquid-overfeed process, including one facility in Illinois that holds 80,000 lbs. (36,287.39 kg) of the hazardous refrigerant. By contrast, the cold-storage plant it opened, Liberty Cold Storage, located in Bolingbrook, Illinois, near Chicago, uses 7,500 lbs. (3,401.94 kg) to refrigerate West Liberty's meats and an array of produce, desserts and other third-party foods.

The Liberty Cold Storage plant, which underwent a 123,000-sq.-ft. (11,427-sq.-m) expansion completed in early 2018, now encompasses 253,360 sq. ft. (23,537.91-sq.-m), and its ammonia charge supports a capacity of 928 TR (3,264 kW), with a ratio of 8.1 lbs/TR (1.05 kg/kW).

This is a much-reduced amount of ammonia. It keeps the charge under the 10,000-lb. (4,535.92 kg) threshold above which cold storage plants need to abide by strict regulations mandated by several U.S. regulations including the Environmental Protection Agency (risk management plan), the Occupational Health and Safety Administration (process safety management), and the Department of Homeland Security (chemical facility anti-terrorism standards).

1 /

1 / Tim Cox, Liberty Cold Storage.

2 / Frick screw compressors in engine room.

3 / Dock area.

“It just seemed like the right fit. We went with their recommendation and it's worked out well.”

– Tim Cox, Liberty Cold Storage

How did Liberty Cold Storage get its refrigerant charge down?

One of the ways that cold storage operators are reducing their ammonia charge is to install one or more low-charge packaged systems, either on a rooftop or on the ground outside.

But another approach — the one implemented by Liberty Cold Storage — is to keep the stick-built, central-engine-room format traditionally used by industrial operators, but employ a DX (direct expansion) evaporator from Colmac Coil Manufacturing for both medium-temperature and low-temperature applications.

DX evaporators, which require much less ammonia than an overfeed system, have been used for medium-temperature but not for low-temperature applications. However, Colmac Coil, based in Colville, Washington, came up with a design (called ADX or Advanced DX) to make them work with low temperatures.

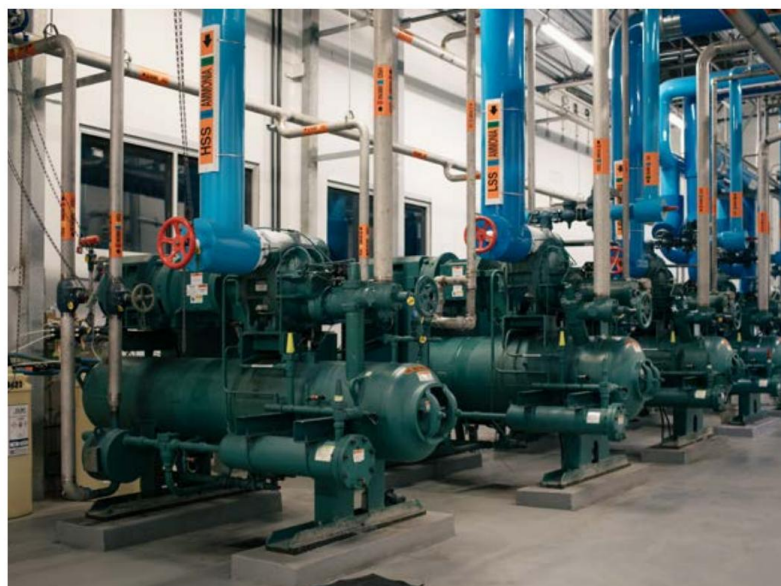
Tim Cox, vice-president at Liberty Cold Storage, who previously spent nine years at parent West Liberty Foods, made the decision to invest in the Colmac Coil ADX evaporators, with direction from his refrigeration contractor, AMS Mechanical Systems, Woodridge, Illinois — and in particular, industry veteran Rick Watters, AMS' VP (refrigeration/food process piping) who has been with the company almost 35 years.

The number one priority was “less ammonia in the facility,” acknowledges Cox. “Being under the 10,000 pound mark was important to us.”

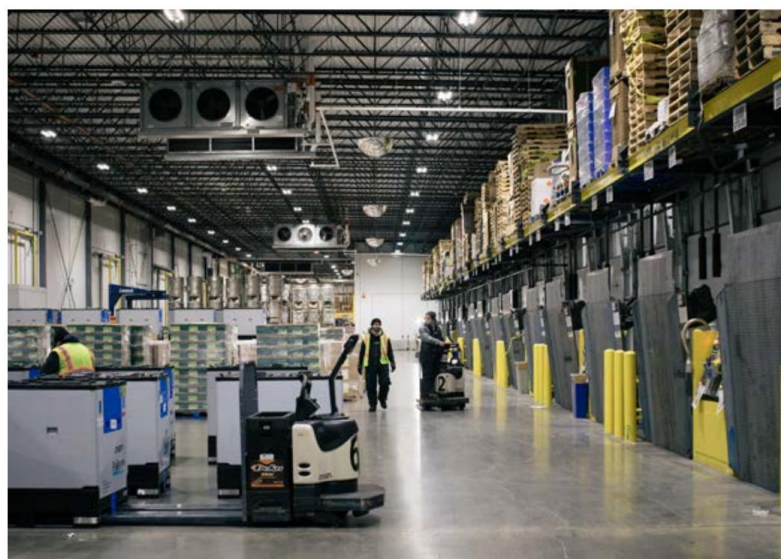
Watters designed and installed one of the first ADX installations, at another Chicago-area warehouse (Joliet Cold Storage, Joliet, Illinois) in 2014, and since then has followed suit at other plants, including Liberty Cold Storage.

The ADX system primarily reduces the ammonia charge by dint of the patented design of the evaporator. According to Bruce Nelson, president, Colmac Coil, the internal surface of the evaporator tubes has a “wicking structure,” which produces “sufficient capillary pressure to cause liquid ammonia to completely coat the inside of the tubes”. “Otherwise, the liquid falls to the bottom of the pipe, with incomplete wetting,” he says.

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3 /



Watters likens the grooves inside the tubes to a rifle barrel, which enables the ammonia to rotate 360 degrees through the length of a tube like a spinning bullet, enhancing the heat transfer.

The other part of the evaporator system that lowers the charge is a distributor that optimises the flow of ammonia throughout the tubes (circuits). “What the distributor does is it allows each tube to get the same amount of liquid as the others,” Watters notes.

Cox thinks the ADX system “makes more sense in how it delivers ammonia to the evaporator and gets on coils versus a traditional system”.

The technology behind this evaporator is actually not new, but Colmac Coil found a way to harness it differently in the ADX unit to reduce the amount of ammonia needed, notes AMS Mechanical Systems' Watters.



Penthouse DX evaporators.



Hanging DX evaporators in dock area.

By reducing the ammonia charge, the ADX system becomes simpler to manage than a traditional system, according to Cox. "The engine room seems simpler when you compare the two for me. It sends out the liquid ammonia that the system needs instead of over-pushing it and bringing it back wet. With ADX it all comes back as a gas," he says.

The ADX system also uses smaller vessels that reduce the amount of ammonia held and eliminate the liquid ammonia pumps used in recirculated systems along with "valving, regulators, reliefs and electrical," says Watters.

"To me, [the ADX system] is simpler to operate," he says, pointing to the ease of restarting the system after a power failure. "It's as easy as flipping on a light switch."

Preventive maintenance is handled by AMS, which monitors the system remotely and visits the plant every other week. "For this system I don't need someone on site – AMS supports it," says Cox.

Safety first

To enhance the safety of the system, most of the 32 evaporators used at Liberty Cold Storage are housed in penthouse enclosures on the roof of the building, blowing cold air through ducts into the cooling area. (The exception is the dock area and a small cooler, which use hanging evaporators). In this way they resemble low-charge packaged units, except that the latter contain all of the refrigeration equipment, not just the evaporators.

With penthouse evaporators on the roof, "no ammonia is in the room itself," notes Cox. That means they are out of reach of forklifts that may bump into a hanging evaporator.

In addition to safeguarding employees, the lower ammonia charge helps keep stored products out of harm's way, which aligned with the overall design of the building. "When we built Liberty Cold Storage, we tried to build with the idea of food safety and food security inside and outside the building," says Cox. "And give people peace of mind that we have control of the product."

While Cox wants to reduce the amount of ammonia he uses, and recognises its potential toxicity, he still appreciates its value as an environmentally friendly natural refrigerant with a GWP of zero. "We did not want a Freon system," he says.

Cost advantage

In terms of cost, Cox sees "an advantage on price" with the ADX system being a little less expensive (in equipment plus installation) than a liquid-overfeed system. According to Nelson of Colmac Coil, what is helping to drive adoption of the ADX system is its lower cost – 2% to 5% less than that of a traditional overfeed system.

Watters calculates that the Joliet facility's ADX system cost 2.4% less than a liquid-overfeed system, a saving of \$100,000 (AUD \$135,096). "We priced it both ways," he says.

Saving energy was another consideration for Cox. In a presentation at the Global Cold Chain Expo in Chicago last year, Watters, in a presentation with Nelson, provided an energy-usage comparison of the Liberty Cold Storage and Joliet plants with a Chicago-area facility that uses a liquid-overfeed system.

In 2015, the Joliet plant used 38% less power (annual average power/sq. ft.) than the liquid-overfeed facility, while Liberty Cold Storage (which does blast freezing in its main freezer) consumed 18% less. (The ADX plants used VFDs for evaporator fan motors while the overfeed facility did not.)

Watters sees the low-charge movement as a good direction for the industrial refrigeration industry. "The less ammonia, the better, period," he says. "There's always risk, so why not minimise the risk?"

■ MG

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— By Devin Yoshimoto

In April, Australia's first transcritical CO₂ system to utilise an ejector was installed at a newly rebuilt Ritchies IGA supermarket in Beechworth, Victoria.

The system encompasses the store's entire heating and cooling needs – including air conditioning and heating during the summer and winter seasons – and is one of a number of stores the retailer is looking to open with fully integrated transcritical CO₂ systems this year.

Dave Redden, principal at local refrigeration consultancy Refrigeration Innovations, has had a long relationship with the folks at Ritchies. For both parties, the move to natural refrigerants was under discussion for a long time, including close monitoring of CO₂ technology and overseas trips, which finally led to this first installation in April.

"Ritchies already decided some time ago that all new greenfield sites and major refurbishments would be with CO₂ transcritical systems," says Redden.

"As we were looking at different options for different [transcritical CO₂ systems], we decided that the Beechworth store would be the first one. We also decided that we would use the Danfoss gas ejector system since it would get us across the line for warm-climate refrigeration."

INSTALLATION DETAILS:

- ▶ **Store name:** Ritchies IGA Beechworth
- ▶ **Store location:** 24 Loch Street, Beechworth, Victoria 3747
- ▶ **Store size:** 1,900 m² floor area
- ▶ **System commissioning date:** April 2018
- ▶ **Transcritical CO₂ rack:** SCM Frigo
- ▶ **Medium-temperature load:** 173.7 kW
- ▶ **Parallel compression and A/C load:** 104.5 kW
- ▶ **Low-temperature load:** 20.4 kW
- ▶ **Full control system and Multi Ejector:** Danfoss
- ▶ **Installation contractor:** MB Refrigeration
- ▶ **Project Management:** TRG



SCM Frigo transcritical CO₂ system with Luvata CO₂ gas coolers

BOOSTING EFFICIENCY IN WARM CLIMATES

The efficiency of transcritical CO₂ systems in warm climates has long been seen as a barrier to implementing this technology in certain regions of Australia. However, over the past few years, technology innovations such as parallel compression, ejectors, sub-cooling and adiabatic cooling have opened the door to the efficient use of CO₂ in warm regions around the world.

The transcritical CO₂ system at Ritchies IGA in Beechworth uses both parallel compression and ejectors to create a buffer against the area's warm summer temperatures.

"We've run it when we commissioned the store," Redden explains, "because it was quite warm still in autumn at the time".

"It was between 29°C and 31°C most days, and it worked very well."

"Since then obviously it hasn't been running because it's very cold up there at the moment. But we'll wait until the next warm period hits – probably around December – when the system will come into its own again," he says.

HEATING, AIR CON WITH TRANSCRITICAL CO₂

The cold season, however, presents its own opportunities to showcase how the fully integrated transcritical CO₂ system improves energy efficiency by using waste heat.

Redden explained how using waste heat to warm up the store during the winter season has delivered energy savings and a comfortable environment for customers and store staff.

"We do it through plate heat exchangers on the rack, which use pumped water and glycol. It gets so cold in Beechworth, because it's up near the Alpine range, so it can actually freeze the water," he says.

Redden says the store runs its heating 24 hours a day, since waste heat is always generated whether or not the indoor heating is on, eliminating the energy needed to run the gas cooler fans outside.

"By monitoring the energy usage, we're able to see that even with the compressors running, the power usage never went up at all because we're not running the gas cooler fans," Redden explains.

"We're diverting all of the heat into the store."



1 /

The store runs at around 20°C to 21°C constantly, eliminating the time it takes to warm up the building in the morning and resulting in a more comfortable store environment.

"The store's warmer for the customers the minute they walk in the door. So the feedback is that the store is very comfortable."

The air conditioning delivers the same level of performance too.

"We ran the cooling side of it when it was pretty warm in the store in the early days, and it coped with that really well," says Redden.

A GAME CHANGER

For Ritchies and Refrigeration Innovations, HFCs are already a thing of the past. In fact, their discussion of the move to natural refrigerants began several years ago and hit a turning point after overseas trips to Europe.

"We discussed it over a period of about four or five years, that there was a change coming," says Redden.

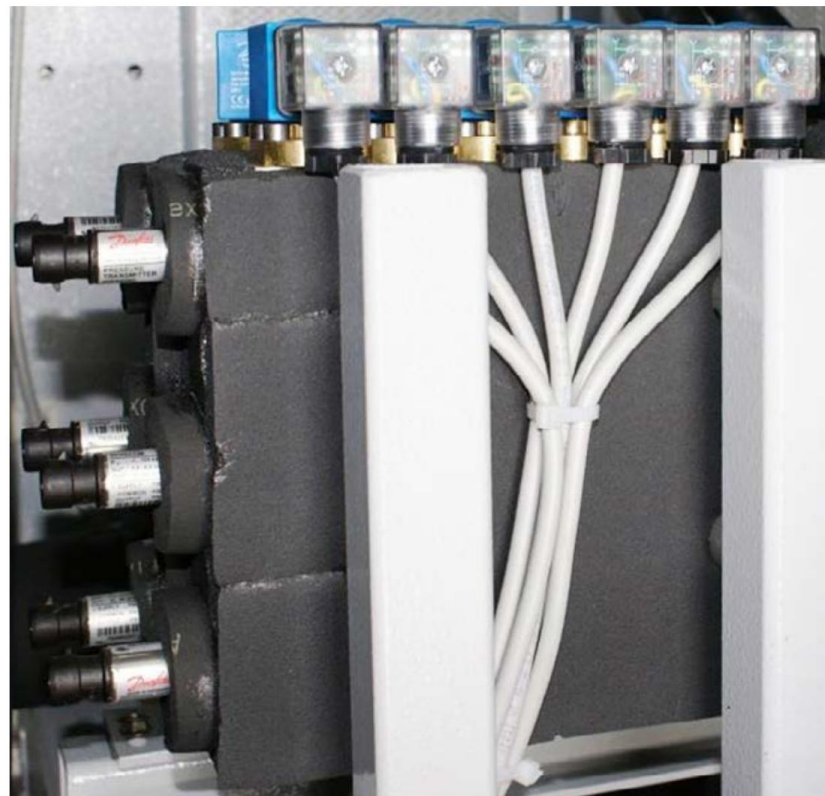
"And I don't think it was until [Ritchies] went to Europe and saw everything on CO₂ that it really hit them that this change had to be managed – because it's a game changer you know, a big dollar value."

Ritchies and Redden, however, see this game changer as a promising one with a long-term payoff. A few more installations for Ritchies with transcritical CO₂ systems are already in the works for the next twelve months, according to Redden.

"We are monitoring power and usage pretty carefully at the moment, comparing it to the old store, which basically used R404A racks, and we're already seeing some quite good savings on it, mainly due to utilising waste heat to heat the store."

Asked how he sees the outlook for uptake of CO₂ systems with warm-climate innovations like ejectors in Australia in the future, Redden replies, "I think they are a good answer". ■ DY

1 / SCM Frigo transcritical CO₂ system
2 / Danfoss Multi Ejector

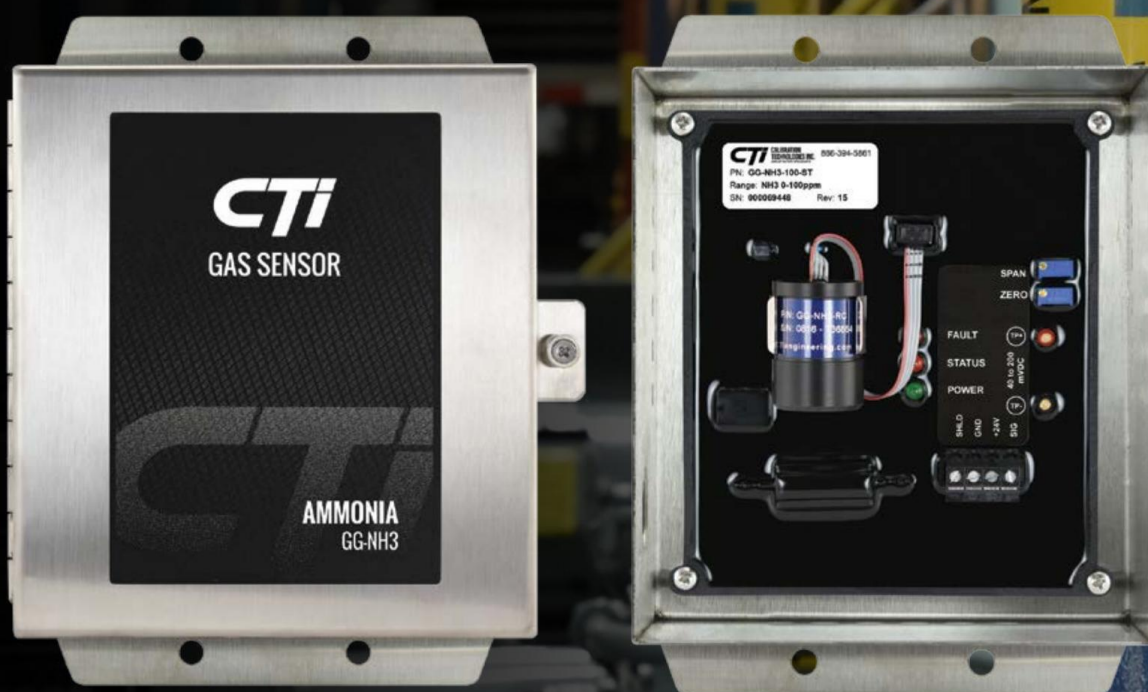


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ATMOsphere makes Australia business case for NatRefs

Photography by: Ben Beech



Demand for future-proof HVAC&R systems is driving further adoption of natural refrigerants in Australia's food retail market in particular, while technological innovations are improving CO₂ transcritical efficiency in Australia's warm climate. Accelerate Australia & NZ reports from ATMOSphere Australia 2018.

— By Andrew Williams & Devin Yoshimoto

Demand for future-proof systems and the push for energy-cost savings are driving further natural refrigerant adoption in Australia's commercial retail market, heard participants at this year's ATMOSphere Australia conference in Sydney.

The event, organised by *Accelerate* publisher shecco and held at Luna Park on 7 May, brought together some 220 stakeholders from across the HVAC&R sector in Australia and New Zealand.

The global HFC phasedown being put in place by the Kigali Amendment to the Montreal Protocol is already having an impact on Australian policy.

Patrick McNerney from the Department of the Environment, Australian Government, said: "HFC bans will be considered if alternatives aren't being introduced into the Australian market at the expected rate, or if demand for bulk HFCs looks to be outstripping supply."

He added: "The phasedown of HFCs in an international treaty provides regulatory certainty and gives business an incentive to invest. The industry is already moving towards lower GWP substances."

Major end users, including some of Australia's biggest retailers in Coles, Woolworths, ALDI and IGA, told a panel hosted by Jon Dee, anchor of Smart Money on the Sky News Business Channel, that they are already doing just that.

"We can't compete with the size of the larger stores, but what we can do is be smarter about how we operate and how we expand our business," said Petar Lujic, group CEO for Kamen Group, which recently opened IGA Market Central – Wentworth Point, where the refrigeration system is CO₂ transcritical ([see cover story, 'One man's vision', page 14](#)).

Independent Grocers of Australia (IGA) is an Australian chain of supermarkets. Metcash owns IGA itself, but individual IGA stores are

independently owned. Lujic is CEO of the Kamen Group, which owns the IGA store at Wentworth Point.

Making the business case for natural refrigerants, Lujic said: "The reality is that the economics is the first way we look at it."

"What we looked at is the fact that we are constrained by costs, capital investment, and competition, but we also looked at the situation and said, 'OK, certain refrigerants are going to be phased out' – certainly the equipment using these synthetic gases will be banned," Lujic said.

"Also, in terms of efficiency, CO₂ does improve our efficiency with energy use," he said.

"We can now focus on running our business and not on changing refrigerants," Lujic said.

Stuart Saville of Coles Supermarkets, meanwhile, said the retailer was happy with its trial CO₂ transcritical store at Coburg North, and had now entered a pilot phase. He told the ATMOSphere audience that five further CO₂ transcritical stores and a hydrocarbon waterloop store were in the pipeline.

New Zealand retailers are getting in on the act too. Greg Lewis of New Zealand supermarket chain Countdown said, "our goal is to go 100% natural refrigerants eventually. We have a plan in place".

CO₂ TECH 'WARM CLIMATE-READY'

New technology innovations such as ejectors are improving the efficiency of transcritical CO₂-based HVAC&R systems in Australia's warmer climates.

"Our partnerships with end users are key to delivering new technology," said Brett Hedge of Heatcraft, citing the firm's 60+ CO₂ transcritical installations across Europe, North America and Australia.

By adding parallel compression with an optional ejector, Heatcraft's racks are "warm climate-ready," Hedge said.

He argued that adopting natural refrigerants reduces an HVAC&R system's environmental impact and energy consumption, helps achieve sustainability targets, and eases compliance with climate-change legislation such as the HFC phasedown.

Heatcraft has invested in training facilities in Victoria (CO₂) and Milperra, NSW (hydrocarbons).

Worldwide, its fully functional CO₂ transcritical test labs have allowed it to refine its systems for all climate conditions.

"Even if you don't immediately convince the customer to opt for CO₂ transcritical, it is important to reach out and 'plant the seed'," Hedge argued. "We model, quote, meet, discuss, revisit and re-quote."

"The momentum is building, and so is the case for CO₂ technologies," he said.

'TAKING AWAY THE FEAR'

In the Australian and New Zealand markets, "investment in training is a must," Hedge said. "Contractor application training is critical," he said, but "training end users on selling the benefits of using the technology is just as critical".

Inderpal Saund from Beijer Ref Australia – which distributes Italian manufacturer SCM Frigo's CUBO₂ Smart CO₂ transcritical condensing unit in Australia – presented field data from a variety of climate conditions in Europe.

Used in conjunction with an adiabatic mesh, the unit is capable of operating effectively in ambient temperatures of up to 35°C.

"With CUBO₂ Smart we've made CO₂ transcritical easy. We've reduced the refrigerant charge and the unit is easy to install," Saund said.

"We're taking away the fear of CO₂ transcritical," he declared.

CO₂ is also primed to make greater inroads into other market sectors.

Jonathon Hare from the Natural Refrigerants Company – which represents Danish multinational Advansor in Australia – presented the business case for CO₂ transcritical cold storage in Australia.

Amid the HFC phasedown, how will contractors negotiate the various alternative industrial refrigeration options? "There are opportunities for CO₂ transcritical here. It is a proven technology worldwide and in Australia too, with thousands of installations worldwide – most of which are in supermarkets. Yet CO₂ transcritical is becoming increasingly competitive with ammonia too," Hare said.

"There is no silver bullet refrigerant. Every specific project and end user needs to be weighed up on its own merits," he said.



From left to right: Greg Lewis, Countdown; Michael Englebright, Woolworths; Stuart Saville, Coles; Petar Lujic, IGA; Marcus Meier, ALDI Stores; Tim Hill, Costco; and Jon Dee, Sky News Business Channel.



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Jon Dee addresses the conference.

► 'EDUCATION, EDUCATION, EDUCATION'

Mads Holst Nielsen from Danfoss cited CO₂ as a global solution that is applicable in all climates. "CO₂ is moving down into smaller systems," Nielsen said. "It's also moving into industrial applications," he added, arguing that it is becoming increasingly competitive with low-charge ammonia in this regard.

Advansor is convinced that CO₂ has a bright future in industrial applications as well as commercial refrigeration, where its use is already more entrenched.

"This technology is growing and growing," said Ian Tuena of the Natural Refrigerants Company. "We're moving forward – we're no longer in the learning phase. We're in the refinement phase."

"Education, education, education – that's the key issue, especially among end users," Tuena said.

Andrew Reid from Arneg Oceania Pty. Ltd. predicted that as components become more readily available, the cost of CO₂ systems will continue to fall.

"We're all here to achieve a common goal: making a success of natural refrigerant-based HVAC&R solutions here in Australia," Reid said.

KNOWLEDGE SHARING KEY TO MARKET GROWTH

Raising awareness of the availability and benefits of natural refrigerant technology options among contractors and end users is key to growing the market and reaching new customers, heard conference participants.

"There is a huge need for greater awareness of the technology transformation that will be triggered by the HFC phasedown – right here, right now," said Stefan Jensen of Scantec Refrigeration Technologies, which specialises in industrial refrigeration with ammonia and CO₂.

More must be done to raise awareness of the market implications of the Kigali HFC phasedown and ensure that high-GWP systems are no longer installed in Australia, Jensen argued. "The education and training needs are enormous," he told the Luna Park audience.

"Everyone in this room knows about it, but the vast majority of the 170,000-odd people involved in the HVAC&R industry in Australia don't," Jensen said.

"We need much greater awareness across the board," he said, calling for more collaboration between technology suppliers, contractors and end users.

Australia's federal and state governments, meanwhile, must do more to remove regulatory barriers to natural-refrigerant adoption, according to Jensen.

REFRIGERANT CHOICE 'PRIMARY DISCUSSION' FOR REGULATORY COMPLIANCE

In other global markets, natural-refrigerant growth is being driven by a combination of regulation (such as the EU F-Gas Regulation in Europe and the SNAP program in the United States) and taxation or subsidies (such as emissions trading or carbon price schemes).

"Refrigerant choice is becoming a primary discussion with customers" as end users demand cost-effective, reliable and future-proof HVAC&R solutions, said Douglas Herkess from Heatcraft Worldwide Refrigeration.

Herkess urged suppliers to partner with contractors to talk to end users and "provide compelling success stories to make end users comfortable with saying 'yes'".

"Almost everyone in this room is a believer in the potential for natural refrigerants and the opportunities that they create for the HVAC&R industry," he said. "But we only represent a small percentage of the total industry."

"Expanding the audience via education, knowledge-sharing and technology is an ongoing and important trend moving forward," he said. "We need to improve understanding of how we deal with this technology" to help reduce the HVAC&R sector's environmental footprint, he argued.

"We're all here to achieve a common goal: making a success of natural refrigerant-based HVAC&R solutions here in Australia."

– Andrew Reid, Arneg

UP-SKILLING TRADESPEOPLE KEY TO FUTURE GROWTH

On the technology side, suppliers' efforts to improve system efficiency in warm climates will help to increase market uptake of natural refrigerants in Australia, according to Herkess.

He cited market trends towards "ready to run" solutions and integrated systems that provide both refrigeration and HVAC among the primary drivers of natural-refrigerant growth in Australia.

Peter O'Neill from Mayekawa Australia Pty. Ltd. highlighted the need to raise awareness among HVAC&R technicians that natural refrigerants are taking a bigger market share. Training and up-skilling of current and future tradespeople is therefore crucially important, he argued.

As for hydrocarbons, Marek Zgliczynski of compressor manufacturer Embraco highlighted their growing penetration in the light commercial refrigeration sector. "Our tests show that propane (R290) beats A2Ls in terms of efficiency and thermal level," he said.

"But there are still legislative barriers to wider use of hydrocarbons," said Zgliczynski, who chairs an International Electrotechnical Commission (IEC) committee working to increase the charge limits imposed on hydrocarbons by international standards.

*"Once you go ammonia,
you'll never go back!"*

— Stefan Jensen,

Scantec Refrigeration Technologies

BUSINESS CASE FOR LOW-CHARGE AMMONIA

Scantec's Jensen made the case for low-charge, centralised ammonia DX systems as a means of complying with the HFC phasedown, citing system simplicity, energy performance and the minimisation of risk to occupants among their benefits.

"People who make the buying decisions generally look at their electricity bill first and foremost," Jensen said.

He presented field data indicating that switching from conventional liquid overfeed NH_3 to low-charge centralised DX NH_3 results in Specific Energy Consumption (SEC) reductions of 18-38% depending on plant layout. "This is a result of the removal of liquid from wet return lines and risers," he said.

Dual-stage central plants with distributed condensing reduce electricity bills compared to conventional liquid overfeed plants, said Jensen, citing specific NH_3 inventories of 0.2-0.4 kg NH_3 /kW.

He argued that capital costs of the new system build are approximately the same as conventional liquid overfeed NH_3 .

Jensen said there are three fundamental types of low-charge ammonia system – packages for chilling of liquid (down to approx. 0.03 kg NH_3 /kW), unitary equipment (0.018 kg NH_3 /kW), and larger central plants (0.65 kg NH_3 /kW).

Among the specifics of the design he presented were:

- ▶ Reciprocating compressors with VFDs for superior part-load performance and turndown ratio.
- ▶ VFDs on all evaporators and condenser fans.
- ▶ Special evaporator circuiting, materials and distribution.
- ▶ Dry expansion controlled by combination of superheat and refrigerant quality at evaporator exits.
- ▶ No heavy liquid in the suction lines.

In these plants there are no ammonia pumps. The low and medium-temperature evaporators are fed by common high-pressure liquid line. The hot-gas defrost condensate returns by means of a high-pressure float valve to minimise the gas bypass. The configuration also allows for adding short secondary refrigerant loops by employing low-charge DX/ NH_3 glycol heat exchangers.

At the close of the show, delegates streaming out of Luna Park into the Sydney sunshine could be confident that natural refrigerants will continue to grow in the Australian market. ■ AW & DY





NatRefs buzzing in Australia at ARBS 2018

ARBS 2018 marked the debut of several new natural refrigerant technologies for end users including a hydrocarbon water-loop solution, new CO₂ condensing units, and CO₂ heat pumps. *Accelerate Australia & NZ* reports from Sydney.

— By Devin Yoshimoto & Andrew Williams

At this year's Air Conditioning, Refrigeration and Building Services (ARBS) exhibition, key technology suppliers were optimistic about the level of interest in and uptake of natural refrigerants among end users of HVAC&R systems.

ARBS 2018 – held on 5-8 May at the ICC Sydney exhibition centre overlooking beautiful Darling Harbour – saw the launch in Australia of several new natural refrigerant-based technologies. Manufacturers were optimistic about the market prospects for these solutions among businesses in all sectors, and hailed growing awareness of the benefits of natural refrigerants among the wider Australian HVAC&R industry.

Jeff Cisco, electrical service manager at local Australian contractor Laser Electrical Orange, captured the tone of the event in an interview with *Accelerate Australia & NZ* on the ICC balcony overlooking the Sydney skyline.

"There is a fairly strong push away from products that harm the environment and education of the general public is increasing," Cisco said.

"The average customer is still unaware of the benefits of natural refrigerants," the contractor suggested, pointing out that he himself had only learned about natural refrigerants when working with them at the request of one of his customers.

"This particular customer educated me on the subject of natural refrigerants," Cisco said.

Over the three days of the exhibition, this sense of moving away from climate-damaging refrigerants towards natural refrigerant alternatives was evident in the series of interviews conducted by *Accelerate Australia & NZ*.

Introducing water-loop solutions

Businesses in Australia now have another option to use natural refrigerants: Arneg exhibited its propane-based water-loop refrigeration system for supermarket and other commercial applications.

The propane-based water-loop system represents an alternative method for businesses such as supermarkets to supply their refrigeration needs in a more flexible, decentralised manner.

Rather than cooling the entire store from a single centralised refrigeration plant, each display case runs off its own propane system. The exhaust heat is carried away by a water loop.

Water-loop systems are already in use in several supermarkets in Europe, and they are beginning to be introduced in the Australian market.



Automatic Heating displays the Itomic CO₂ heat pump.



Mayekawa's UNIMO CO₂ heat pump.

Arneg exhibited its water-loop system for the first time at ARBS this year and was pleased with the interest it received at the show.

"This morning, we literally couldn't move in this area, we had so much interest," Andrew Reid, national key account manager for Arneg Oceania, told *Accelerate Australia & NZ* at the show.

Reid said Arneg is seeing a broad trend towards natural refrigerants and that the company is responding by continuing to develop its natural refrigerant product range.

"The general direction is towards natural solutions," Reid said.

"We've shifted a long way from the last time we were displaying at ARBS two years ago. Completely natural solutions at our booth this year. It's what the industry expects," he continued.

CO₂ condensing units make big splash

SCM Frigo's CUBO₂ Smart CO₂ condensing unit also made its debut in Australia at ARBS 2018.

Beijer Ref first announced that it would be bringing the CUBO₂ Smart condensing unit to Australia at the ATMOSphere Australia conference in 2017. At this year's ARBS, the unit was on display at the Beijer Ref booth and received a large amount of attention from exhibition participants.

"The response at ARBS this year with the launch has been phenomenal," said Inderpal Saund, APAC business development manager at Beijer Ref.

The CUBO₂ Smart CO₂ condensing unit is manufactured by Italy-based SCM Frigo, which specialises in the manufacture of CO₂-based refrigeration systems and is owned by the Beijer Ref Group.

In Australia, the unit is targeted at the commercial sector, where there is a growing trend towards smaller format stores requiring smaller format systems.

"The CUBO unit is one of our latest developments where we are using CO₂ technologies now in a small format," said Saund.

"So, we've got a condensing unit in theory for smaller applications like hotels, convenience stores, one-off cool rooms, etc. Now we can do it with a natural refrigerant in a small format."

Saund sees growing worldwide demand for CO₂ in smaller format applications and believes this trend is now beginning in Australia too – driven by adoption in large supermarket chains.

"I think what's happening now is globally, there is a shift towards smaller formats. Whether it's a supermarket chain or a convenience store, everyone wants to get a little bit smaller in size. So, there is a demand there."

CO₂ heat pumps to replace gas boilers

Natural refrigerants are also poised to make greater inroads into the hot water supply market in Australia, with the promotion of heat pump technology at the show notably increasing this year.

As Australia continues to experience rising gas prices, companies are seeing more opportunities to educate the market on the benefits of replacing traditional natural gas boiler systems with heat pump technology.

With significant benefits on both the energy efficiency and emissions reduction fronts, CO₂ heat pump technology stands to replace a large portion of Australia's gas boilers for hot water supply in the residential, commercial, and industrial sectors.

"If I look back about six to twelve months ago, the amount of inquiries we were getting would probably be about one a month," said Peter O'Neill, sales and marketing manager for Mayekawa Australia, which supplies the UNIMO CO₂-based heat pump to Australia.

The UNIMO was prominently on display at the Mayekawa booth.

"Over the past three to four months, we're getting inquiries just about every week, which tells me there's more interest in the UNIMO. I think it is mainly due to the price of gas and the price of electricity.

So, I think we are at the first step of a huge market for CO₂ hot water heat pumps," O'Neill said.

Mitsubishi Heavy Industries Air-Conditioners Australia (MHIAA) was displaying its Q-ton CO₂ heat pump. Trent Miller, air-to-water manager for MHIAA, spoke during the ATMOSphere Australia conference the day before ARBS about the additional benefits of using CO₂ heat pumps in some of Australia's extreme climate zones.

"We're very proud of one of our first installations in the tropics. It's really proving how effective CO₂ is in high-temperature applications," said Miller.

"We've got five Q-tons providing 9,000 litres of [hot water] storage in Cairns. Conventionally, it was done with liquid petroleum (LP) gas and instantaneous hot water heaters. We've replaced that with five Q-tons and 9,000 litres of hot water and saved the application \$60,000 a year," he said.

Melbourne-based Automatic Heating, a new player in the CO₂ heat pump market in Australia, exhibited the Japanese-made Itomic CO₂ heat pump at its booth, marking Itomic's Australia debut.

Lachlan Shemilt, business development manager for Automatic Heating, spoke of the opportunity to communicate life-cycle cost benefits to customers when talking about CO₂ heat pumps as energy-efficient hot water supply solutions for businesses, especially when compared to older boiler systems.

"There may be a bit more capital cost upfront if you compare kilowatt to kilowatt with a traditional heat pump," said Shemilt.

"But we've done a lot of return on investment calculations, especially opposed to LP gas solutions, and we've got an operating cost of about 75% less than an LP gas system, so it's huge."

"It's a no-brainer. If we can get a job – domestic hot water production – and we can run storage, we can run the heat pump on off-peak power, and we can store the water at higher temperatures because of the CO₂, then it's an easy sell to the end user," Shemilt said.

Time will tell, however, as significant challenges remain in raising awareness and educating on natural refrigerants, especially among those in the wider HVAC&R industry in Australia.

"There's a need for more education," said Cisco, of Laser Electrical Orange.

"We're all trying to keep up with technology, and make sure that we move forward and use the right stuff." ■ DY & AW



Arneg's R290 water-loop system.



CUBO₂ Smart



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AMMONIA TAKES CENTRE STAGE AT ATMOSPHERE AMERICA

From the industrial refrigeration panel to keynote speeches and even the commercial refrigeration session, ammonia showed itself at ATMOSphere America 2018 to be an innovative and ever-evolving refrigerant. CO₂, for its part, is also entering the industrial arena.

— By Charlotte McLaughlin

Ammونيا continues to play a strong role in the US industrial refrigeration industry, while it is also entering into new market segments along with CO₂, heard participants in this year's ATMOsphere America conference, held in Long Beach, California (12-14 June 2018).

A particular R&D focus in the North American market is currently low-charge ammonia innovations, with many leading end users – Henningsen Cold Storage, Western Gateway Storage and KPAC General – investing in lowering the refrigerant charge of their installations.

The motivations for going low-charge among end users at the natural refrigerants conference – organised by shecco (publisher of this magazine) – were various, but many focused on the cost effectiveness of these systems.

David Bornemeier, president of Western Gateway Storage, said installing Evapco's compact low-charge ammonia solution on the roof of the cold storage company in July 2016 had allowed the firm to save space and invest in new areas. He was the first person to install the system in the US.

Investing in the Evapco system freed up space for Western Gateway Storage to enter the packaged ice business. The new revenue stream from the additional space has "increased our revenue," Bornemeier told the audience during the second day of the conference.

Similarly Ronnie R. Ceballos, vice-president and general manager, KPAC General, noted that the additional space gained by using a NXCOLD low-charge ammonia package had helped his cold storage company too.

"With a conventional [ammonia] system you need an engine room," Ceballos said. "Now we have empty space that's potential revenue space."

Another benefit is the reduced energy costs of low-charge compared to conventional ammonia systems.

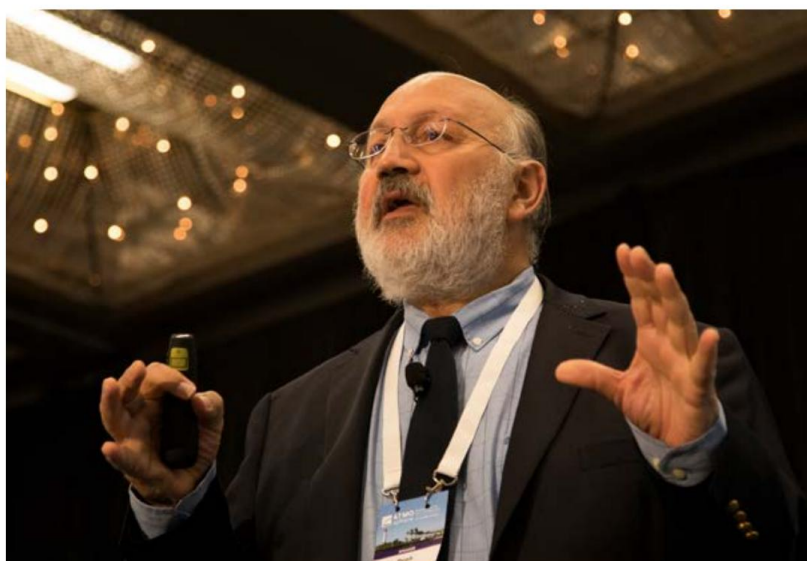
"We have only been in operation about five months, [and in these] five months, we have averaged \$20,000 [AUD \$27,280] [in electricity costs] a month," Ceballos said.

"From an accounting standpoint it looks pretty good," he pointed out.

The company also projects that taking into account liability insurance savings, space savings, energy savings and cost savings, it will save \$425,000-\$482,500 (AUD \$570,541-\$647,732) compared to a traditional liquid overfeed NH₃ refrigeration system.



Industrial panel, from left to right: Aditi Joshi, Amgen; Ronnie R. Ceballos, KPAC General; Peter Lepschat, Henningsen Cold Storage Co.; David Bornemeier, Western Gateway Storage Co.



Prof. Pega Hrnjak, CTS.

Opting for a very different solution, Pete Lepschat of Henningsen Cold Storage explained how the company he works for as director of engineering had been investing in lowering the charge of ammonia in each of its installations and upgrades, but had now decided to move to full CO₂ instead.

Lepschat is hopeful that the installation of a CO₂ transcritical system at his company's new facility will lead to savings.

In installing this system compared to low-charge ammonia, "so far we have had 5-6 weeks of construction saved," Lepschat said. The CO₂ transcritical system is also \$534,000 (AUD \$720,333) cheaper than a low-charge ammonia system, he argued.

Can we have ammonia air conditioning?

In addition to cost savings, reducing the ammonia charge allows this natural refrigerant to enter new applications, including chillers for air conditioning as outlined by Prof. Pega Hrnjak, president of Creative Thermal Solutions, Inc. (CTS), during his presentation.

Hrnjak, who is also a professor at the University of Illinois at Urbana-Champaign, sees huge market potential for ammonia manufacturers to enter the chiller market in industrial and HVAC applications.

"The chiller market is huge. It's worth \$5 billion [AUD \$6.7 billion] per year for positive displacement compressors alone," he noted.

Hrnjak said that for manufacturers of ammonia-based equipment to take advantage of this huge market, they must overcome four key challenges.

The first, and the key one for Hrnjak, is technical. "We need to make them sound like and feel like what they are competing against," he said. "We need to do [it] the same way."

He explained that hermetic compressors for ammonia, suitable for use in chillers, are already available but are not yet widespread enough to compete with existing HFC-based compressors suitable for chiller applications.

Hrnjak conceded that the cost and weight of chillers would need to be reduced. The entry of more ammonia system manufacturers into the chiller market will also lower costs, according to the professor.

CTS has been testing ammonia chillers. "CTS has developed and made several ultra-low charge (18g/kW – 23 oz./ton) and efficient chillers, but is probably too small a player to change the game," Hrnjak conceded.

Some market players understand the need to develop the ammonia chiller market. Star Refrigeration – known as Azane in the US – has also developed ammonia chillers, Hrnjak noted, while German company GEA launched one



Ed Estberg, refrigeration consultant.

at Mostra Convegno in Milan, Italy earlier this year.

Education also plays a key role, according to Hrnjak. "We need to support and educate technicians," he said, "[and] reduce initial resistance".

Some of this education, he noted, will need to come from manufacturers who will have to adjust the way they sell units – as buyers of chiller technology are different customers than industrial refrigeration end users.

Fourthly, he noted, some will gain from being first movers in bringing their ammonia chiller technology to Europe. "Many may lose or will need to shift [and we will need to] find them a role to avoid internal confrontation instead of making them obstructive losers," he said.

Entering supermarkets

An innovative retailer in the US has also recognised that ammonia can play a role in a public environment at lower charges.

California-based retailer Raley's (121 stores) told ATMOsphere America that it plans to start installing ammonia/CO₂ refrigeration systems in the coming years.

"We're probably a year away from starting it up," said Ed Estberg, who previously worked for Raley's and is now working as a consultant on refrigeration systems since retiring from the retailer in May 2009.

Estberg, who was representing Raley's at ATMOsphere America, said the grocer had made the decision to opt for an ammonia DX (direct expansion) system with liquid-overfeed CO₂ in its larger stores (the majority).

"For the downtown stores or the real small stores, they will be doing transcritical CO₂," he said.

The reason Raley's is going down the ammonia/CO₂ route rather than CO₂ transcritical in most stores is related to the simplicity, reliability and efficiency of the ammonia system build, according to Estberg: what Raley's calls 'SRE'.

The ammonia system is simple as it is basically the same build as the previous systems Raley's had been working with for some time.

It is reliable as it has more standard industry parts, has lower operating pressures, no high side regulators, low speed compressors, more standard industry parts and a proven reliable control system.

"Our failure rate [with our chemical refrigerant-based systems] is virtually zero in 25 years. So I am pretty happy with the reliability of our compressors," Estberg said.

The new system is also more efficient in hot and cold climates, twice as efficient as CO₂, and modelling suggests a CO₂ transcritical system would mean \$38,000 (\$51,000 AUD) more electricity costs per year.

Raley's will start using the technology soon, according to Estberg.

At ATMOsphere America, ammonia continued to shine as a refrigerant that can be used for air conditioning and in commercial and industrial refrigeration. ■ CM

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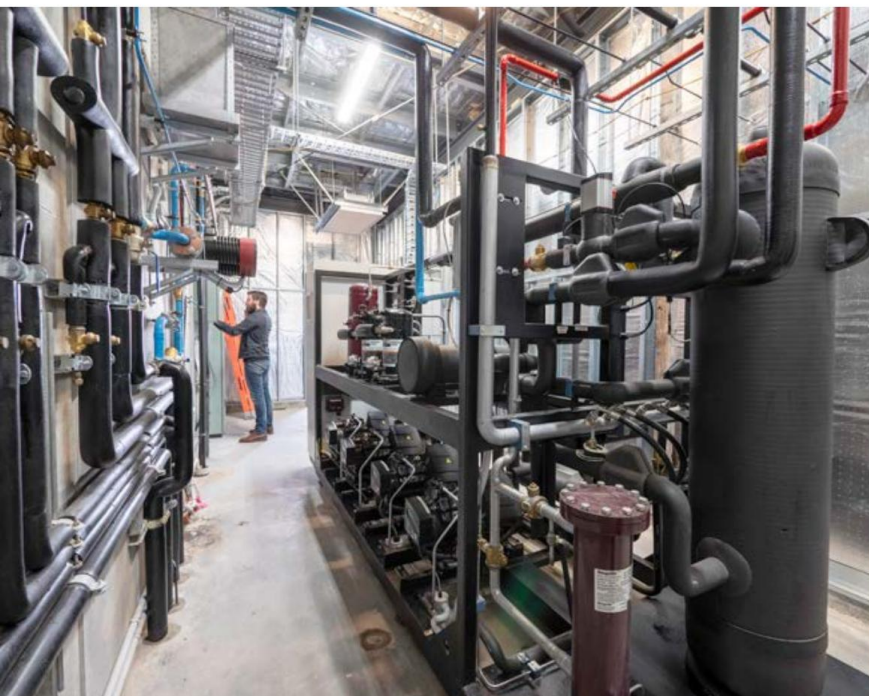


IGA Clarinda Village looks to future with new transcritical CO₂ store



Amid increasing awareness among Australian retailers of the long-term implications of installing HFC-based refrigeration systems in new stores, *Accelerate Australia & NZ* looks at a recent installation of a fully transcritical CO₂ HVAC&R installation at an IGA in Cranbourne West, Victoria.

— By Devin Yoshimoto



ABOVE LEFT
IGA Clarinda Village, Cranbourne West, Melbourne, Victoria

LEFT
Transcritical CO₂ rack

Australia's HFC phasedown has begun. Although many in the HVAC&R industry are still coming to grips with the implications of the phasedown, end users of the equipment are themselves beginning to take a more proactive role in protecting their future exposure to the risk of rising refrigeration costs.

This end-user awareness is being driven by an increase in communication between end users and leading HVAC&R contractors and technology suppliers who are working closely together to deliver these future-proof solutions in Australia.

IGA Clarinda Village opened its doors in March. Located in Cranbourne West, in Melbourne, Victoria, the store is powered by a fully integrated transcritical CO₂ HVAC&R plant, delivering the store's heating and refrigeration needs from the single centralised system.

This installation is one of the first in Australia to deliver the store's entire HVAC&R needs from a single transcritical CO₂ system, but it is also part of a growing trend of fully integrated systems being installed in the country ([see article on IGA Ritchies Beechworth, page 36](#)).

CO₂'s long-term benefits

Communication between end users and their trusted contractors about the long-term impacts of the refrigeration systems they choose to install is increasing. As these two parties work together to consider the best options, the benefits of natural refrigerant-based systems for protecting against future costs become more apparent.

"MB Refrigeration has been my refrigeration and air conditioning company for many years," said Salam Rasool, owner of IGA Clarinda Village.

"When MB told me about the refrigerant changes and environmental impact of old refrigerants along with the long-term cost of ownership with CO₂, I could see that it was important to embrace the new system for my latest store. I am delighted with the result."

MB Refrigeration is actively pursuing further adoption of CO₂ transcritical technology in Australia, as it understands very well the benefits for end users.

Regarding the IGA Clarinda Village store, MB Refrigeration has been developing a holistic approach to refrigeration for over 10 years and "saw no other way to deliver the next progression in refrigeration technology," meaning a "transcritical

CO₂ store delivering heat reclaim for store heating, cold isle returns and refrigeration duty for 100% of store refrigeration," says Shaun Davis, general manager, MB Refrigeration.

Commercial Refrigeration Services (CRS), a leading CO₂ system supplier in South Africa, sees opportunities in Australia as well. The Clarinda installation is the firm's first in the country, and it hopes to see many more of its systems installed going forward.

"I think the fact that the independents are pushing hard into the natural market is making everybody realise that it's possible," said CRS's head of engineering, Wynand Groenewald, at this year's ARBS 2018 exhibition.

"I do foresee that in the next year or two the uptake of CO₂ will gradually increase in the Australian market. We are currently manufacturing our fourth [transcritical CO₂] rack for a fourth project for MB Refrigeration in Australia. So we will have completed at least four projects before the end of this year," Groenewald said.

"We are hoping to gradually increase and have more input in terms of solutions around CO₂ showing that it's cost effective and energy efficient, finding alternative ways of making the installation around CO₂ and not just the product more energy efficient." ■ DY

System specifications:

- ▶ Transcritical CO₂ booster
- ▶ Parallel compression
- ▶ Integrated heat reclaim (space heating)
- ▶ Medium temperature
70 kW @ -5°C
- ▶ Low temperature
18 kW @ -28°C

Key suppliers and contractors:

- ▶ **Turnkey Contractor, Store Design/Engineer & Construction:** MB Refrigeration
- ▶ **Local sales agent:** Avance Energy Solutions
- ▶ **CO₂ rack supplier:** Commercial Refrigeration Services
- ▶ **CO₂ refrigeration case supplier:** Hussmann
- ▶ **CO₂ gas cooler and evaporator supplier:** Güntner



Mayekawa's UNIMO transcritical CO₂ hot water heat pump (right) installed at the Croft rest home in Timaru.

Replacing traditional hot water heaters with CO₂ heat pumps

CO₂ heat pumps are continuing to make inroads into the hot water supply market around the world. In Timaru, New Zealand, an installation completed at the Croft rest home has saved the organisation NZ \$9,000 per annum.

— By Devin Yoshimoto



As the worldwide focus on phasing down HFCs in refrigeration continues to pick up pace, it is easy to overlook the potential for heat pump technology to greatly reduce emissions and increase energy efficiency for hot water applications.

At this year's Air Conditioning, Refrigeration and Building Services (ARBS) exhibition – held at the ICC Sydney in Darling Harbour on 8-10 May, natural refrigerant-based heat pumps made a strong showing, with clear messages communicating the technology's advantages over traditional fossil-fuel and gas-based boilers.

Japan-based OEM Mayekawa was among the companies displaying natural refrigerant-based heat pump technology, exhibiting its UNIMO heat pump using natural refrigerant CO₂.

Efficiency of CO₂ heat pumps

Among the progressive end users looking to adopt this natural refrigerant technology is Presbyterian Support South Canterbury, which replaced the hot water heating system at the Croft, an aged care facility in Timaru, with the UNIMO. It is now reporting significant energy savings.

The CO₂ heat pump installation, completed in early 2018, used one UNIMO air-to-water transcritical CO₂ hot water heat pump supplied by Mayekawa.

Local New Zealand-based contractor Active Refrigeration, the biggest user of Mayekawa systems in New Zealand, completed the installation.

According to a statement released by Mayekawa, the heat pump "provided a more reliable and energy efficient system to replace the previous electric hot water heating system, which had reached the end of its life".

The previous hot water system used a "310 kW bank of electrical elements to heat a 30,000 litre tank of non-potable water to 90°C".

"This water was then tempered to 70°C with a three-way valve and used to heat hot water via three calorifiers with 11,000 litres of total storage volume, and also circulated through the underfloor heating at the rest home."

The new CO₂ heat pump provides domestic hot water at 70°C to a new 3,000 litre buffer tank.

The UNIMO unit also provided several other benefits to the aged care facility.

The system had a smaller footprint than the 30,000-litre tank it replaced. The new buffer tank was connected to the existing hot water mains in the rest home without disrupting supply during the home's operation.

In terms of energy efficiency, the heat pump operates with a coefficient of performance (COP) of up to 4.3, resulting in projected energy cost savings of NZ \$9,000 per annum.

The efficiency of CO₂ heat pumps leaves them well placed to replace traditional, more inefficient hot water supply systems in New Zealand.

With an increasing number of suppliers providing CO₂ heat pumps and with the phasedown of HFCs, these systems look set to increase in popularity in the coming years. ■ DY



Woolworths' CO₂ transcritical journey continues

Woolworths has commissioned its second transcritical CO₂ system at a new store in Wadalba, New South Wales. The retailer sourced the Kirby eCOBoost system from Heatcraft, which had met the technical brief.

— By Devin Yoshimoto

Woolworths commissioned its pilot transcritical CO₂ store in Colebee, NSW last winter ([see cover story, Accelerate Australia & NZ Issue #6](#)). It is now on its way towards its stated goal of installing ten natural refrigerant-based systems employing technologies such as transcritical CO₂ or water-loop solutions by 2020.

The retailer recently commissioned its second transcritical CO₂ system at a new store in Wadalba, NSW and has more stores in the pipeline.

Since the commissioning of the first pilot store, internal installation team WRI (formerly Retail FM D&I), led by Shaun Merry and supported by Woolworths Sustainable Innovations Engineer Dario Ferlin, has taken significant steps towards system standardisation and the upskilling of internal and external stakeholders.

Together with rack supplier Heatcraft, Woolworths has worked to cut costs and upskill technicians, boosting confidence in the deployment of natural refrigerant systems at the Australian retailer.



ABOVE

Two Kirby eCOBoost transcritical CO₂ racks provided by Heatcraft at a new Woolworths store in Wadalba, NSW

Installation and store details:

- ▶ **Store location:** Wadalba, NSW
- ▶ **Store size:** 2,800 m² trading floor
- ▶ **Low-temperature showcases:** 15
- ▶ **Medium-temperature showcases:** 58
- ▶ **Low-temperature cool rooms:** 4
- ▶ **Medium-temperature cool rooms:** 8

Commissioning date: June 2018

Installation contractor: WRI (formerly Retail FM D&I)

Woolworths 'E-Specification' standard

The recent Wadalba installation marks the first time Woolworths has ordered a transcritical CO₂ system according to its 'E-Specification' plug 'n' play standard.

"The Kirby eCOBoost transcritical rack in the 'Ready Connect' configuration conforms to the Woolworths 'E-Specification' design brief, which essentially entails factory mounted and wired switchboards complete with control system," says Ferlin.

With the previous pilot installation, 'E-Specification' was not used in order to leave the flexibility to manually configure the system on-site.

"Colebee was our first and one of the precautions we took was to run with non- E-Specification racks," explains Ferlin. "This afforded the opportunity for us to tweak a lot of the logic and control applications – and these are numerous within each rack."

However, for Woolworths, the goal with the second iteration was to standardise the system as much as possible in order to reduce the cost and time of future system installations.

"With the iteration of the Woolworths E-Specification fully integrated control and electrical wiring here at Wadalba, those applications have been built in," Ferlin continues. "Now, a lot of the commissioning time, thinking and rationale that the commissioners would have needed on-site has been eliminated."

Rack supplier Heatcraft Australia, which built the

system at its facility in Milperra, NSW, saw the opportunity not only to deliver a fully integrated system, but to also reduce commissioning time by working together with WRI.

"We were able to use our in-house engineering and design capability to evolve the Kirby 'Ready Connect' switchboard to meet the specific requirements of the Woolworths E-Spec," says Heatcraft Segment Engineer Douglas Herkess.

"Heatcraft invited the Woolworths commissioning team to the Milperra facility during dry-testing and pre-commissioning to observe and complete the testing with the Heatcraft team. This was an important step for the commissioning team to have a complete understanding of the system being delivered prior to its arrival on site," Herkess says.

The Milperra visit provided the opportunity to fine-tune the system and problem-solve in a factory environment, which ultimately reduced the on-site commissioning time. "We're very pleased with the end result," Herkess says.

Ferlin agrees: "I didn't expect the transition towards E-Specification on our first transcritical job to be so smooth," he says.

"It's been, for all intents and purposes, seamless. Within a very short timeframe we had both racks running and we had another four weeks to fine tune before store opening. This is unprecedented – even for a standard refrigeration system, so we have made a lot of progress."



1 /

1 / Demonstration of transcritical rack control system to Woolworths team.

2 / Bohn 3C-A CO₂ evaporators (fitted with EC fans).

More transcritical CO₂ upskilling

One of the ways Woolworths took further advantage of the opportunity to train and upskill during this project was by working closely with the external installation contractor set to work on Woolworths' next transcritical CO₂ store.

"For the first two transcritical installations, we allocated the servicing to our own internal service team Woolworths FM Service," says Ferlin.

Ferlin explains that for an upcoming transcritical CO₂ store that is now going to tender, Woolworths will be working with installation contractors that they are yet to work with on CO₂ transcritical systems. Though it will be a challenge, the Woolworths team sees this as an opportunity to continue promoting natural-refrigerant knowledge sharing with the wider industry.

"By bringing them here and making them fully aware and engaged in the processes and documentation of what a successful installation looks like," says Ferlin, "we are effectively upskilling our technology partners and enabling them to step up to the same level as the WRI team".

Contractor's voice

One of the goals for both Woolworths and Heatcraft with the Wadalba installation was to continue taking steps towards upskilling external industry stakeholders on transcritical CO₂ systems.

One such stakeholder was Contract Refrigeration, an installation contractor who visited the Woolworths and Heatcraft commissioning teams during the setup and initial operation of the system.

Mark Ward, project engineer, Contract Refrigeration offers his thoughts on what he learned during that process: "I can see transcritical CO₂ refrigeration systems being the standard for supermarket refrigeration moving forward."

"So, it's important and in the best interests of the end user to share knowledge with their refrigeration contractors so there is some consistency with the design, engineering and installation of transcritical CO₂ plants and equipment for future projects," says Ward.

Reflecting on the comparisons between traditional HFC systems and transcritical CO₂ systems, Ward remarks, "I was surprised at how quiet the two Kirby eCOBoost transcritical CO₂ racks were compared to an HFC plant of the same capacity in operation".

"The Kirby eCOBoost transcritical CO₂ racks were not overly complicated in design and the E-Spec package complete with switchboard makes for a simpler, quicker installation for electricians that will cut down on commissioning time as well."

2 /



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System specifications

- ▶ Kirby eCOBoost transcritical parallel compressor racks: 2
- ▶ Emerson transcritical stream compressors: 14
- ▶ Low-temperature capacity: 35 kW
- ▶ Medium-temperature capacity: 114 kW
- ▶ High-temperature capacity: 87 kW
- ▶ Alfa Laval gas coolers (fitted with CAREL 'chillBooster' adiabatic spray systems): 2
- ▶ Bohn 3C-A CO₂ evaporators (fitted with EC fans): 16
- ▶ Danfoss variable speed drives and high-pressure expansion valves
- ▶ Emerson iProRACK electronic controllers
- ▶ Emerson E2 facility management system

BELOW

Heatcraft, Woolworths, and Contract Refrigeration key team members.

"There's a lot to be said about the Woolworths team sharing their knowledge and IP with external providers," Ferlin continues.

"We want nothing than more than for the learnings that we're offering to the industry to then be replicated in the wider market. If we're all converging down the same path it has benefits for all of us."

For Heatcraft, the opportunity to grow their business with transcritical CO₂ in Australia is apparent as well.

"We have the local capability to offer transcritical CO₂ solutions not only for supermarkets but also for wider applications," says Herkess. "The platform we have is scalable, which allows us to meet requirements for air conditioning, heat reclaim and cold storage."

"Plus the acquisition by Beijer Ref provides additional opportunities to further widen our climate-neutral equipment offer," Herkess adds.

In addition, the company will be continuing to play an active role in providing training opportunities for the industry in Australia.

"Heatcraft's first round of industry CO₂ training commenced in August 2018," says Herkess.

"The training is open to refrigeration contractors with staff who are installing, commissioning and servicing CO₂ systems in the field to help drive hassle-free start-up and ongoing operation."

"The application training will be provided by Heatcraft subject experts at the Heatcraft Milperra, NSW training facility. Attendees will also receive first-hand installation tips through technology and commercial partners."

Contractors interested in attending should forward their expression of interest to training@heatcraft.com.au or contact their Heatcraft representative.

From the Woolworths team installing and servicing the systems, to Heatcraft designing and manufacturing the systems, to installation contractors in the wider industry – confidence with natural refrigerant technology is growing as familiarity increases with each new installation.

But even with the day-to-day challenges of each project, the company's focus remains on the bigger picture.

"The model we have developed here is repeatable, from both a technology and skillset perspective," says Ferlin. "Everyone that we have relied upon is here and we can use them again for the next store."

"Bringing the industry along with us on this journey is more than just a catchphrase for us. This is not so much a story about the product but about the support – ensuring that not only is the store commissioned at store opening, but that the skillset is available in the industry to sustain the success of the store opening for the next 20 years," Ferlin says. ■ DY





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Migros pioneering water-loop technology

ABOVE & RIGHT

Inside Migros' pilot propane water-loop store.

Migros has been installing propane-based water-loop systems as an alternative to CO₂ transcritical refrigeration in its smaller stores. *Accelerate Europe* reports from the Swiss retailer's pilot propane water-loop store in Zürich, Switzerland.

— By Andrew Williams

Founded in 1925, Migros is Switzerland's largest retail company, its largest supermarket chain and its largest employer. Structured as a cooperative with over two million members, every adult living in Switzerland can become a member, receive one share for free, and vote in the general assembly.

The 'Generation M' programme governs Migros' sustainability objectives across five areas – consumption, environment, employees, society and health. For supermarket refrigeration, CO₂ transcritical has been the retailer's standard system choice since 2010.

Proud of its history at the forefront of innovation, Migros is also keen to trial new technologies as it searches for the most effective means of meeting its sustainability targets, says Urs Berger, who heads the Energy and Building Technology department at Migros Engineering Solutions (MES). This is what drove some Migros cooperatives to begin installing water-loop HVAC&R systems in supermarkets.

Water-loop systems represent an alternative method for businesses such as supermarkets to supply their refrigeration needs in a more flexible, decentralised manner.

Migros currently boasts 25 supermarkets fitted with water-loop systems based

on natural refrigerant propane (R290). *Accelerate Europe* reports from Migros' pilot propane water-loop store in Zürich, Switzerland – where the system was installed in May 2016 – to find out what's driving interest in this technology.

Rather than cooling the whole supermarket from a centralised refrigeration plant, each wall-mounted display case runs off its own propane system.

The exhaust heat is carried away by a water loop.

"There are three hydrocarbon circuits within each cabinet. The new edition contains only one circuit per cabinet. The water loop rejects the heat to a nearby logistics centre, where it provides hot

water for the central heating system," Andreas Moser, who works on energy efficiency and climate protection in Berger's team, told *Accelerate Europe*.

For Migros, the business case for choosing a water-loop system is at its most compelling if the store is small enough, if there is limited space on site for a machine room, and if there is demand for hot water elsewhere on the premises.

"Part of the motivation for installing these R290-based water-loop systems is if you don't have space on site for a machinery room," says André Deppeler of *Cooperative Migros Zürich*, who is responsible for the system seen by *Accelerate Europe* in the Zürich store.

"They also make sense if you connect them to another water system, or if there is demand for hot water nearby," Deppeler says.

Reliability is another significant advantage of this configuration. "If something goes wrong, then it's only one cabinet that will fail, rather than the whole system. That's an advantage," argues Moser.

A competitive option for small stores

He believes water-loop systems are best suited to smaller stores.

"This system is very good for convenience stores and petrol stations," Moser says. "We've also got experience of using it in bigger shops, but there, we're asking ourselves if it's the right solution" given the competition posed by CO₂ transcritical condensing unit and rack systems, he admits.

Asked whether water-loop has the potential to become a serious rival to CO₂ transcritical, his colleague Berger replies: "Yes, in the niche market of small convenience stores up to a maximum surface area of around 500 m², and in train stations and petrol stations."

"Water-loop systems are interesting if you don't have space for machinery to produce the refrigeration centrally," says Berger. "It depends on the location in which you want to install the system."

Lithuanian firm Freor LT provides the 'Jupiter Green' cabinets in Migros' water-loop stores. The system also offers a heat pump box, which is an ideal solution for standalone shops in Switzerland's climate.



MES works with the HAVO Group, which supplies Freor products to the Swiss market. In addition to the cabinets, HAVO provides the piping, the controls, and the cooler outside – everything that is required for a complete system. "We seek one installer who is responsible for the lot," Berger says. "We prefer to have the whole installation in one pair of hands."

An attractive option for Asia-Pacific climates

He concedes that in Switzerland's climate, the efficiency of the R290-based water-loop systems does not always compare favourably with CO₂ transcritical solutions.

"If you're designing CO₂ transcritical systems for the outside ambient temperatures of Switzerland, then you're designing for up to 34°C," Berger says. Given that the average annual temperature in Switzerland is 9.5°C, "you're only operating in that particular scenario for a few hours per year" – meaning that CO₂ transcritical remains

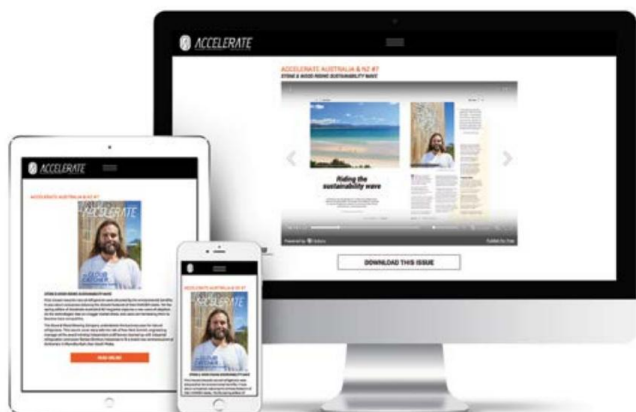
the more efficient system, he admits.

The longer a CO₂ system must operate in high ambient temperatures, however, the more attractive a water-loop system becomes as an alternative option. In the warmer climates of Asia and Australia, therefore, the water-loop solution becomes more competitive.

As for Migros, the retailer will continue to install water-loop systems where there is a business case to do so.

"At Migros, most of our future expansion will be in small convenience stores, and in railway stations, and such like. We're looking for good, natural refrigerant-based solutions," Moser says. "This is one of them."

■ AW



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