

WINTER 2017

ACCELERATE

ADVANCING HVAC&R NATURALLY

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



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Building NatRef momentum



#GoNatRefs



Building momentum for change



– Editor's note by Andrew Williams

The passing of HFC phase-down legislation by the Turnbull government in June gives manufacturers and end users alike an extra incentive to invest in climate-friendly replacement technologies. The winter edition of *Accelerate Australia & NZ* looks at the progress being made in bringing natural refrigerant-based equipment to the region.

Retail giant Woolworths opened its first transcritical CO₂ store – in Colebee, New South Wales – on 16 May. Designed to perform in ambient temperatures of up to 45°C, fitting the system contributed to training local HVAC&R talent along the way, laying the foundations for future growth of natural refrigerants in Australia ([p. 14](#)).

In a demonstration of Australia's commitment to achieving its international obligations under the Montreal Protocol, the government has successfully passed a bill to amend the existing Ozone Protection and Synthetic Greenhouse Gas Management (OSPGGM) Act by adding an HFC phase-down plan ([p. 52](#)).

The bill's passage makes the need to transition Australian industry away from HFCs even more pressing. Industry leaders from across the Asia-Pacific region joined government officials and other experts in Sydney to discuss the future of the HVAC&R sector at ATMOsphere Australia 2017 ([p. 26](#)).

Meanwhile the Australian Refrigeration Council has put in place a new accreditation scheme that includes natural refrigerants, in an effort to help industry to respond to the new refrigerants being adopted in response to the HFC phase-down ([p. 56](#)).

Further afield, at this year's International Food Machinery & Technology Exhibition (FOOMA Japan 2017) in Tokyo, several market-leading manufacturers were proud to display new technologies harnessing natural refrigerants ([p. 40](#)).

In the United States, meanwhile, uptake of natural refrigerant-based systems looks poised to increase despite a climate of regulatory uncertainty – thanks to their impressive efficiency performance ([p. 44](#)).

At ATMOsphere America in San Diego, Hannaford Supermarkets and the Defense Commissary Agency demonstrated how to replace ageing HFC systems in existing stores with transcritical CO₂ systems ([p. 48](#)).

For heat pumps to be more successful they must be efficient, have a low environmental impact and be economical to buy. Propane heat pumps meet all these requirements, but more must be done to boost their uptake ([p. 62](#)).

Features on SCM Frigo and Beijer Ref bringing CO₂ condensing units to Australia ([p. 58](#)), natural refrigerants training in Europe ([p. 12](#)), and Austrian company AHT Cooling Systems ([p. 66](#)) are among the other stories waiting for you in this winter edition of *Accelerate Australia & NZ*.

These are exciting times for natural refrigerants in the region. Thank you for making *Accelerate Australia & NZ* the place to read all about it first! ■ AW



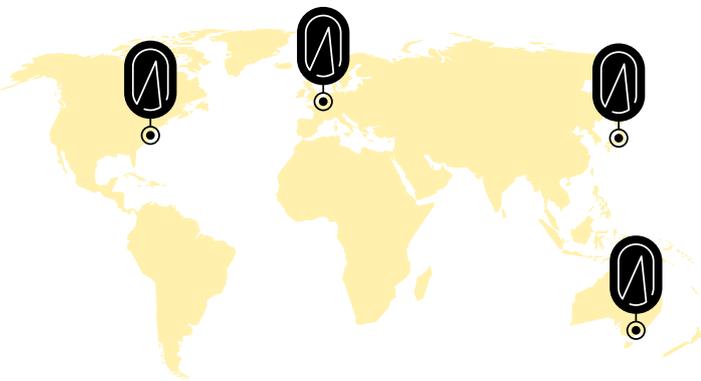
ACCELERATE

ADVANCING HVAC&R NATURALLY AUSTRALIA & NZ

About Accelerate Australia & NZ

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

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Raising the propane charge limit

The IEC's proposed 500g charge cap for R290 is moving toward a resolution.

Last year's Kigali Amendment to the Montreal Protocol, calling for a phase-down of HFCs, saw the global community take another important step towards reducing greenhouse gas emissions from human activity in order to preserve our planet for future generations.

In the refrigeration sector, the global phase-down of HFCs is making an important contribution to this international mitigation effort.

To that end, recent regulations in different parts of the world (the EU F-Gas Regulation, the U.S. EPA SNAP rules and California Air Resources Board actions, etc.) will impose bans on high-GWP refrigerants in the next few years in several refrigeration and air-conditioning segments, including different categories of light commercial refrigeration.

Today, light commercial refrigeration appliances follow IEC (International Electrotechnical Commission) safety standards. IEC standards are the reference for regional and national legislation (e.g. EN and UL standards, EPA rules, etc.).

The present IEC standard used for hermetically sealed applications, IEC60335-2-89, limits to 150g the charge of any flammable refrigerant. This makes the full application of the Kigali Amendment for transitioning to low-GWP refrigerants more difficult – notwithstanding the fact that by using multiple independent circuits, the problem of charge limits in bigger cabinets can be solved with the existing standard.

How to allow more change

In the IEC SC61C/WG4 working group, the industry is trying to define specific additional measures needed to allow higher charge levels without increasing risks above the existing standard.

The activity, led by Werner Schwaiger from the Austrian National Committee, started in 2015. Recently, during a meeting held in Turin, Italy, at the end of April, the working group addressed comments received on the last draft of the amendment to IEC standard 60335-2-89.

The main factor used to minimise the creation of a flammable mixture around an appliance is the airflow. Its effectiveness must be certified using a special leak test, which was developed with the help of specialised laboratories in Great Britain and in Germany.

Additionally, the working group will take into consideration the outcomes of an Air Conditioning, Heating and Refrigeration Institute (AHRI) project, currently in progress in the U.S., to assess the severity of negative events due to flammable refrigerants (both A3 and A2Ls).

Meanwhile, a new Draft for Comments (DC) document that considers a 500g limit for propane charges, and will also allow the use of slightly flammable A2L refrigerant alternatives, was circulated in June. If positively commented upon, and if a consensus is reached, the document will be submitted to the SC61C committee and go to the first official vote as a Committee Draft (CDV) during the Plenary Meeting of the SC61C in October in Vladivostok, Russia.

During 2018, in the event of a positive CDV and FDIS (Final Draft of International Standard) vote – a 66.7% majority of P (participating)-members is required – the final standard amendment would be published.

It is important to note that the majority of experts participating in WG4 working group activity are from leading U.S. companies. Therefore there is a good chance that UL and the EPA will also adopt the approved IEC standard into American legislation quite soon. The European version of the IEC standard will be voted in parallel and other regions, like China, Japan, etc., should follow as well. ■ MZ

Marek Zgliczynski

is chair of IEC SC61C and manager of commercial refrigeration product engineering for Brazilian compressor manufacturer Embraco.



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Please contact your nearest Beijer Ref Australia branch for further detail.

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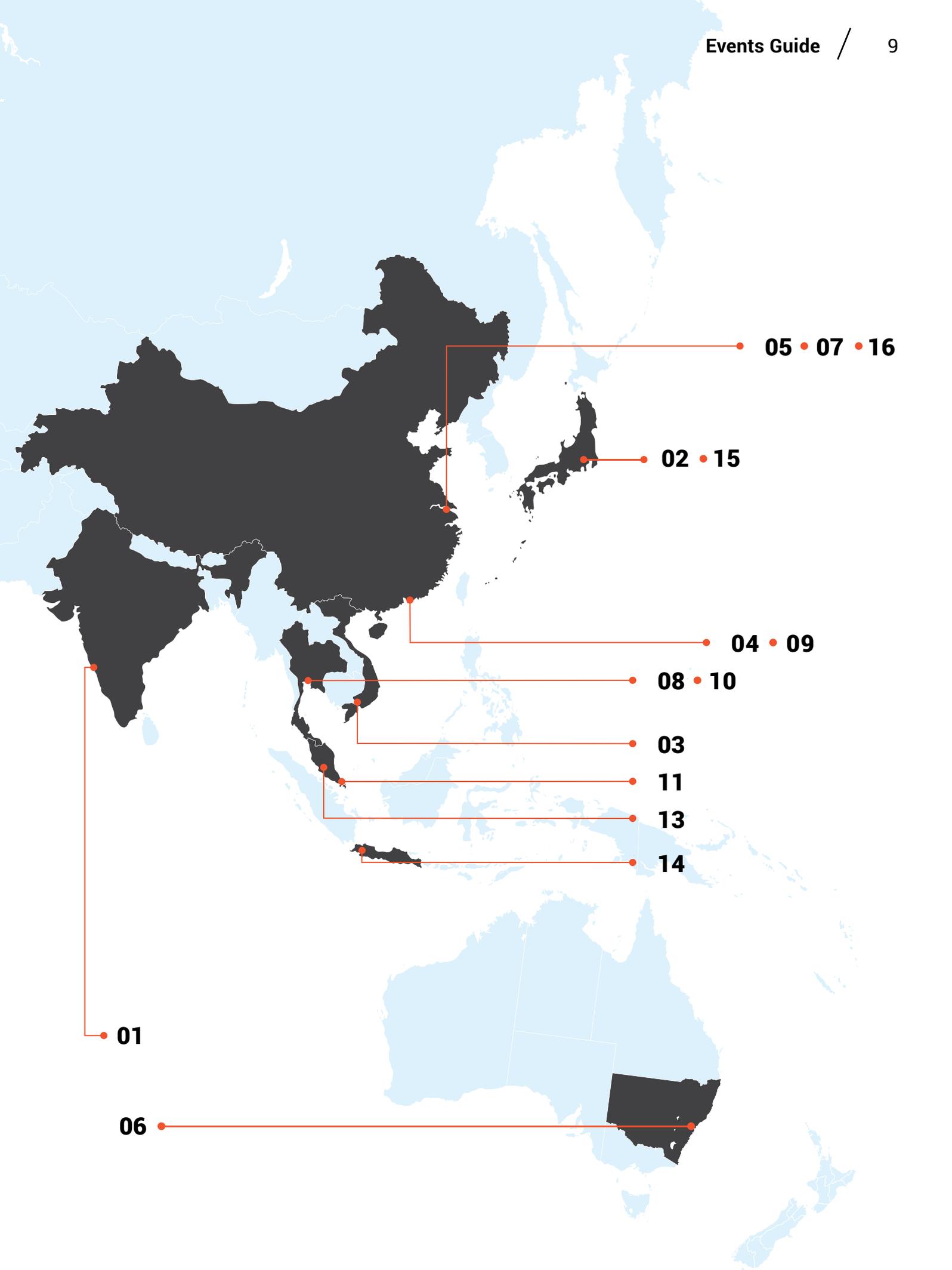


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EVENTS GUIDE

August / September / October 2017

- **01** 3-5 August, Goa, India
Food Hospitality World
www: <http://www.fhwexpo.com/fhw-mumbai-2016.php>
- **02** 7-10 August, Tokyo, Japan
International Sorption Heat Pump Conference 2017
www: <http://biz.knt.co.jp/tour/2017/ISHPC2017/congress.html>
- **03** 9-12 August, Ho Chi Minh City, Vietnam
VIETFOOD & BEVERAGE
www: <http://hcm.foodexvietnam.com/en>
- **04** 17-21 August, Hong Kong
Food Expo Hong Kong
www: <http://m.hktdc.com/fair/hkfoodexpo-en/HKTDC-Food-Expo.html>
twitter: @hktdc
- **05** 19-21 August, Shanghai, China
8th Shanghai International Frozen & Chilled Food Expo
www: <http://www.ffb2b.com/en/>
- **06** 24 August, Sydney, Australia
Climate Control News LIVE
www: <http://www.climatecontrolnews.com.au/live>
- **07** 5-7 September, Shanghai, China
ISH Shanghai & CIHE 2017
www: <http://ishs-cihe.hk.messefrankfurt.com/shanghai/en/visitors/welcome.html>
- **08** 6 September, Bangkok, Thailand
ATMOsphere Asia 2017
www: <http://www.atmo.org/asia2017>
twitter: @ATMOEvents #ATMOAsia
- **09** 6-8 September, Hong Kong
Cool Logistics Asia 2017
www: <http://coollogisticsresources.com/asia/>
- **10** 7-9 September, Bangkok, Thailand
Bangkok RHVAC 2017
www: <http://www.bangkok-rhvac.com/>
- **11** 12-14 September, Marina Bay Sands, Singapore
Mostra Convegno Expocomfort Asia 2017
www: <http://www.mcxpocomfort-asia.com/en/home/>
- **12** 25-27 September, Berlin, Germany
ATMOsphere Europe
www: <http://www.atmo.org/europe2017>
twitter: @ATMOEvents ATMOSphere
- **13** 26-29 September, Kuala Lumpur, Malaysia
Food & Hotel Malaysia (FHM) 2017
www: <http://www.foodandhotel.com/home/index.php>
twitter: @FoodHotelMsia
- **14** 28-30 September, Jakarta, Indonesia
Refrigeration & HVAC Indonesia
www: <http://www.refrigeration-hvacindonesia.com/>
- **15** 4-5 October, Tokyo, Japan
Innovation for Cool Earth Forum
www: <https://www.icef-forum.org/>
- **16** 17-18 October, Shanghai, China
Greenbuild China
www: <http://greenbuild.usgbc.org/china>



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AUSTRALIA & NZ IN BRIEF

MARKET

Hillphoenix installs 'the first ejector in North America'

A Sprouts Farmers Market store – which opened on 28 June in Woodstock, Georgia – is the first place in North America to feature a transcritical CO₂ system with ejector technology, according to Sprouts and systems manufacturer Hillphoenix.

The grocery store is estimated to save an average of 10% energy each year by using Hillphoenix's Second Nature™ CO₂ system with an ejector and parallel compression.

Originally announced at ATMOsphere America 2017 in San Diego, California, Jeff Newel, director of R&D in Hillphoenix's systems division, explained how an ejector can yield more significant savings than parallel compression in warm ambient areas like Georgia in the southern United States.

Testing in Conyers, Georgia found that parallel compression increases the peak energy efficiency of a standard booster system by 8%. Using a Danfoss ejector increases peak savings by 11.3% in non-optimised conditions.

When the system has been optimised – as revealed in tests carried out by Hillphoenix's partner in Europe, Advansor – savings with parallel compression can reach up to 15% and 23% at their peak with an ejector.

The store has also qualified for the U.S. Environmental Protection Agency's GreenChill Platinum certification. ■ Charlotte McLaughlin

TECHNOLOGY

Panasonic launches new ultra-low temperature freezer

The Panasonic Healthcare Corporation of North America has launched a new environmentally friendly freezer for laboratories based on hydrocarbons propane (R290) and ethane (R170).

Marketed as the VIP ECO freezer, this new upright cabinet delivers more dependable, energy efficient, ultra-low temperature storage by using smart compressors with hydrocarbons in a cascade refrigeration circuit – with R290 on the high-stage circuit and R170 on the low-stage one.

Panasonic is targeting new laboratories as well as the immediate replacement of less-efficient freezers. The VIP ECO's interior volume of 729 litres is sized to accommodate many existing inventory racks in use in other freezers. In replacement installations, this permits quick transfer with zero downtime.

Intuitive internal monitoring and feedback systems are designed to optimise component performance, maintain balance between power consumption and temperature control, and to assist facility users in meeting environmental sustainability goals.

The Advanced Frost Control System, based on the EZlatch door handle, simplifies door openings and closings. Multi-point door gaskets protect the cabinet periphery to save energy, reduce moisture accumulation and eliminate ice build-up. ■ Andrew Williams

RESEARCH

AHRI publishes first flammable refrigerant report

In a bid to identify suitable replacements for high-GWP HFCs being phased down under the Montreal Protocol, industry association the Air Conditioning, Heating and Refrigeration Institute (AHRI) on 13 June issued an A2L research report as part of its ongoing testing of flammable refrigerants.

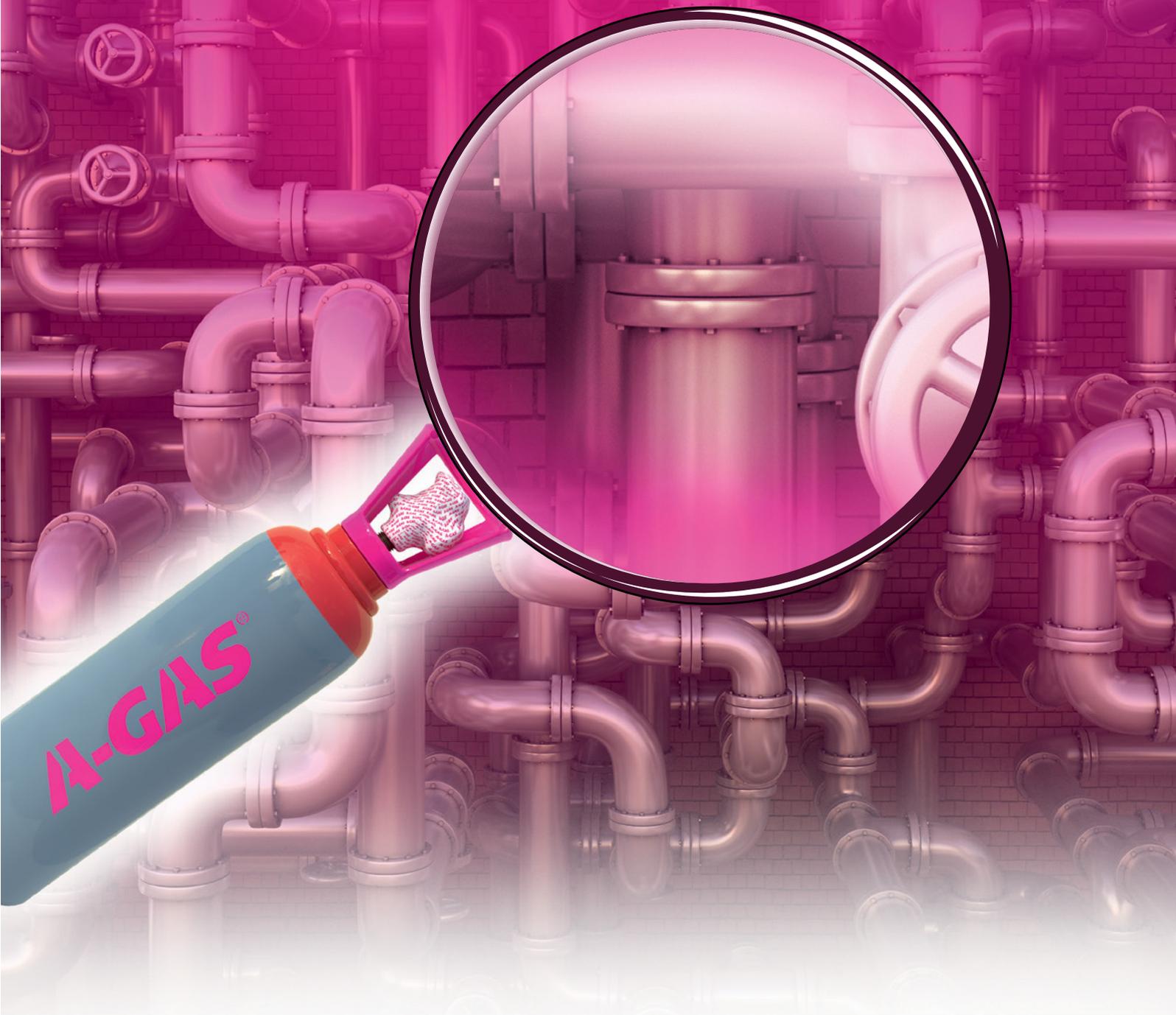
The research and testing programme is part of a US\$ 5.2 million commitment on the part of AHRI, ASHRAE, the U.S. Department of Energy, and the California Air Resources Board to further test in real-world settings low-GWP, but mildly flammable or flammable, refrigerants.

The report – 'Benchmarking Risk by Whole Room Scale Leaks and Ignitions Testing of A2L Refrigerants' – was developed following testing at UL, which began in June 2016. The objective was to conduct refrigerant leak and ignition testing under real-world conditions to develop data and insight into the risk associated with the use of A2L refrigerants, which are mildly flammable, but have a low GWP.

Room-scale tests were performed for commercial and residential scenarios. Further tests are planned, the results of which will be released when they are available. ■ Andrew Williams

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New report sheds light on NatRef training in Europe

A perceived lack of training among technicians and installers is often cited as a barrier to wider uptake of natural refrigerant-based technologies. But a new report shows that training is in fact readily available in Europe for those who need it. *Accelerate Europe* reports.

– By Andrew Williams

Packed full of exclusive interviews, industry surveys and data analysis, the *GUIDE to Natural Refrigerants Training in Europe 2017* – published on 8 May by the market development department at shecco, publisher of the *Accelerate* magazine series – is the most comprehensive investigation of Europe's training landscape to date.

The GUIDE analyses survey responses and opinions from over 340 participants on a range of topics, including:

- ▶ Major trends in training on CO₂, hydrocarbons and ammonia in Europe.
- ▶ Figures for participation in training courses and growth prospects.
- ▶ Analysis of barriers and drivers of natural refrigerants training in Europe.
- ▶ Comparative analysis of supply and demand for training in Europe.

Survey participants identified the need to comply with legislative requirements at global, regional and national levels as one of the biggest drivers of natural refrigerants training uptake. The cost of investing in training – both in terms of attending and offering courses – was singled out as the biggest barrier, closely followed by a perceived lack of available facilities in some parts of Europe.

Manufacturers, universities and government can all play a role in addressing this. "Many local associations are setting up training courses in CO₂ applications and alternative systems, and this has to be implemented more and more. Actually the government should support these trends in order to put professionals in the position to handle the new refrigerants safely," says Giovanni Dorin, marketing manager at compressor manufacturer Dorin.

Among the GUIDE's highlights is a directory of natural refrigerants training currently on offer in Europe. The directory matches readers to the most suitable training providers, from a list of almost 200 located throughout Europe, according to their needs.

Growing demand for natural refrigerants training

From state-of-the-art training centres provided by companies like Carrier and Bitzer to EU-funded projects and free online resources, the GUIDE is a one-stop shop for all training initiatives that support the development of natural refrigerants.

"CO₂, in particular, is clearly a major area of development for the future. Bitzer is supporting this with its focused carbon dioxide training course, based at the company's headquarters in Germany," says Kevin Glass, Bitzer's UK managing director.

The industry survey conducted for the GUIDE found that 98% of natural refrigerant training providers offer theoretical training, and 80% offer practical training. 82% of them offer CO₂ training, 63% offer hydrocarbons training, and 55% offer ammonia training.

As natural refrigerants become more popular, the training offer is expected to increase. "The industry leads, and we follow along. [...] As the industry introduces all of these natural refrigerants, the training sector will catch up and it will mingle in. I do think it's just a matter of time," says Jason Clark, senior training consultant at the Grimsby Institute of Refrigeration.

Peter White, director of British installer and maintenance company Polar Pumps Ltd., observes that this is already happening. "50% of those we train are for ammonia, and this seems to be growing. The industry is changing as refrigerants have gone from CFCs, HCFCs, HFCs and now on to HFOs," he told the GUIDE.

"People want a bit of security. Ammonia has been here since forever and it will stay here forever," White says.

With a diverse range of training options already out there, Advansor Managing Director Kim G. Christensen believes that motivated people will have no trouble finding the course they need. "The story that there isn't enough CO₂ training in Europe is a lie," he says.

To read the *GUIDE to Natural Refrigerants Training in Europe*, visit publication.shecco.com. ■ AW

Solutions Covering The Needs Of CO₂ Refrigeration Systems



MODULATION



EFFICIENCY



MULTI
REFRIGERANT



DIAGNOSTICS





Dario Ferlin, sustainable innovations engineer, Woolworths on site in Colebee, NSW

Woolworths' first transcritical CO₂ store: **Building NatRef momentum in Australia**

On 16 May retail giant Woolworths opened its first transcritical CO₂ store, in Colebee, New South Wales. Designed for ambient temperatures of up to 45°C, fitting the robust system has helped to train local HVAC&R talent along the way, laying the foundations for future growth of natural refrigerant-based HVAC&R systems in Australia.

— By Devin Yoshimoto

A single bottle of champagne sat on a bottle cooler shelf in an empty walk-in cool room. The rest of the 3,200m² supermarket was virtually empty of stock.

Two weeks before the grand opening of Woolworths' new store at Greenway Village mall in Colebee, New South Wales, *Accelerate Australia & NZ* toured the facility with Dario Ferlin, Woolworths' sustainable innovations engineer, alongside other key team members Shaun Merry, national installations manager for the Woolworths design and installation team, Jim Dowling, Woolworths' senior refrigeration field engineer, and Gary Howle, system commissioner.

"You'll notice that somebody's already put out a bottle of champagne," remarks Ferlin with a smile.

No doubt Ferlin and the rest of his team later enjoyed the champagne in celebration of Woolworths' first transcritical CO₂ store, which is now open to trade.

The store's pilot transcritical CO₂ system is certainly a great technological achievement:

it is designed to operate in ambient temperatures of up to 45°C reliably and efficiently, incorporating the latest in commercial refrigeration technology innovation.

"This journey has taken quite a number of years to get to where we are today," Ferlin explains. "But along the way, there have been quite a few learnings, all with the view to developing, what we believe, is the best the world can offer for the Australian environment."

It is not just the technical achievements that make the system so remarkable.

As Ferlin led the *Accelerate Australia & NZ* team around the facility, he revealed the true significance of Woolworths' pilot transcritical CO₂ system.

"This isn't about simply opening up a store successfully and then walking away. This is about building up the skill sets in the industry. It's about sparking creativity and imagination – with other contractors and other retailers – so we can start the ball rolling," says Ferlin.

From the outset, Ferlin and his team recognised the opportunity to use the development of this store to help move Australia's wider HVAC&R industry forward.

"We used, almost exclusively, local technology providers," says Ferlin, "which meant the R&D, the development and the support was all done locally. It also means the day we open to trade, that skill set is still around. It's available for the next store – or our competitor's next store".

Woolworths' first transcritical CO₂ store, Ferlin explains, was just an early but important step towards the wider HVAC&R industry's evolution to an HFC-free future.

"This is what I mean about the momentum after the store opening," says Ferlin. "We're opening up a new horizon to the industry and it goes beyond the conversation limited to this store alone. That's exciting."

Woolworths Greenway Village

- ▶ Address: Greenway Village Shopping Mall, 799 Richmond Rd., Colebee NSW 2761, Australia
- ▶ Trade area: 3,200m²
- ▶ Attached BWS liquor store
- ▶ Number of fixtures: 70
- ▶ Number of showcases: 60
- ▶ Load: 300 kW medium temperature
- ▶ Load: 40 kW low temperature
- ▶ Two booster transcritical systems with parallel compression

Woolworths' sustainability journey

2007

Releases '2007-2015 Sustainability Strategy'. Key goal: 40% reduction in carbon emissions by 2015 (based on projected growth levels).

2010

Signs Consumer Goods Forum agreement to phase out high-GWP refrigerants, in Cancun. Key goal: Begin phasing-out hydrofluorocarbon (HFC) refrigerants as of 2015 and replace them with non-HFC refrigerants.

2017

Releases 'Corporate Responsibility Strategy 2020'.

Key goals:

- ▶ Reduce Woolworths' carbon emissions to 10% below 2015 levels.
- ▶ Innovate with natural refrigerants and reduce refrigerant leakage in stores by 15% of CO₂-e below 2015 levels.
- ▶ Towards zero food waste going to landfill.
- ▶ Improve recyclability of own-brand packaging and contribute to circular economy.
- ▶ Source key raw materials and commodities sustainably to an independent standard by 2020.
- ▶ Achieve net zero supply chain deforestation for 'high-impact' commodities in own-brand products



“ This isn’t about simply opening up a store successfully and then walking away. This is about building up the skill sets in the industry.

It’s about sparking creativity and imagination, so we can start the ball rolling. ”

– Dario Ferlin, Woolworths

► Towards an HFC-free reality

Woolworths’ industry-leading sustainability initiatives began more than ten years ago.

In 2006, Woolworths released its 2007 to 2015 sustainability strategy, which targeted a reduction of carbon emissions by 40% – an ambitious target and a remarkable achievement, which the company hit in 2015.

The conversation about Woolworths’ pilot transcritical CO₂ system began in 2010, when it became a signatory to the Consumer Goods Forum agreement to phase out the use of high-GWP refrigerant gases, announced on the first day of the UN climate talks in Cancun, Mexico. It was at this time that Woolworths committed to begin phasing in HFC-free supermarkets.

In 2017, Woolworths doubled-down on that pledge by announcing its ‘2020 Corporate Responsibility Strategy’ – which aims to reduce carbon emissions by an additional 10% below their 2015 levels by the year 2020.

Natural refrigerant systems are key to delivering this strategy. “By 2020, we will install ten natural systems employing technologies such as transcritical CO₂ or water-loop,” reads the statement.

In light of Australia’s impending HFC phase-down – beginning January 2018 – the wider need to upskill the entire industry has also become immediate and apparent.



From left to right: Jim Dowling, Woolworths senior refrigeration field engineer / John Nemet, senior installation technician / Dario Ferlin, Woolworths sustainable innovations engineer / Gary Howle, system commissioner / Shaun Merry, national installations manager for Woolworths D&I team

The path leading towards Woolworths' first transcritical CO₂ system became an opportunity to push not just Woolworths itself, but the whole commercial refrigeration industry ecosystem, towards an HFC-free future.

There must be an "acknowledgement that sustaining refrigeration innovation requires the upskilling of the local commercial refrigeration industry. That acknowledgement goes beyond Woolworths and is industry-wide," Ferlin told the ATMOsphere Australia 2017 conference in Sydney on 2 May.

Investing in local

Investment in upskilling the local industry began with stakeholder engagement. Merry and Dowling played active roles in this process as the project's suppliers were first identified.

"Stakeholder engagement was one of the key pieces for me and my team coming in to this project," says Merry, national installations manager at Retail FM.

Retail FM is a wholly Woolworths-owned subsidiary that served as the installation contractor for this project.

"On this job, everyone was coming along for the same trip," says Merry. "The case manufacturers, the rack manufacturers, the electricians, the people who do the architecture for the controls, have all worked together to get here."

Woolworths hosted meetings at its offices in an effort to foster active participation and discussion among all stakeholders.

"Together with all of our subcontractors and all of our suppliers, we had several roundtable meetings at our head office," says Ferlin.

Merry and Dowling described the kind of discussions that were held at these meetings.

"We went through the whole design and concept of a transcritical system," says Merry, "so they understood what it was we were trying to achieve from the outset".

"It was a collaborative approach – everyone's voice was heard," adds Dowling.

This collaborative attitude, explains Ferlin, set the tone for the whole project and helped establish local transcritical CO₂ know-how.

"This exchange – this ongoing dialogue between stakeholders – meant that the knowledge base, collectively, was increasing."

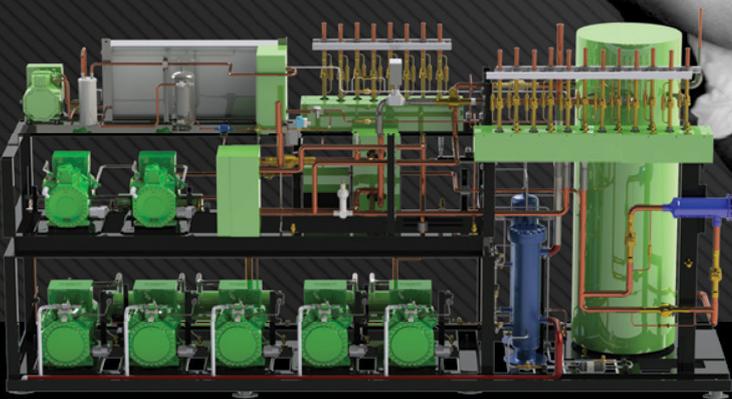
One of the most important areas of this collective knowledge increase was in the design, installation, and training of the transcritical CO₂ rack.

Transcritical rack design and training

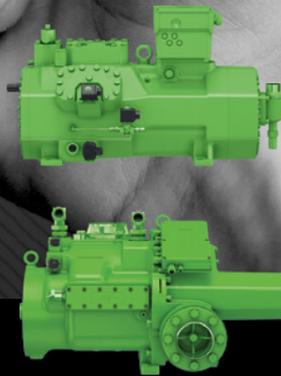
The rack supplier for this project was Bitzer Australia, which also played a key role in encouraging upskilling of all stakeholders early in the design process.

"Throughout the design process, we had forums where the Retail FM

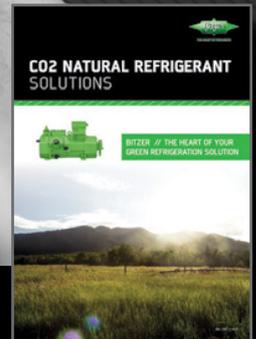
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THE HEART OF FRESHNESS

“It’s the momentum after the store opening. That’s what I’m excited about. It’s like we’re opening up a new horizon to the industry.”

– Dario Ferlin, Woolworths

design and installation team would come in, Bitzer Australia would come in, and the engineering department of Woolworths would come in, and we would actually flesh out the design that Bitzer was proposing, and it offered everyone an opportunity to challenge each other,” says Ferlin.

“Why are you doing this? Isn’t there a better way of doing it?’ So, having that local content being delivered by a local technology partner is part of that training – part of that skill set investment that we are trying to achieve.”

Once the design process was complete, Bitzer Australia facilitated hands-on transcritical CO₂ training for the technicians.

“The design and install contractor, Retail FM, actually had an opportunity to charge up a test rig at Bitzer’s facility and assist in actually starting up the test rig,” says Ferlin. “And this is following a theoretical seminar, leading up to that hands-on experience.”

“The training that the rack manufacturer has done has been really good,” remarks Merry. “It helped make sure that the technicians were comfortable [working with transcritical CO₂].”

Both Ferlin and Merry highlight the importance of upskilling suppliers and contractors to help sustain this transcritical CO₂ system, and the others to follow, for the coming decades.

“It’s not only about the technology. It’s about creating a momentum within the industry and bringing it with us, not just going on a journey on our own,” observes Merry.

▶ Programmable controls encourage learning

Another key choice in the design of the transcritical CO₂ system was the controls.

Ferlin explains how the difference between the controls for a conventional system and a transcritical CO₂ system offers another opportunity to increase knowledge and foster a learning environment.

“What is particularly different about transcritical CO₂ systems, as opposed to conventional systems, are the controls,” he says. “From a controls perspective they are fundamentally different.”

The team decided to use Emerson programmable controllers for the front of the racks rather than conventional parametric controls. Why?

“Programmable means everyone needs to have a fundamental understanding of what the transcritical cycle is and how it’s supposed to operate. You are obliged to do that when you’re forced to program the controller to manage the cycle,” says Ferlin.

Though choosing a parametric control system might have been the simpler choice, Ferlin again argues: “That would have come at the cost of not learning, understanding and developing that local transcritical CO₂ knowledge base.”

Whether identifying suppliers and contractors who were locally based, designing, installing and commissioning the system, or investing in training technicians, Ferlin and his team ensured that the groundwork was laid for the entire HVAC&R ecosystem to sustain the innovation into the future.

“That support has to be created,” says Ferlin, “simply because that skill set is still in its infancy. By doing what we did here – by specifying a store using local technology partners – we are actually creating an environment where that support will exist.”

Technology partner companies

Showcases: Hussmann

Compressor racks: Bitzer Australia

High-pressure expansion valves: Danfoss

Flash-gas bypass valves: Danfoss

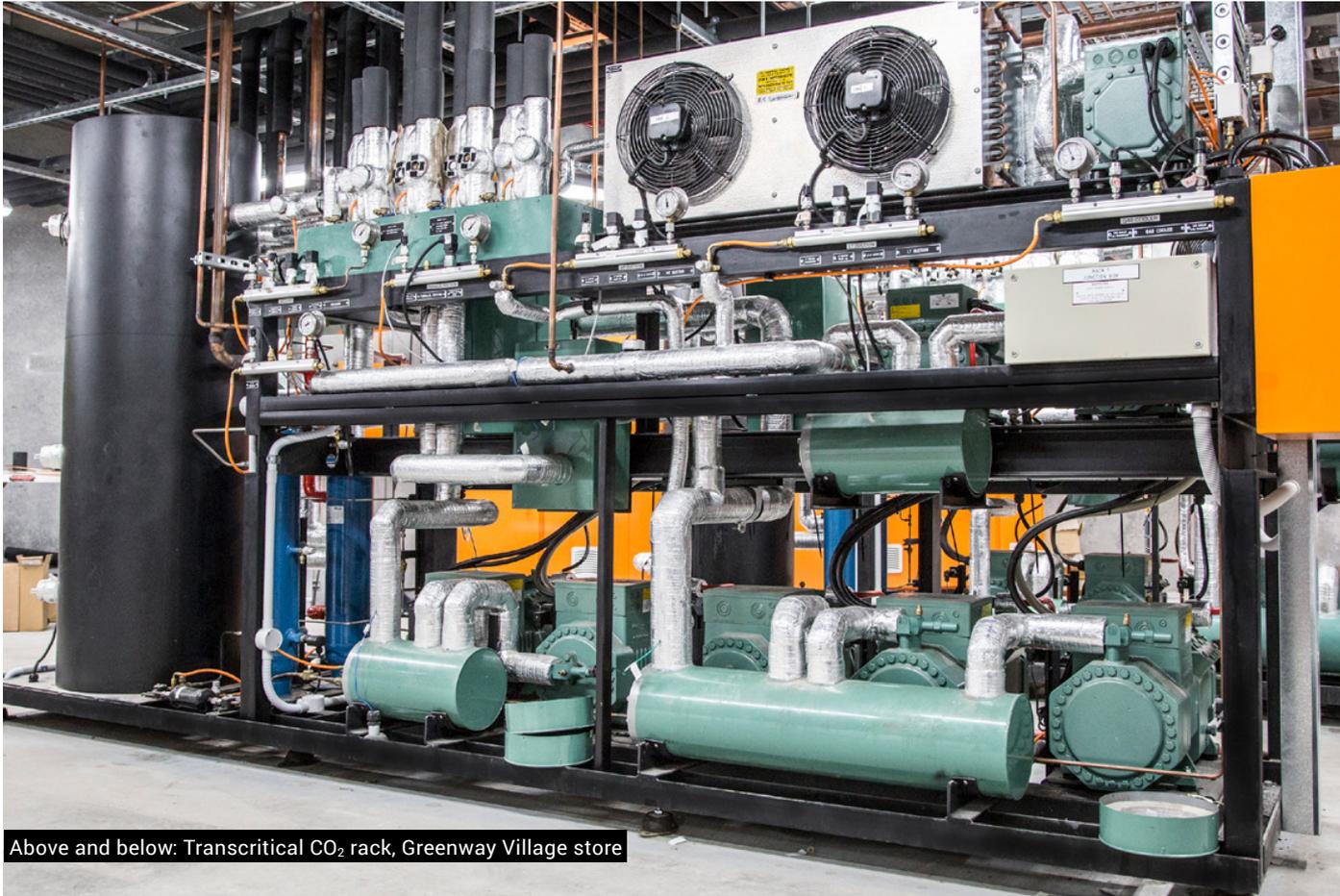
Gas coolers: Alfa Laval

Cool room evaporators: Buffalo Trident

Stepper electronic expansion valves: CAREL

Controllers (showcases, rack, gas-cooler, HPEV & FGBV): Emerson

Installation contractor: Retail FM



Above and below: Transcritical CO₂ rack, Greenway Village store





Merry (l) and Ferlin (r)

Australian tailor-made solution

“This really is more than an R&D opportunity,” says Ferlin, as he showed us around the main plant room of the system.

“This is a template, which we aim to replicate. One that is robust, energy-efficient, and simple to service in the years to come.”

Woolworths’ pilot transcritical CO₂ system is unique in that it is designed for ambient temperatures of up to 45°C, with a view to replicating it almost anywhere in Australia across various temperature conditions.

The system consists of two independent racks, each one serving 50% of the freezer load and 50% of the medium temperature load.

The main challenge facing the team is the management of flash gas – a side-effect resulting from the operation of the system in transcritical mode on hot days.

The management of that large proportion of flash gas is key to maintaining the system’s efficiency and reliability in Australia’s blistering summer temperatures.

“This plant room, in the middle of summer,” explains Ferlin, “could very easily get to 40 or 45 degrees.”

The solution chosen to manage this issue was the use of parallel compression – a well-known flash gas management method tested in several transcritical CO₂ systems around the world.

However, that method comes with its own challenges, as Ferlin explains.

“Because then, you are balancing the use of parallel compressors with the flash gas bypass valve adding a bit more commissioning complexity.”

The issue of additional complexity, especially for transcritical CO₂ systems operating in high ambient, is a big one. But, as Ferlin explains, the decision was made with a long-term view, looking ahead to the several more transcritical CO₂ installations to follow around Australia.

“From a life-cycle perspective,” says Ferlin, “we looked at the cost of running the store end-to-end. We took that step in full knowledge that it would add complexity and cost, but create a very good template which we could then replicate almost anywhere in Australia.”

As Woolworths continues to look for opportunities to reduce its carbon emissions, one large target is the air-conditioning system, which, as Ferlin explains, “has hundreds of kilograms of synthetic refrigerant”.

Though not currently being tackled at this time, Ferlin confirmed future plans to move towards a completely 100% HFC-free store.

Integrating air conditioning

"This is the first iteration. We have in mind several iterations, which would end up being our potentially bullet-proof specification moving forward," says Ferlin.

"One of these iterations would include integrating the HVAC system into the refrigeration rack and therefore completely eliminating synthetic refrigerants from both the refrigeration system and the air-conditioning system," Ferlin explains.

"So that you have one system or one plant room running on CO₂ managing the entire mechanical refrigeration load."

The challenge, Ferlin says, would not be a technical one but rather a logistical one.

Typically, the retailer owns the refrigeration units and the air-conditioning system belongs to the building owner.

"If we are to integrate the two assets into the one, it just becomes a little bit tricky from a contractual perspective. It's not so much an engineering challenge. It's a corporate challenge, but it's one that we are certainly looking at," he says.

▶ "To my surprise and to my gratification, they were both on board with this concept."

Merry adds in agreement: "I think other installation contractors, who do work for Woolworths – we'd certainly be open to letting those guys through [to become familiar with the project]."

As Ferlin and his team's meeting with *Accelerate Australia & NZ* that day came to a close, they continued to highlight the willingness of each industry player to work cooperatively with one another.

"I think what you're potentially getting out of this conversation is a very healthy attitude from all angles," says Ferlin. "And it was there from the beginning of the project, which really is the key to delivering a successful outcome." ▶

▶ Culture of innovation

One of the most interesting developments *Accelerate Australia & NZ* learned from speaking to Ferlin and his team was the unique shift in attitude displayed by almost everyone involved over the course of the project.

At one point, Ferlin described how he challenged every stakeholder to take the non-traditional role of being open to co-operating with competitors – in order to lift up the entire industry.

"Before Retail FM engaged the potential local rack manufacturers," says Ferlin, "I challenged both of them with a concept which was unfamiliar to them."

"To the first potential manufacturer, I said, in the event that you are successful, are you willing to allow your competitor, the alternative rack supplier, to become familiar with your successful installation?" says Ferlin. "I asked the same question to the other one." ▶

Control and flexibility with stepper valves

Ferlin explains how another non-standard choice was made with the view of increasing the amount of control and flexibility in the transcritical CO₂ system.

Stepper valves, which are used to control the rate of refrigerant flow throughout a refrigerant system, were chosen as opposed to pulse valves.

"Most transcritical systems use pulse valves, which means they are fully open or fully closed," he says.

Due to the size and number of fixtures in the Woolworths store, stepper valves were specified to provide additional control over showcase temperatures and superheat coming out of the evaporators.

Additionally, pulsing valves may cause other issues with a store with a large amount of fixtures, Ferlin explains, including system noise and fatigue.

"What's characteristic of a transcritical store with pulse valves is that as you walk around the store, you hear the clicking. There's none of that here," he says.

"Having 70 fixtures all with pulsing valves potentially introduces a risk of liquid hammer or vibrations and long-term potential fatigue problems," Ferlin explains.

"So for these reasons, we decided to specify stepper valves all around. That is not standard. That is something that we opted to do, specifically for this store," Ferlin says.

Techology Focus

Simple piping, reduced labour costs

One advantage, the team found, of working with transcritical CO₂ is the simplicity of the pipework.

“One thing that’s worth noting is the simplicity of the piping inside the cabinets,” says Shaun Merry, national installations manager for Woolworths D&I team.

He explains how significant labour costs and time were saved during the installation process.

“Here we have one riser that’s got pipework going back up to the plant room,” says Merry.

“Typically, in a normal supermarket on HFC refrigerant, we have three or four going down to these cabinets. And there would be a series of ball valves, EPR valves, etc. throughout the cabinets,” he said. “It’s very simple pipework. It took the guys only a few days to pipe up the cabinets, which would have typically taken them a week or so to do it.”

The time saved translated to a significant reduction in labour costs.

Ferlin cites the additional advantage of having much smaller sized pipes due to the efficiency of CO₂ as a refrigerant.

“The diameters are much, much smaller, simply because of the thermodynamic properties of CO₂,” says Ferlin. “It’s just a much more efficient refrigerant.”

▶ Just the beginning

As stated in Woolworths ‘2020 Corporate Responsibility’ strategy, Greenway Village is just a pilot store, with the company poised to roll out ten CO₂ transcritical stores in Australia by 2020.

“The conversation with internal stakeholders is still on-going,” says Ferlin. “But there is enthusiasm within the engineering department to not just make this a one-off, but the start of a new journey.”

The real key here is not the number of transcritical stores planned, but rather that the groundwork has been laid to make that future goal a reality.

“Our driver from the beginning was not to look towards a PR solution,” Ferlin says. “We were really driven by the objective of getting momentum happening within the industry.”

Indeed, the goal of sparking creativity, excitement and imagination seems to have also been achieved.

“There’s certainly a lot of interest, especially from other commissioners, who want to know what is so different about the system,” says Merry.

Ferlin’s conviction is firm, and no doubt necessary, in order to continue driving Woolworths – and the rest of the industry – forward towards an HFC-free reality.

“It is not necessarily the easiest path,” Ferlin admits. “Not necessarily the path most travel by. But I believe in the long-term interests of the viability of CO₂ transcritical.”

“We are facing a reality now where HFCs are going to be phased out. So we, as an industry, have to start taking measures towards that HFC-free environment. We need to start investing in upskilling the industry now.”

“I believe this is what we’re doing here.” ■ DY





ATMOsphere Australia 2017: Industry charts sustainable HVAC&R course

With the passage of HFC phase-down legislation by the government on 19 June, the need to transition Australia's HVAC&R industry away from HFCs has become even more pressing. Industry leaders from around Australia and New Zealand joined participants from government and leading multinationals to discuss the future of the industry at ATMOsphere Australia 2017 in Sydney on 2 May. *Accelerate Australia & NZ* reports.

– By Devin Yoshimoto



The second annual ATMOsphere Australia conference, held on 2 May 2017, brought HVAC&R industry leaders from Australia and New Zealand together with representatives of leading global companies at the beautiful Luna Park conference hall, overlooking Sydney Harbour, to discuss the region's latest natural refrigerant developments.

Building on the momentum established by the first ATMOsphere Australia event held last year, the one-day conference welcomed 205 participants from the HVAC&R sector, including 34 end users.

Ramped up standards and training

Compelling case studies from Australia and New Zealand's top retailers, system suppliers and industrial end users showed continued rapid adoption of natural refrigerant systems across the region. Industry associations and government representatives are becoming increasingly aligned on the need for updated training and standards.

As Australia steadily moves forward with its HFC phase-down ([see 'Australia's HFC phase-down', p. 52](#)), the need to revamp HVAC&R standards, training, and recruitment has become increasingly pressing.

shecco CEO Marc Chasserot painted a picture of a global HVAC&R sector in flux, with changes expected in U.S. policy under the new administration, Europe's f-gas phase-down picking up speed, and increased government support for natural refrigerants in China.

Patrick McInerney, director of the international ozone protection and synthetic greenhouse gas section in the Department of the Environment, highlighted the Australian government's focus on aligning the country's HFC phase-down targets with the trajectory set by the Montreal Protocol.

The phase-down entails an HFC import limit of 8.0 megatons CO₂e beginning in January 2018. Additional reductions are planned for every two years thereafter, resulting in a final import limit of 1.6 megatons CO₂e in 2036.





shecco CEO Marc Chasserot (l) and Robbie Mayer, F. Mayer Imports

▶ The goal, though ambitious, was a hot topic of discussion amid concerns among attendees about industry readiness to handle the technology transition.

Kim Limburg, president of the Australian Refrigeration Mechanics Association, a leading industry group, said: “[The HVAC&R] industry is tasked with an enormous amount of change that must be met by an enormous amount of training.”

Several initiatives outlined at the conference showed the different ways in which industry is beginning to collaborate to fill this gap.

Glenn Evans, CEO of the Australian Refrigeration Council, announced the launch of the group’s Green Scheme Accreditation program, which now includes training for natural refrigerant systems.

Leading component supplier Danfoss highlighted its partnership with TAFE (Technical and Further Education) NSW (New South Wales), one of Australia’s leading providers of vocational education and training, to provide technicians with up-to-date transcritical CO₂ system training.

Although the direction of the industry has become clearer, attendees agreed that much work remains to be done in up-skilling Australia’s refrigeration technicians to safely manage the coming technological shift. Closer collaboration is needed here.

McNerney said: “We need to work with all levels of the industry to see what levels of support are required. Let’s work together on it.”

“We need to work with all levels of the industry to see what levels of support are required.”

– Patrick McNerney

Director, International Ozone Protection and Synthetic Greenhouse Gas Section, Department of the Environment, Australian Government



Patrick McNerney



▶ End users see results, push forward

End users were eager to showcase the enormous progress made in both commercial and industrial sectors over the past year. Combined with increasingly ambitious targets for future growth, they showed that the momentum of the transition among key players is already underway.

Stuart Saville, national refrigeration engineering manager at leading Australian retailer Coles, chaired the end user panel and set the tone by highlighting Coles' commitment to sustainable refrigeration systems and the importance of communicating these initiatives with consumers.

"From the fact that you have solar panels on the roof, to mitigating waste through recycling programs, down to the type of refrigeration plant you have – they are all good messages to try harder to put in front of the public," said Saville.

Michael Englebright, head of engineering for Woolworths, announced the leading retailer's newly released '2020 Corporate Responsibility' strategy, which specifically targets investments in natural refrigerant systems.

"By 2020, we will install ten natural systems. Our target is to reduce carbon emissions to 10% below 2015 levels. Natural refrigerants are going to be a key part of that mission," said Englebright.

The retailer also announced the opening of its first transcritical CO₂ store ([see cover story, p. 14](#)). The store represents Woolworths' first step towards achieving its 2020 goals. ▶

First-ever CEO Interview session

In the global ATMOsphere conference series' first ever CEO Interview session, Robbie Mayer, joint managing director of Australian gourmet food importer F. Mayer Imports, sat down for a conversation with shecco CEO Marc Chasserot.

F. Mayer Imports, in collaboration with industrial refrigeration firm Strathbrook Industrial Services, has installed natural refrigerant systems at all three of its cold store locations.

The most recent installation boasts a fully transcritical CO₂ system with ammonia chillers (for full story see: Cover Story, *Accelerate Australia & NZ* #4).

Chasserot and Mayer discussed the impressive energy efficiency and cost savings as well as the history of trust and communication between Mayer and Ian Wilson – project engineer and co-owner of Strathbrook.

Mayer interview highlights

- ▶ F. Mayer's third generation CO₂ transcritical system in Melbourne
- ▶ Size of facility: 2,568m²
- ▶ Temperature range: 120 kW freezers (-20°C); 240 kW cool room (-4°C); 134 kW dock area (16°C); 52 kW chocolate room
- ▶ Transcritical system capacity 306 kW
- ▶ Two ammonia chillers: 320 kW total capacity
- ▶ Ammonia charge 4.9 kg each
- ▶ COP of eight to 10
- ▶ "Yeah we're happy. Our CFO worked out what we used to run at our old site, which would have been three or four thousand square metres. At [our new site], we are running about 7,000 square metres total refrigeration, and it costs us less to run."
- ▶ "We built a bigger plant in Melbourne. All CO₂."
- ▶ "Compared to the old plant, we're using a lot less power. There's been no breakdowns and we haven't had any down time."

“There is acknowledgement that sustaining refrigeration innovation requires a strategy which includes investing in the up-skilling of the local commercial refrigeration industry.”

– Dario Ferlin, Woolworths

Dario Ferlin, Woolworths' sustainable innovations engineer, led the team who commissioned the system. During the conference, Ferlin emphasised the fact that the system was developed with a view to sustaining the technology into the future.

“There is acknowledgement that sustaining refrigeration innovation requires a strategy which includes investing in the up-skilling of the local commercial refrigeration industry. I think that acknowledgement goes beyond Woolworths and is industry-wide,” he said.

In addition, attendees heard from Ian Garradd, sustainability project officer for North Sydney Council, and Tim Hill, director of real estate & construction at Costco Australia, who offered their perspectives on natural refrigerants.

Garradd highlighted the city's need for efficient and sustainable hot water solutions in the face of skyrocketing gas prices.

In a strong statement regarding natural refrigerant-based heat pumps, Garradd declared: “We found that heat pumps were considerably more efficient. For us, there is no question that natural refrigerant heat pumps are the right way to go.”

Hill emphasised Costco's long-term view and the advantages that natural refrigerant-based systems provide in terms of total cost of ownership.

He commented: “We would like to future-proof our future installations as much as possible. Total cost of ownership is more important to us than initial cost.”

Multinational OEMs expressed confidence in the direction of the natural refrigerant market in Australia, not only revealing several collaborations already underway but also exciting plans for the coming year.

CO₂ transcritical becoming standard in NZ stores

“[CO₂ transcritical] is now, essentially, the standard for supermarkets in New Zealand for new supermarkets and even for refurbishments,” said Brian Rees, group technical manager for system supplier Hussmann Oceania, describing the rapid pace of growth in transcritical CO₂ over the past couple of years.

“Our first system was commissioned and operating in June 2013,” Rees said. “It's now very rare that you will see a supermarket in New Zealand go out to tender and be looking to have an HFC refrigerant as its requirement.”

“That's a pretty big step-change for a country in just a couple of years.”

Rees commented that the main drivers for growth were not just the efficiency of the CO₂ systems themselves but the effect that New Zealand's emissions trading scheme (ETS) was having on the cost of carbon as well.

As a supplier, Hussmann is seeing repeat and on-going business for its transcritical CO₂ systems. Rees was optimistic, predicting that this growth will continue throughout the country.

“As we look towards the end of 2017,” he said, “we think there will be around 40 supermarkets in New Zealand operating full transcritical CO₂ natural refrigerant. In context, that's around about 10% of the supermarkets in New Zealand, so it's quite a big shift in a pretty short period of time – and on-going. It's only going to get larger.”

Thriving market in New Zealand

Several leading suppliers and end users of natural refrigerant-based systems in New Zealand also attended the conference.

The firms demonstrated how natural refrigerant technology and adoption are continuing to progress at a rapid pace in New Zealand due to the increasing standardisation of transcritical CO₂ for supermarkets as well as the superior cost savings seen by end users in both the commercial and industrial sectors.

New Zealand retailer Foodstuffs, a leading domestic user of transcritical CO₂, detailed how both the ETS and the long-term cost savings had driven them to adopt CO₂ as the refrigerant of choice for all new stores.



End User Panel, from left to right: Tim Hill, Costco Australia; Michael Englebright, Woolworths; Sean Davel, Foodstuffs North Island; Stuart Saville, Coles; Austen Chittock, Freeze Dried Foods; Ian Garrard, North Sydney Council



Market trends session



Market trends session

“The ETS drove us to a conclusion that we needed to look at a different refrigerant,” said Sean Davel, refrigeration specialist for Foodstuffs North Island. “CO₂ looked the best bet, considering that with the ETS, R404A – which most of our fleet was on – was going to increase by approximately NZ\$100/kilogram.”

Davel also commented on how they were looking at global trends, especially in Europe, to determine the best paths for long-term investment.

“The phase-down in Europe was a concern for us,” said Davel. “And what type of impact that was going to have, with the availability of R404A and R507 in the New Zealand market.”

According to Davel, as Foodstuffs looked overseas to determine which refrigerants would be available in the long term, they also dove deep into calculating the cost savings they would achieve through the use of CO₂.

“Our concern was that, in the past, a new synthetic refrigerant would come on the market, and would last us say, 20 years, and then we’d have to look at something else. CO₂, to us, looked like it was going to be the best fit, long-term,” said Davel.

“Our refrigeration consultants also calculated that through the 20-year lifecycle of the refrigeration system, there could be NZ\$1 million in savings by using CO₂ as an alternative to R404A,” Davel continued. “This was calculated through savings and the comparative costs of refrigerant leakage.”

Overall, Davel demonstrated how the long-term benefits of using CO₂ were undeniable considering its increased efficiency combined with the global phase-down of synthetic refrigerants.

“We now have seven medium-format stores that are transcritical CO₂ and five that are subcritical CO₂. We also have 12 large format stores that operate with CO₂,” said Davel.

After several years of working with subcritical CO₂, “the company default now is that all new CO₂ builds are transcritical,” Davel added.

NZ industrial end users see long-term value

As CO₂ becomes standard for the commercial sector in New Zealand, its uptake is also widening to the industrial sector.

One industrial end user to have reported significant cost savings is Freeze Dried Foods New Zealand.

Executive Director Austen Chittock detailed how the company had moved their industrial freeze-drying plant from R22 to CO₂.

Chittock, who has been closely involved in developing a unique continuous freeze-drying technology – dubbed FD Continua – at Freeze Dried Foods’ NZ plant over the past 18 years, argued that CO₂’s operating efficiency at the company’s required temperatures allowed him to justify the larger initial capital cost.

“The capital cost of these systems is a point. I have to make the case to the board basically to say which way we want to go here. But it quickly gets overtaken with the actual operational efficiency of the refrigerant,” said Chittock.

“Our systems run 24/7, 330 days a year. So you get very big hours on the refrigeration. If we can increase its efficiency, even slightly, the payback is very, very fast,” he added.



ATMOsphere

Business Case for Natural Refrigerants

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- ▶ Among the challenges still facing the industry in New Zealand is the matter of improving the ability to communicate the value of investing in natural refrigerants to the rest of the market.

Matthew Darby, managing director of New Zealand-based system supplier EcoChill, discussed the leadership of the largest companies in the distribution sector in adopting natural refrigerant systems.

“The produce distribution sector gets it,” said Darby, “And they get it because, from what we understand, these are bigger businesses. They have long-term strategic vision.”

These larger companies have the resources and the vision to invest in the future. Yet Darby pointed out that a large percentage of the companies in New Zealand are small businesses.

“97% of our businesses employ 20 or less people,” added Darby. “The people who are doing the work during the day are then tasked with doing all the administrative processes, or business plans, or whatever it might be, at night. So, where is the opportunity for that strategic thinking, like the big corporates have?”

The proof of the energy and cost savings is already there, Darby concluded. It is up to the HVAC&R industry to communicate that value.

“When we stack up those case studies in front of them,” said Darby, “and we show them these 20-25% savings, just in energy alone, it makes really good business sense for them.”

“It’s really up to us now, to help our customers understand how refrigeration can make a shift and be used in their business as a competitive advantage,” he added.

Local, international suppliers ready to support Australian market

With such results now being realised by the larger companies in the Australian and New Zealand market, global suppliers stand ready to collaborate more closely with local industry and ramp up investments as the rest of the market follows suit.

Epta, whose Full Transcritical Efficiency solution was launched at the EuroShop tradeshow in Düsseldorf in March, updated attendees on their work bringing the solution to Australia together with local system supplier AJ Baker & Sons.

“At the moment, we’ve got two plants operational in Perth, with our partner AJ Baker & Sons. They’ve got ten transcritical CO₂ systems in operation now, and two of those have now been tested with the FTE solution,” said Steve Laing, national commercial manager for Epta in Australia and New Zealand.

“We are seeing savings in the vicinity of 7-8% on top of the transcritical operation,” he added.

Michael Baker, managing director at AJ Baker & Sons, was also encouraged by the results and discussed the company’s plans to continue rolling out transcritical CO₂ across Australia.



Left:
Matthew Darby
Managing Director
EcoChill

Right:
Trent Miller
Mitsubishi
Heavy Industries

▶ “We believe we’ll be up to 25 transcritical CO₂ system installations in Australia by 2020,” Baker remarked.

“[Transcritical CO₂] has to be the system of choice not just for supermarkets but for other commercial applications as well,” he added.

Danish system supplier Advansor, which partners Australia-based Natural Refrigerants Company Pty Ltd., announced its first transcritical CO₂ installation in Australia.

Advansor Service Manager Kristian Sørensen was enthusiastic about the potential for growth in Australia. “To date we have produced 2,800 transcritical racks in 33 countries with 100+ systems in hot climates including Brazil, Egypt, Oman, Spain and Portugal.”

“Our estimated production for 2017 is 800 racks and our production capacity is 1,200 racks per year. That means we have 400 racks we can produce for Australia. C’mon guys!” he exclaimed.

Also in attendance were representatives from system and component suppliers Bitzer, SCM Frigo and Danfoss, who highlighted the growth they had seen around the world for their natural refrigerant-based solutions.

Italy-based manufacturer SCM Frigo, which has installed more than 1,800 transcritical racks in 25 countries, discussed its expected continued growth in sales globally as well as plans to enter the Australian market this year.

“In 2017 we expect to deliver 450 CO₂ racks plus more than 500 CO₂ condensing units,” said Mirko Bernabei, technical director at SCM Frigo.

Beijer Ref Australia, which partners with SCM Frigo to bring the Italian firm’s condensing units to Australia, revealed their upcoming customer trials.

“We are looking to bring in the SCM CUBO₂ Smart CO₂ condensing unit to Australia by Q3 2017. We are looking at conducting trials with convenience stores and supermarkets, hopefully by the end of the year,” said Jason Pearce of Beijer Ref Australia.

Bitzer, meanwhile, announced the recent launch of its new ECOLINE+ series of CO₂ compressors. “Bitzer’s global sales of CO₂ compressors continue to increase year over year,” said Ian Suffield, engineering manager – compressor systems, Bitzer Australia.

Bitzer also announced the launch of the new OS series of compressors developed for use with ammonia.

Inderpal Saund, food retail business development manager at Danfoss, was enthusiastic about the number of the Danish firm’s ejectors for transcritical CO₂ systems currently in use worldwide: “We’ve got over 160 ejectors running globally. I think that’s pretty impressive.”

‘Natural refrigerants make good business sense’

The conference featured several case studies in industrial refrigeration, where presenters showcased exciting technological developments for natural refrigerants outside of the commercial sector.

Japanese manufacturer Kawasaki Heavy Industries presented the world’s first commercially available water-refrigerant turbo chiller.

Hayato Sakamoto, assistant manager, Engineering & Development Section, Aerodynamic Machinery Department, Kawasaki Heavy Industries, discussed the estimated CO₂ emissions for the turbo chiller in different cities in Australia and New

Left:
Michael Baker
Managing Director
AJ Baker & Sons

Right:
Steve Laing
National Commercial
Manager
Epta Australia
and New Zealand



 **ATMO** Business Case for
sphere Natural Refrigerants
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 **ATMO** Business Case for
sphere Natural Refrigerants
02/05/17 - Sydney

Zealand, using each city's respective ambient temperature conditions.

Sakamoto showed that, compared to a standard HFC centrifugal chiller, the Kawasaki turbo chiller would result in a 17% reduction in total CO₂ emissions in Brisbane, Australia and a 26% reduction in Christchurch, New Zealand.

Sakamoto cited several other estimates in cities such as Sydney, Melbourne and Perth. He concluded that, "in Australia, CO₂ emissions, overall, would be reduced by the water-refrigerant turbo chiller".

Another large Japan-based manufacturer, Mitsubishi Heavy Industries, presented a future project analysis for a Q-ton installation in northern Australia.

"This is a job for a twin-tower, 220-room, five-star hotel that's going to be built in the tropics in northern Queensland," said MHI's heat pump and hot water sales executive, Trent Miller.

The hotel's theoretical amount of hot water consumption is measured at 37,400 litres per day.

Miller showed that the projected average monthly energy consumption for the Q-ton would be 10 MWh compared to nearly 60 MWh for a traditional condensing boiler.

Much of the energy savings are due to the Q-ton's programmability, which allows the Q-ton to vary the amount of energy used throughout the day to match the hotel's hot water demand hour by hour.

The installation precedes their most recently completed Q-ton installation at Matterhorn Ski Lodge.

As conference attendees streamed out of Luna Park, they were left energised and optimistic about upcoming natural refrigerant growth and development ahead of upcoming ATMOSphere events being held in Bangkok (6 September) and Berlin (25-27 September) this year.







Danfoss' Inderpal Saund (l) and shecco's Chasserot (r)

Danfoss' TAFE training site

On the day after ATMOsphere Australia 2017, participants were invited to participate in an exclusive site tour of TAFE (Technical and Further Education) NSW (New South Wales), one of Australia's leading providers of vocational education and training.

The location is the site of a partnership between leading component supplier Danfoss and TAFE to provide Australia's refrigeration technicians with much-needed up-skilling and training for natural refrigerant-based systems.

The free visit, organised and sponsored by Danfoss, gave conference attendees a chance to see the facility first-hand, and to learn more about how the industry is working hard to engage the public.

Inderpal Saund, business development manager for Danfoss APAC, spoke of the recent resurgence in CO₂ systems in the market and how the TAFE NSW program aims to seize upon this opportunity to re-engage the public.

"The idea is that Danfoss is backing TAFE to try and rejuvenate some of that interest. To try and get the learning back into it," he said.

Leading system supplier Strathbrook Industrial Services supplied the two CO₂ systems (transcritical and subcritical) used by the students for training. The systems are connected to a simulated supermarket showcase floor along with two walk-in freezer units.

"You need a system that mimics what [end users] were putting in at the time, as well as what they are going to be doing in the future, which is transcritical [CO₂]," said Strathbrook Managing Director Ian Wilson, who led the facility tour.

Kim Limburg, president of the Australian Refrigeration Mechanics Association, who attended the site visit, was encouraged to see natural refrigerant training included in the curriculum.

"From a training perspective, it was important to see what the facility offered, in terms of physical training on site. To see that the [students] were learning about natural refrigerants was brilliant."

Limburg emphasised the fact that the level of engagement shown by industry-leading organisations was a step in the right direction for Australia.

"One of the things I acknowledged while I was there was, you have TAFE and you have the students, but you also have a wholesaler that's as actively engaged as Danfoss. What the HVAC&R industry needs is that engagement." ■ DY

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Food manufacturers seek NatRef solutions

This year's International Food Machinery & Technology Exhibition (FOOMA Japan 2017) saw several market-leading companies expand their natural refrigerant product lines. *Accelerate Australia & NZ* reports.

– By Devin Yoshimoto & Rena Okabe

Amid growing end-user demand driven by Japanese government subsidies and increased awareness of the long-term benefits of HFC-free systems, leading manufacturers were proud to display new natural refrigerant-based HVAC&R equipment at FOOMA Japan 2017 in Tokyo.

Over 700 companies and close to 100,000 representatives from the food manufacturing industry in Japan and around the world gathered at the tradeshow on 13-16 June.

FOOMA Japan is one of Asia's largest exhibitions for food machinery and processing technologies. This year, with an expanded exhibition area of roughly 15,000 square metres, several of Japan's leading natural refrigerant-based system suppliers spoke to *Accelerate Australia & NZ* about how they see the country's natural refrigerant market developing.

Industrial CO₂ competition increasing

Signalling an increasingly competitive market for CO₂ condensing units in Japan, Mitsubishi Heavy Industries Thermal Systems Co. Ltd (MHI) debuted its new HCCV1001 CO₂ condensing unit for the first time at the show.

The 10 HP unit, targeted at cold stores, has an operating temperature range of -45°C to -5°C and uses MHI's patented two-stage scroll-rotary compressor technology. This same compressor is also used in MHI's already successful CO₂ commercial heat pump water heater, the 'Q-Ton'.

Sales of the HCCV1001 began in April. Takeo Koiso, sales department manager for MHI, told *Accelerate Australia & NZ* that they had already exceeded expectations.



MHI debuted its new HCCV1001 CO₂ condensing unit at the show.

"We will have several HCCV1001 CO₂ condensing units installed this year in Japan," Koiso said.

In fact in recent months, demand has been strong enough to prompt the company to already begin developing a 20 HP version.

"We are now planning to launch a 20 HP unit in September 2018," said Koiso.

Koiso was very optimistic about displaying the new condensing unit at the FOOMA show this year.

"We are excited to have sold so many units in a short period of time and we are seeing a lot of interest here at FOOMA," he said.

In addition to CO₂ solutions for cold stores, several companies showcased their tunnel freezer solutions.

System supplier Takahashi Manufacturing was keen to showcase its CO₂ booster tunnel freezer solution this year after debuting it to large crowds at the FOOMA Japan exhibition in 2016.

The CO₂ booster system is the first of its kind for industrial applications and was first installed in March 2016 at a processing facility of Tokyo-based food manufacturer Wellfam Foods Corporation.

Tomokazu Naruta, president of Takahashi Manufacturing, updated *Accelerate Australia & NZ* on the performance of that installation and outlined the company's vision moving forward.

"It's been a little over one year and the system is performing well," said Naruta. "We've had no big issues. It runs like a normal freezer, even during the summer months."



Rei-tech/Liebherr R290 showcase (left), R600a showcase (right)

The company has received such good feedback from the end user that it has revised its sales targets and predicts a bright future for CO₂ booster systems in industrial applications.

"According to Wellfam Foods Corporation, when they install a new freezer, it will use natural refrigerants," Naruta remarked. "Immediately after the installation, we were aiming to sell two units per year," he said. "But now we are aiming for five per year. Soon, CO₂ booster systems will no longer be unique for industrial freezing applications."

Naruta was optimistic about the opportunities for ammonia-free solutions in freezer applications.

"There are many users who don't want to use ammonia, so there is a large opportunity for CO₂ booster systems," he said.

"I believe that in two to three years, after training and education around CO₂ booster systems has increased sufficiently, people will be well aware that CO₂ booster systems can compete with NH₃/CO₂ cascades," said Naruta.

Takahashi Manufacturing joins Mayekawa and MHI in providing freezer solutions.

Mayekawa's Chorus Total Freezing solution was on display at the exhibition. The Chorus tunnel freezer is used in combination with the company's NewTon NH₃/CO₂ package.

At the show, Mayekawa announced the expansion of its NewTon NH₃/CO₂ line-up with the new NewTon CH system.

The CH model is half the size of the standard NewTon system and provides 135 kW of refrigeration capacity versus the 237 kW capacity of the standard NewTon.

"Once sales begin, we hope to sell 100 units of the NewTon CH system per year," said Yutaka Arai, assistant general manager at Mayekawa.

Arai explained that the system was developed in response to growing demand for a more compact solution from small and medium-sized companies.

In addition to the reduced-size NewTon CH, Mayekawa has also developed the 'Sierra-A' air-cooled NH₃/CO₂ chilling package.

The Sierra-A, a follow-up to the popular water-cooled Sierra-W unit, was on display for the first time at the FOOMA Japan exhibition.

"We have been receiving a lot of demand and interest from food manufacturers in Japan for this air-cooled solution," said Hidehiro Kitayama, sales manager at Mayekawa.

Subsidies inspiring industry leadership

Japanese government subsidies for cold stores and the leadership of the sector's largest companies are helping to grow the market for natural refrigerants in industrial applications, according to MHI's Koiso.

The launch of the MHI HCCV1001 CO₂ condensing unit at the show this year was timed to coincide with the opening of the first round of applications for Japan's Ministry of Environment subsidy for natural refrigerant systems, which ran from April through May of this year.

The subsidy is available for cold store operators who wish to install natural refrigerant systems. According to Koiso, the number of applicants had already exceeded the maximum.

Additionally, Koiso commented on the fact that the largest companies are taking the lead in adopting natural refrigerant solutions, such as the HCCV1001, for their cold store businesses, and the rest of the industry is following suit.

"The awareness and demand among the cold storage industry for HFC-free products is increasing, mainly due to the big name companies taking the lead," he said.

The first HCCV1001 installation is being planned for Yokohama Reito, one of the largest refrigerated warehouse operators in Japan.

Another company is moving forward with an installation despite not having received the subsidy, Koiso added, without naming the company specifically.

Rei-tech, a leading Japanese distributor of showcases, displayed its line of Germany-based showcase manufacturer Liebherr's R290 and R600a brand-able showcases.

The showcases feature the option for companies to more prominently display their branding on the unit.

"Many companies are interested in this concept. As an added benefit, branding these HFC-free, environmentally responsible showcases is a great way to

promote the company's sustainability messaging," said Rei-tech's director of merchandise strategy, Masahiko Kato.

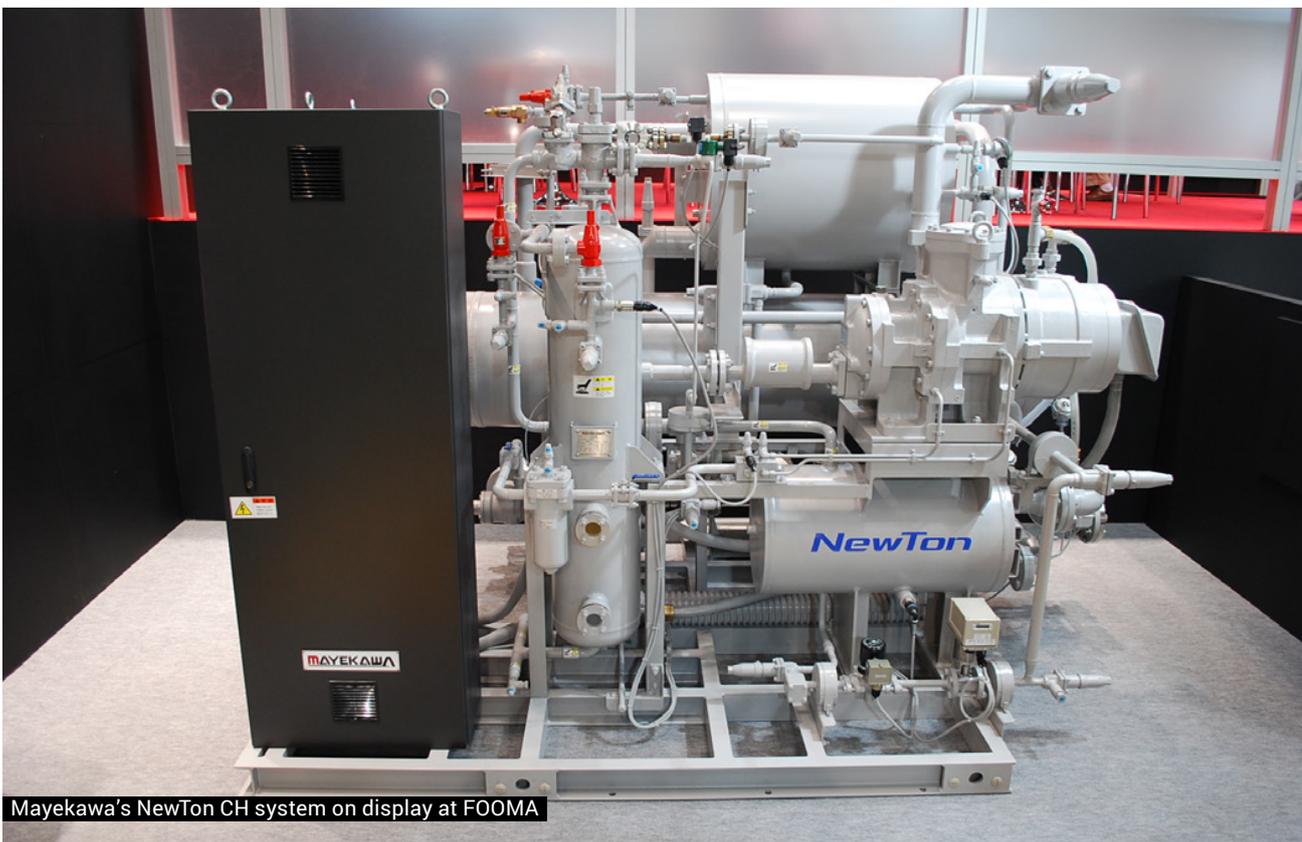
Though subsidies are available for cold store operators, they are not currently available to food manufacturers.

However, interest and awareness among food manufacturers of the benefits of converting away from HFCs remains strong.

"Many large companies are replacing R22 with natural refrigerants in food manufacturing," said George Miyajima, director of the food division at Mayekawa.

"In fact, food processing associations have submitted a report showing how many freezers are in the market and what percentage of them are still using R22 in order to push for subsidies for food manufacturers."

Exciting times, then, for natural refrigerants in Japan. ■ DY & RO



Mayekawa's NewTon CH system on display at FOOMA

BoReas

Efficient & All Natural NH₃/CO₂ Chiller

*A New Wind in Energy Conservation
with Environmentally Conscious Design*

COP=2.65

(DB35C, CO₂ -6C leaving temp)

Efficient semi hermetic reciprocating
compressor installed

Natural & Sustainable Refrigerant

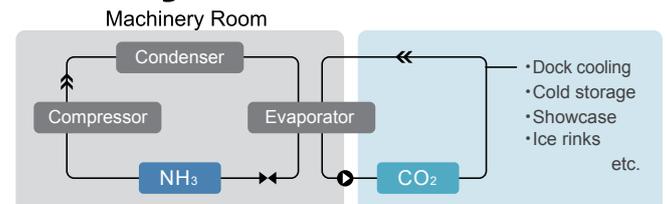
NH₃ (primary) : ODP = 0, GWP = < 1

CO₂ (secondary) : ODP = 1, GWP = 1

Optimized VFD Operation

VFD on main motor and condenser fans can
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Sealed design by semi-hermetic motor
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refrigerant charge by microchannel condenser
and NH₃/CO₂ indirect cooling method.



U.S. NatRef industry determined to grow

Thanks to their superior efficiency over HFC-based systems, uptake of natural refrigerant-based HVAC&R solutions is poised to increase in the United States despite a climate of regulatory uncertainty. *Accelerate America* reports from ATMOsphere America 2017.

– By Andrew Williams & Michael Garry

On 1 June, President Donald Trump announced that the United States would pull out of the landmark, globally accepted Paris Agreement on mitigating climate change.

While there has been much speculation about the impact of this decision, 78% of attendees polled at ATMOsphere America 2017 – held in San Diego on 5-7 June – said they did not expect the market prospects for natural refrigerant solutions in North America to be affected.

Speakers taking part in the seven-person ‘Thought Leaders’ panel discussion – which kicked off the conference – echoed that view. “There’s too much momentum [behind natural refrigerants],” said Bryan Beitler, vice-president and chief engineer at Source Refrigeration, an Anaheim, California-based contractor with 1,400 technicians. “Folks have already invested significantly.”

Scott Martin, director of business development and industry relations at Hillphoenix, said it would be “shortsighted” for businesses to react adversely to U.S. withdrawal from the Paris accord. “Ultimately, I don’t think it’ll have much of an impact on the adoption of natural refrigerants,” he said, pointing out that natural refrigerants’ strong track record should lead to future growth.

The Thought Leader panelists saw many positive signs for natural refrigerant growth in North America. “I believe the train is leaving the

station,” said Antoine Azar, who after 16 years at the Coca-Cola Company now runs a consulting business called Sustainable Solutions.

Fernando Campos, deputy director for sustainability infrastructure at Walmart Mexico, said that, “to improve the sustainability of our operations, we need to take a deep look at natural refrigerants. Over the coming years it will make more and more sense to invest in these technologies. We think there is a business model in place”.

Walmart, which operates stores in 28 countries, is weighing options for complying with the global HFC phase-down put in place by the Kigali Amendment to the Montreal Protocol last October. The retail giant currently has 34 outlets in Mexico with self-contained propane (R290) cases, “which will become a bigger number by the end of the year,” said Campos. Walmart has also installed CO₂ systems in the U.S., Canada and Africa.

Whole Foods Market is another retailer that is investigating the adoption of natural refrigerant-based systems. With 465 total stores, Whole Foods now runs 22 using CO₂ in some form in a remote system, with 12 that employ only natural refrigerants, including 10 transcritical operations. More than 50 Whole Foods stores have propane display cases.

Tristram Coffin, director of sustainability and facilities at Whole Foods Market’s Northern California Region, extolled the virtues of natural refrigerants.



Thought Leaders Panel, ATMOsphere America 2017

"These are good refrigerants," he said. "They're efficient, and they work well. That's why we're all sitting in this room today – not because we're worried about regulation, but because we know that natural refrigerants have a positive effect on the environment and on companies' bottom lines."

Gerard von Dohlen, president of Newark Refrigerated Warehouse, is convinced that ammonia, hydrocarbons and CO₂ are the refrigerants of the future. "They are easy to handle and easy to use," he said. "They can take all kinds of abuse, they're tolerant of oil, they run really well, and they're very resilient."

Coffin pointed out that there's a "huge opportunity" to "merge expertise" about natural refrigerant applications in the commercial and industrial sectors "so we can move forward as one rather than in separate sectors".

Praise for propane

Propane got a lot of support at the panel discussion. Coffin argued that R290 in self-contained display cases is already becoming a mainstream refrigerant in food retail today. "[OEMs] True and AHT have dedicated their cases to propane almost exclusively, so [retailers] will be buying natural refrigerant-based systems whether they know it or not," said Coffin.

Self-contained propane cases are particularly suitable, Coffin added, in smaller urban stores and mixed-use buildings "where you can't fit in centralised racks".

"In retail applications, R290 is hard to beat," added von Dohlen.

Chiming in from the audience, Jim Rutz, global platform director, light commercial, for compressor maker Tecumseh Products Company, declared: "The war is over. R290 has won in the small commercial marketplace. There are a few manufacturers who don't realise it yet, but they're going to get steamrolled." His remarks elicited applause in the room.

However, one challenge facing the use of self-contained propane cases is meeting the requirements of store merchandisers "who care about case depth and width and want to know that they can merchandise their products," noted Coffin.

An oft-cited limitation of hydrocarbons is the small charge that is allowed – 150g for commercial applications (60g for water coolers) and 57g for domestic uses – by the U.S. Environmental Protection Agency (EPA).

At a global level, the International Electrotechnical Commission (IEC), through its SC61C Sub-Committee Working Group (WG4), is focused on raising the charge limit for flammable (A3) refrigerants by next year. The new maximum charge under consideration for propane is 500g.

"From a technical perspective, the challenge is always going to be charge limits," said Coffin.

“To improve the sustainability of our operations, we need to take a deep look at natural refrigerants.”

– Fernando Campos, Walmart Mexico

“Assuming we can get beyond the charge limit regulations, we’ll be in really good shape – R290 self-contained cases will be a winner across the board.”

With regard to the flammability of hydrocarbons, Walmart’s Campos said that could be dealt with via proper design, operation and maintenance. “When the gasoline car came out, you could have said it’s dangerous so let’s keep riding horses,” he said.

Beitler of Source Refrigeration emphasised the importance of training technicians on propane as well as other natural refrigerant technology. Some manufacturers, such as True Manufacturing with its propane cases, “have a great contractor supply network to take care of their systems,” but others “don’t have a strategy for repairs”.

Source Refrigeration has its own training facilities at three locations where it keeps its technicians up to speed on the latest natural refrigerant technologies. Beitler also works on training with groups like RSES, NASRC and RETA, with whom he is working on a CO₂ certification manual.

What about HVAC?

Coffin expressed the view that “we don’t talk enough about naturals in the HVAC space”.

Taking up that challenge, Campos noted that because commercial HVAC systems are mostly situated on rooftops, flammable hydrocarbon refrigerants could be employed with minimal risk using a secondary refrigerant inside the occupied space.

While some of these systems exist in Europe, they are not available in North America. “It’s important to get

that here,” he said. “We need a rooftop unit to operate with a natural refrigerant, whether R290, CO₂ or ammonia.”

Hillphoenix’s Martin observed that with the advent of low-charge ammonia systems, “ammonia would be great for [commercial] air-conditioning”.

Von Dohlen believes ammonia could be used in hotels in large central air-conditioning systems using centrifugal compressors, though others noted the obstacles posed to such applications by local codes and high costs.

Dealing with uncertainty

The panelists did not shy away from delving into other challenges facing natural refrigerant adoption. For example, along with its withdrawal from the Paris accord, the Trump administration has created some uncertainty with its aggressive anti-regulatory posture, they noted.

“How do you build a refrigeration system that copes with the lack of certainty about regulation in the United States in the coming months and years?” asked von Dohlen.



San Diego, California



“The war is over. R290 has won in the small commercial marketplace.”

– Jim Rutz, Tecumseh Products Company

“I’m trying to build systems that avoid uncertainty, because I don’t know what’s going to happen.”

Added the humorous von Dohlen: “There’s nobody in this room who has a better guess than my cocker spaniel what Trump is going to do next!”

OEMs, end users and engineering groups, Coffin pointed out, need to manage to “the most stringent regulations in the marketplace,” which could end up being the HFC-reduction rules under consideration in California.

Perhaps the biggest challenge facing the natural refrigerants marketplace is finding a good retrofit solution for existing facilities, since retrofits through drop-ins are not yet possible with naturals, and end-of-life system retrofits can be cost-prohibitive.

Coffin agreed that finding a cost-effective retrofit solution for natural refrigerants is “the Holy Grail”. “We’ll still be talking about this in 10 years until we come up with a better retrofit solution,” he said.

Hillphoenix’s Martin warned that HFO refrigerants also represent a retrofit option for end users. “Make no mistake – there will be a play in our lifetimes for HFOs and HFO blends,” he said. “For every one of us innovators here, there may be a hundred who would love to have a refrigerant they could drop in to their systems today. The world wants a drop-in, simple solution. It’s up to us as contractors, installers, engineers and equipment designers to build low-cost, highly efficient systems.”

Azar of Sustainable Solutions urged putting a greater emphasis on total cost of ownership (TCO) in the evaluation of natural refrigerant-based HVAC&R solutions. That includes considering the efficiency and other attributes of these systems.

“We know that natural refrigerants are efficient,” said Azar. “We know they work. It’s not like 15 years ago. Now, it’s about mass production – and going to market.”

Ricardo Garcia, director of engineering and projects at Mexican cold storage operator Frialsa, is another firm believer in the TCO argument. Five of the company’s 24 cold storage facilities use NH₃/CO₂ systems.

“At first, NH₃/CO₂ systems may be more expensive,” he said. “But your return on investment down the line will be better with natural refrigerants. We look at natural refrigerants because they’re good for the environment – but they’re also good for business.”

Coffin thinks more education of retailers and consumers about natural refrigerants could put pressure on retailers to make a change, but he put a lot of the onus for future progress on manufacturers. “If OEMs continue to invest more in natural refrigerant solutions and bring costs down, then end users are going to adopt them.” ■ AW & MG



U.S. retailers meeting retrofit challenge

At ATMOsphere America, Hannaford and DeCA demonstrate how to replace ageing HFC systems in existing stores with transcritical CO₂ systems.

– By Michael Garry & Andrew Williams

There are about 410 supermarkets in North America that have installed transcritical CO₂ refrigeration systems – not a lot compared to the just over 9,000 stores with transcritical systems in Europe, and the more than 2,400 in Japan. Still, it was just four years ago that the first transcritical system in the United States was deployed at a Hannaford Supermarkets outlet in Turner, Maine.

In North America, most of those installations have been in new stores. This has given rise to one of the hottest topics in the food retail industry – whether natural refrigerant-based systems can be economically installed at existing stores as a replacement for ageing HFC systems, thereby expanding the market for natrefs well beyond new stores (natural refrigerants are not generally considered acceptable drop-in substitutes for HFCs or R22 in central systems that are not old enough to be retired).

Representatives of Hannaford and the Defense Commissary Agency addressed this question in detail in the food retail panel discussion at ATMOsphere America 2017 last month in San Diego, California (5-7 June). Here are their stories.



Food retail panel, ATMOsphere America 2017

“ The results look promising; it looks like we’re meeting our energy goals. ”

– John Stuit, Defense
Commissary Agency

A suitable retrofit candidate

Last December, Hannaford, which has installed transcritical CO₂ booster systems in two new stores since 2013, began orchestrating its first transcritical retrofit at a 15,240m² supermarket in Raymond, New Hampshire (which the previous summer had sold a winning USD 487 million Powerball lottery ticket).

The 27-year-old store’s racks (R507 for low-temperature and R22 for medium temperature), piping, condensers, evaporators and display cases were all “at the end of their useful life,” said Harrison Horning, director of energy and facility services for Delhaize America, a subsidiary of the newly formed Dutch company Ahold Delhaize; he focuses on supporting Hannaford’s 181 stores in five northeastern U.S. states.

One of the fortunate features of the store from a retrofit perspective was that “there was ample space to put a new system while the old system was running next to it,” said Horning. The space came from moving an old emergency generator outside and removing an old air-conditioning rack.

Hannaford would like to find at least one store every year or two that similarly meets the criteria for retrofitting with a transcritical CO₂ system.

On a broader basis, retrofitting existing stores with transcritical systems supports Ahold Delhaize’s corporate goals for phasing out HFCs and reducing greenhouse gas emissions, which include lowering the average global warming potential (GWP) of refrigerants. In addition, these projects align with company’s commitment, as a member of the Consumer Goods Forum, to install, where viable, new equipment that utilizes natural refrigerants or other ultra-low-GWP refrigerants.

“That European influence is a significant motivator for us to move forward that may not exist with other U.S. companies,” he said.

First with parallel compression

The Raymond store retrofit, which provides 1.8 million BTUs/hr. of total heat of rejection, is Hannaford’s first transcritical system with parallel compression. It is also the first transcritical system to use hot high-pressure CO₂ gas for direct heat reclaim in a main HVAC unit.

In the store’s walk-in freezers and coolers, and in its compressor room, Hannaford has installed CO₂ leak detection, “respecting ASHRAE 15 and 34 requirements,” said Horning.



John Stuit, Defense Commissary Agency



Harrison Horning, Delhaize America / Hannaford

▶ A notable construction challenge in the retrofit was that the transcritical rack needed to be simultaneously hooked up to low-temperature and medium-temperature loads in new cases overnight to allow start-up.

“In a new store, you don’t think about that because it happens when nobody is looking,” said Horning. “In this case, it happened overnight, because we needed to be open and operational the next morning.” But the operation was “planned well and it worked OK”. Subsequent cases were phased in over the ensuing weeks.

Hannaford decided not to run some of the store’s display cases on CO₂, and those were linked to a separate R407A condensing unit. “So, the store is not 100% CO₂ but it’s well over 90%,” Horning noted.

Horning offered some caveats about doing a transcritical system retrofit. One was to “make sure that when the equipment leaves the factory, it’s ready”. In May, the system sprung a refrigerant leak after a fitting cracked. This was because the system was intentionally designed with additional pressure transducers on the high side and thus more threaded connections. “So, pay attention to factory engineering.”

He also advised having round-the-clock technical support available. This was true at the Raymond, New Hampshire store, which also required skilled welders to work on stainless steel piping as well as people with controls expertise.

Hannaford does not have any energy data on the retrofit transcritical system yet, but Horning expects its performance to be better than that of the original system, “not because of the CO₂ but just because it’s new”. He believes the parallel compression will “give us additional savings”.

Horning acknowledged that the first-cost premium for the transcritical system above a standard HFC system was in the 10%-20% range. “I truly believe that’s coming down every year as we do more projects,” he said. Moreover, when the Raymond store factors in heat reclaim, the premium “might have been closer to zero”. And he is “very confident” of a positive total cost of ownership.

The Raymond store was subsidised by Hannaford’s remodeling budget and by “another bucket of money specifically for advanced refrigeration and converting refrigerants,” he said.

However, under Hannaford’s new parent Ahold Delhaize, it is getting harder for the chain to secure funding to invest in refrigeration technology, Horning said. “So, we need to find the best solutions and show the business case for a system like this.”

Three retrofit transcritical stores

Another food retailer engaged in retrofitting stores with transcritical CO₂ booster systems is the Defense Commissary Agency (DeCA), part of the U.S. Defense Department. DeCA, with 240 stores worldwide, is the “supermarket to the military,” said John Stuit, its chief of design and construction who has been a refrigeration engineer for 31 years.

DeCA has been experimenting with different natural refrigerant-based systems since 2014, including transcritical CO₂ and ammonia/CO₂ cascades, “to find out what the end game is going to be,” said Stuit. “It’s certainly going to be some kind of natural refrigerant.”

Over the past year, DeCA has retrofitted transcritical CO₂ systems in three existing stores – in Newport, Rhode Island; Mojave, California (Edwards Air Force Base); and Mountain Home, Idaho. The climates of the three stores are marine, hot/dry and cool/dry, respectively.

All three installations use adiabatic condensers and parallel compression, both designed to enable transcritical systems to operate efficiently in hot weather.

At one site, which used installers who had not worked on a CO₂ installation before, “they managed to blow the entire charge right into the sales area,” Stuit said. “But it’s working well now.”

Like Hannaford’s Raymond, N.H., store, the three DeCA retrofit stores required significant caseloads (from 30% to 50%) for system start-up, said Stuit. “Store operations don’t like giving up display cases; they want to keep selling groceries.”

Stuit provided preliminary energy results for the transcritical system at the Newport, Rhode Island store over a six-month period (October 2016-April 2017), when there was 14% less energy consumption compared to the previous HFC

“That European influence is a significant motivator for us to move forward that may not exist with other U.S. companies.”

– Harrison Horning, Delhaize America / Hannaford

system. “The results look promising; it looks like we’re meeting our energy goals,” he said.

However, Stuit said the first-cost premium for the transcritical systems, according to his contractor, “is probably USD 200,000 for the typical store”. Depending on energy costs, the ROI for that ranges from five to 10 years for a system that will run for 15-20 years, he added.

DeCA has also installed a transcritical CO₂ booster system at a new store in Spangdahlem, Germany – a cool climate – that opened in May 2016. Preliminary data shows that the system consumes 23% less energy than a comparable HFC system. The agency plans to deploy a transcritical system in northern Italy that will be the first to include an ejector, which will help with efficiency in the warmer climate.

Ammonia-CO₂ retrofit

DeCA’s other natural refrigerant retrofit project, an ammonia-CO₂ cascade system from Hillphoenix, was installed at DeCA’s Lackland Air Force Base commissary in San Antonio, Texas, in November 2014, replacing an ageing R404A system; it went fully operational in August 2015. The store remained open during the installation (see ‘DeCA’s New Mission’, *Accelerate America*, February 2016).

The system – one of only four ammonia/CO₂ cascade systems installed in U.S. supermarkets – employs ammonia on the roof to condense CO₂ that is used in low-temperature DX cases and in medium-temperature cases via pumped liquid overfeed.

The rooftop ammonia is housed in nine individual 130,000-BTU refrigeration modules, each containing about 3.6 kg of ammonia. A separate fluid cooler is used with water-cooled condensers. The system uses 816.5 kg of CO₂.

After initial communication glitches between the ammonia and CO₂ parts of the system were resolved, the ammonia/CO₂ cascade system has been able to “achieve proof of concept – it works,” said Stuit, adding it would be “a viable alternative if commercialised”. The presence of ammonia on the roof has not proved problematic, even though the store is near other stores, schools and housing.

One challenge Stuit cited was overcoming the paucity of service contractors qualified to work with ammonia and CO₂. “The shortage of qualified technicians is very real,” he said.

The cascade system has met DeCA’s energy goal for the store as a whole. Store engineers expected 8% better efficiency from the system itself over the legacy HFC system, and Stuit believes “we met or exceeded that target”. ■ MG & AW



Australia passes HFC phase-down legislation

The government has passed legislation to phase down HFCs from 2018 and deliver an 85% reduction by 2036.

—By Andrew Williams

In a demonstration of Australia's commitment to achieving its international obligations under the Montreal Protocol, the government has successfully passed a bill to amend the existing Ozone Protection and Synthetic Greenhouse Gas Management (OPSGGM) Act by adding an HFC phase-down plan.

Both houses of the Australian parliament passed the bill, introduced in March, on 19 June.

The new bill, entitled the Ozone Protection and Synthetic Greenhouse Gas Management Legislation Amendment Bill 2017, obliges Australia to start phasing down HFC imports from 2018 to achieve its Kigali target of an 85% reduction by 2036.

HFCs, which are powerful synthetic greenhouse gases widely used in refrigerators, air conditioners, fire extinguishers and insulating foam, contribute up to 2% of Australia's national carbon-equivalent emissions.

"The Coalition Government's early action on passing this legislation demonstrates our continued international leadership and will constitute a significant domestic [greenhouse gas] emissions reduction of up to 80 million tonnes," said Josh Frydenberg, Australia's minister for the environment and energy.

"The bill will achieve these environmental outcomes at the same time as significantly cutting red tape, including reducing the number of businesses required to hold a licence by one third, halving the reporting obligations, and reducing the number of invoices sent by 94%," Frydenberg said.

No HFCs are manufactured in Australia itself. The HFC phase-down will be a gradual reduction in the amount of bulk HFCs permitted to be imported into Australia, beginning in January 2018. It will be managed through a quota system on imports.

Australia's HFC phase-down will cover only imports of bulk gas such as in cylinders. It will not cover gas imported in pre-charged equipment such as air-conditioners or refrigerators.

Bans on the import or manufacture of new equipment may be considered in future, says the government, "where alternative technologies are readily available". This will only be implemented following a review and further consultation with industry.

These bans, if adopted, would only apply to new equipment being imported or manufactured and not to equipment already installed in Australia.

"The Coalition Government's early action on passing this legislation demonstrates our continued international leadership and will constitute a significant domestic [greenhouse gas] emissions reduction of up to 80 million tonnes."

– Environment and Energy Minister
Josh Frydenberg

Existing equipment that has already been imported into Australia is therefore unaffected by the phase-down, the overall pace of which is designed to match demand and end-of-life equipment replacement. The intention is to align demand for HFCs with supply to avoid spikes in the price of HFCs that might lead to equipment being retired prematurely.

The Kigali Amendment to the Montreal Protocol, agreed in October of last year, puts in place a global HFC emission reduction plan that is estimated to save up to 72 billion tonnes in carbon-dioxide equivalent emissions by 2050.

In 2012-13, synthetic greenhouse gases represented 1.8% of Australia's carbon dioxide equivalent (CO₂-e) emissions. The vast majority of synthetic greenhouse gas emissions are HFCs, and those emissions were projected to increase had the government not taken action.

The HFC phase-down will contribute to Australia's target of reducing greenhouse gas emissions to 26-28% below 2005 levels by 2030. It is expected to encourage industry to move to technologies using lower or zero GWP alternatives, such as natural refrigerants.

Hailing the passage of the bill, Senator Louise Clare Platt, representing the opposition Labor Party, said: "Although hydrofluorocarbons make up only 2% of Australia's greenhouse gas emissions, their contribution to our emissions has been increasing, because they have been used to replace other ozone-depleting chemicals that are being phased out under the Montreal Protocol."

▶ “This bill now means that Australia’s phase-down is consistent with the international HFC phase-down under the Protocol that was agreed in Kigali in October last year,” Pratt said.

Cutting red tape

The new bill also streamlines licensing, reporting and administration of existing legislation, significantly cutting red tape.

The government has announced a number of measures to reduce the burden on business and improve regulatory efficiency, such as extending the refrigeration and air-conditioning and fire protection end use licence period to three years and allowing for licences to be renewed rather than re-applying.

The regulations applying to people who acquire, possess, dispose of or handle ozone-depleting substances (ODS) or synthetic greenhouse gases in the refrigeration, air-conditioning and fire protection industries will remain. This includes requirements for Refrigerant Handling Licences, Refrigerant Trading Authorisations, Extinguishing Agent Handling Licences and Extinguishing Agent Trading Authorisations.

Any individual (including a repairer or dismantler) who removes, handles or substitutes a HFC, HCFC, CFC or halon from any refrigeration and air conditioning or fire protection equipment must be licensed.

Licences can be obtained from the Australian Refrigeration Council or the Fire Protection Association Australia.

“ A predictable phase-down in HFCs can [...] deliver a range of benefits including reduced costs to consumers, better performance of refrigeration and air-conditioning equipment, improved energy efficiency and significant emission reductions. ”

– Greg Picker, Refrigerants Australia

Industry welcomes new bill

Australia’s HVAC&R sector broadly welcomed the passage into law of the amended legislation.

Greg Picker, executive director of Refrigerants Australia – a refrigerant suppliers and users group – said the legislation would grant industry long-term regulatory certainty and deliver an improved environmental outcome.

“Refrigerants Australia has long contended that a predictable phase-down in HFCs can assist the industry and deliver a range of benefits including reduced costs to consumers, better performance of refrigeration and air-conditioning equipment, improved energy efficiency and significant emission reductions,” said Picker.

Hailing the passage of the bill, Mark Padwick, president of manufacturers group the Air-Conditioning and Refrigeration Equipment Manufacturers of Australia (AREMA), said it would give industry the long-term certainty it needs to invest in new technologies.

“Manufacturers must contend with a range of issues when they select which refrigerant to use. They need to consider safety for the consumer, energy efficiency, cost, suitability and environmental impacts,” Padwick said.

The reduction scheme will begin on 1 January 2018 with a 25% reduction of the baseline granted to Australia under the Kigali Amendment. This translates into an annual import limit of eight megatonnes (Mt) CO₂-e.

The phase-down will have reductions at the start of each two-yearly quota allocation period, aligned with licensing periods under the OPSGGM Act.

The end point of an 85% reduction will be reached on 31 December 2035, which equates to 1.608 Mt CO₂-e annually from 2036 onwards. The end point is calculated by taking 15% of the average HFC imports and 75% of HCFC imports for the period of 2011–2013. This approach is consistent with HFC phase-down agreement under the Montreal Protocol.

The scheme will allow for quota transfer. Businesses may trade their quotas if they wish to do so. The government is aiming to announce quota allocations in late 2017, depending on the passage of the legislative amendments. ■ AW

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ARC accreditation scheme in the spotlight

In a continued effort to up-skill Australia's HVAC&R industry, the Australian Refrigeration Council (ARC) has put in place a new accreditation scheme that includes natural refrigerants.

– By Devin Yoshimoto

On 1 July, the Australian Refrigeration Council launched a new accreditation scheme for technicians, which includes natural refrigerants.

The new scheme is separate from the existing licensing structure and adds guidelines for natural refrigerant training in Australia.

“What the ARC are doing is stepping outside their historical position, and embarking on putting in place an accreditation scheme which incorporates key refrigerants that are not currently covered by the existing Ozone Depleting Substances and Synthetic Greenhouse Gas (ARCTick) licence scheme,” said Glenn Evans, chief executive officer of the Australian Refrigeration Council, at the ATMOSphere Australia 2017 conference in Sydney on 2 May.

“Initially, the refrigerants we're looking at to be part of the scheme include: hydrocarbons, CO₂, ammonia, and class A2/A2L refrigerants,” he said.

The ARC has been appointed as the RAC Industry Board, which administers the Australian refrigeration and air conditioning licensing scheme on behalf of the Australian government, with over 85,000 licenced individuals and businesses Australia-wide.

The goal of the new scheme is to help Australian industry to respond to new refrigerants that are now being adopted in response to the country's HFC phase-down.



Glenn Evans, CEO, ARC

“[It] will provide an up-skilling pathway for technicians and assist in new technology and refrigerant uptake,” said Evans.

The ARC has registered a great deal of interest in the new accreditation scheme from technicians who would like to familiarise themselves with new refrigerant types.

Evans hopes the announcement will serve an important role in bringing the wider industry together to better prepare for the coming refrigeration technology changes.

“We've had hundreds of phone calls to the ARC saying, 'when are you going to do this?' So, there is a real grassroots swell demanding this training,” says Evans.

“Hopefully [the technicians] will be better positioned to actually work in this field and support the uptake of new technology,” he adds. ■ DY

“ There is a real grassroots swell, demanding this training. ”

– Glenn Evans, Chief Executive Officer,
Australian Refrigeration Council



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The ARC Green Scheme Accreditation is a voluntary, qualifications-based program run by the ARC, the peak body for the climate control industry.

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SCM Frigo, Beijer Ref bring CO₂ condensing units to Australia

Accelerate Australia & NZ spoke to SCM Frigo Technical Director Mirko Bernabei and Key Account Manager Anna Stella about the company's small format CO₂ condensing units coming to Australia and growing interest in CO₂ from end users.

– By Devin Yoshimoto

Following the official passing of HFC phase-down legislation by the Australian government on 19 June, the Australian market is now set to begin phasing down HFC imports beginning in January of next year.

As such, interest in natural refrigerant-based systems is continuing to increase as key players in Australia look towards solutions developed overseas to help manage the phase-down.

Signalling this interest is the announcement by Italy-based SCM Frigo S.p.A that they will be bringing their new CUBO₂ Smart CO₂ condensing unit to Australia later this year.

Accelerate Australia & NZ spoke to SCM Frigo Technical Director Mirko Bernabei and Key Account Manager Anna Stella about the company's history of working with CO₂-based refrigeration systems and the opportunities they see for them in Australia.

A decade of CO₂ development

SCM Frigo began working with CO₂ in 2004, developing cascade systems for customers in their largest market of Scandinavia. At the time, the company was responding to growing demand from those customers for alternative refrigerants.

"There was a need for CO₂ units because of the huge taxes they had to pay for using HFCs in the European Nordic countries," says Stella.

Progressive legislation, combined with an overall high regard for environmental protection in that region, continued to drive the market further away from HFCs.

"The Scandinavian countries have always had more focused strategies in terms of eco-friendly development and the use of refrigerants. They are generally greener countries and taxation on HFC refrigerants was very high," Stella explains.

In response, SCM Frigo – just one year later in 2005 – began developing transcritical CO₂ systems. Asked why the company had committed so heavily to CO₂, Bernabei explains that they believed it to be the best long-term solution at the time.

"We decided on CO₂ because we were convinced that CO₂ was easiest to manage," says Bernabei. Their customers were looking for a solution that was easy, reliable, and would be future-proof and provide long-term certainty.

This commitment to CO₂ has paid off. SCM Frigo has seen a lot of success in Europe, along with several countries overseas.

As Bernabei stated at the ATMOsphere Australia conference in May 2017, "we now have more than 1,800 transcritical racks installed in 25 countries. They are operating in Europe, which is our main market, along with South Africa and South America".

Their line-up of CO₂ solutions extends also to industrial systems and most recently light commercial, with the recent release of the CUBO₂ Smart CO₂ condensing unit.

The small-footprint unit has a cooling capacity of 0.6 up to 8.5 kW and was developed in response to market demand for smaller commercial applications.

"These days, the market is asking us to provide something for small capacities. The condensing unit was developed to fill this need, while at the same time, keeping it simple and staying [cost] competitive," says Bernabei.

Opportunity for CO₂ condensing units in Australia

With the success the company has seen with CO₂ systems over the past 12 years, they are now confident the timing is right to share this technology with the Australian market.

To do this, SCM Frigo is working very closely with Beijer Ref Australia to promote CO₂ in Australia. SCM Frigo is a 100% wholly owned subsidiary of Beijer Ref group who helps with sales of SCM Frigo systems.

Currently, the company only has a few CO₂ systems running in Australia, but sees that situation changing quickly in the near future.

"In Australia, we still only have a few installations. We have three cascade systems at the moment and no transcritical systems yet. However, we are very close to delivering our first transcritical system," says Bernabei.

Bernabei and Stella also reveal that the company is starting its first trial runs for the CUBO₂ Smart CO₂ condensing unit with a key customer later this year. ▶





▶ Peaking interest

Among the wider HVAC&R industry, awareness of natural refrigerant-based systems is continuing to build. As companies discuss what their options are for energy-efficient and environmentally-friendly solutions, natural refrigerants are becoming increasingly attractive.

Bernabei explains how SCM Frigo is closely involved in these discussions and is seeing, at first hand, the changing mind-set among end users. "We are definitely in the right moment," he explains, "because they are quite ready. They want to start".

End users remain cautious, however, in these initial stages. "Before they go for a solution, they need to see all of the simulations. Not only from a technical point of view but also from an economic point of view, to understand which solution best suits their needs," Bernabei says.

One of the key challenges for CO₂ solutions in Australia, of course, is warm ambient temperatures which can reach 40°C in the hottest summer months.

However, as Bernabei explains, SCM Frigo brings a wealth of experience from similar climates in Europe, having completed CO₂ installations in Italy and the south of France.

So, the challenge was not necessarily technical but rather an economic one. SCM Frigo chose to use an adiabatic system in the CUBO₂ Smart unit to help manage the high ambient temperatures.

This allowed for the best compromise between technology and affordability, keeping in mind that initial cost and simplicity are the most important factors for end users.

"It would be unrealistic to expect customers to invest twice or three times the price just to stay green," argues Stella.

"Adiabatic systems are the best compromise, to have good efficiency without impacting the complexity of the unit," Bernabei adds.

As SCM Frigo nears the final stages of several tenders with customers, it seems likely that the market in Australia will now begin to follow the same path seen by the company several years ago in Europe.

"The timing is right," says Bernabei. "Now we just need to support them in these last evaluations and as soon as they have some installations in operation, I think they will be more confident in choosing CO₂ compared with the traditional refrigerants."

For both Stella and Bernabei, environmental responsibility is both a professional and a personal mission. The company's mission and vision, Bernabei states, is in fact derived from personal values.

"We have been dealing with natural refrigerants in general, for example in 2010, we also introduced a range of ammonia packs to support the green alternatives in the market," says Bernabei.

Bringing these natural refrigerant-based systems to Australia and sharing that knowledge, ultimately, is what drives them.

"That opportunity to share this experience with others, and the possibility to participate in that change, is the reason why I like my job so much," says Stella. ■ DY

UPCOMING EVENTS

Interactive conferences bringing together decision-makers from industry and government to change the future of heating and cooling technologies, naturally



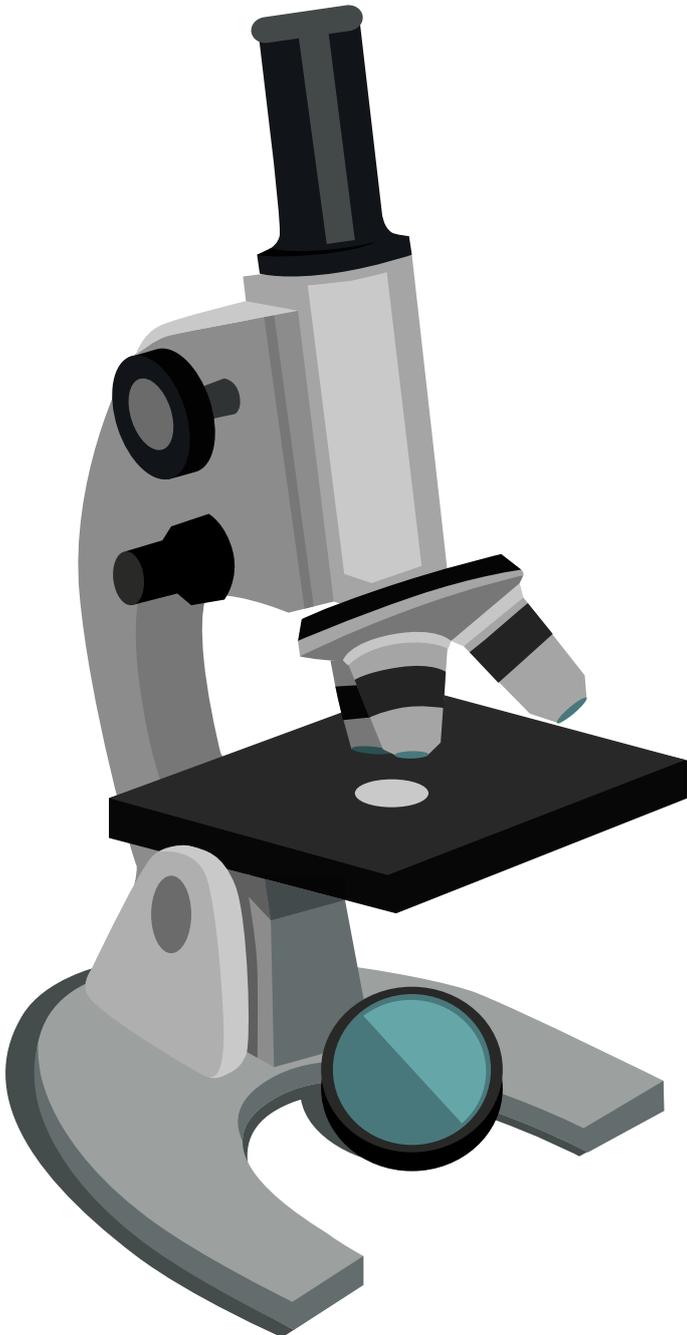
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Propane heat pumps under the microscope

For heat pumps to be more successful they must be efficient, have a low environmental impact and be economical to buy. Propane heat pumps meet all these requirements. So what can be done to boost their uptake?

– By Charlotte McLaughlin & Nina Masson

According to the European Commission, heating and hot water alone account for 79% of total final energy use in EU households. Space and process heating, meanwhile, accounts for 70.6% of EU industry's energy consumption. Reducing this, therefore, can help to slash energy bills for consumers and businesses alike. Heat pumps are one way to do this.

According to the Australian Bureau of Statistics, in Australia heating and cooling can account for more than 40% of a household's annual energy consumption. Just over half of Australian households use electricity for their hot water system (56%), over one third use mains gas for it (38%), and 10% uses solar hot water systems. A household may use more than one source of energy as a result of having more than one hot water system or boosters on solar hot water systems.

Frequent heat waves add to pressure on energy demand. As a result governments in New South Wales (NSW) and the Australian Capital Territory (ACT) have warned residents that air-conditioners should go no lower than 20°C. Authorities warn any extra power could lead to load shedding.

The issue of energy demand is not limited to the eastern seaboard. The use of air-conditioning was blamed for the blackout that affected 40,000 people in south Australia this February, according to reports in the Guardian.

Efficiency – propane’s trump card

During the 22nd Meeting of the Conference of Parties on Climate Change in Marrakesh (COP22) last November, Didier Coulomb, director-general of the International Institute of Refrigeration, urged the refrigeration and air-conditioning sector to improve energy efficiency and reduce HFC consumption in order to help meet the emission reduction objectives of the Kigali Amendment to the Montreal Protocol and the Paris Agreement.

“The replacement of today’s technologies using high-GWP refrigerants needs to go hand in hand with a true effort of increasing the energy efficiency of facilities and systems more generally,” Coulomb told delegates at COP22.

A recent report by European natural refrigerant advocates Eurammon reveals that the natural refrigerant propane could increase the energy efficiency of air-conditioning systems.

“Propane [...] is considered to be one of the most efficient refrigerants,” Eurammon says in its latest paper on hydrocarbons. It points out that hydrocarbons are already being applied to air-conditioning systems.

A EU-funded research project, called ‘Next Generation Heat Pumps working with Natural fluids’ (NxtHPG for short), looks at ways of reducing the environmental impact of heat pumps to help them fulfill their true potential.

The project developed five reliable, safe, high-efficiency and high-capacity heat pumps (prototypes capacity around 50 kW) using hydrocarbons and CO₂ – very efficient heat pumps that had a “10 to 20% increase on Seasonal Performance Factor (SPF) compared to current HFC and HFO equivalent equipment,” according to the NxtHPG report.

Two of the heat pumps use hydrocarbons as the refrigerant – cases one and two – and both achieve very high coefficients of performance (COP) far exceeding the market standard.

For example, case one (see ‘Box’) achieves a COP of 3.43, which is 20% higher than the comparable reference unit provided by Spanish manufacturer CIATESA, whose COP is 2.96.

In case two, the COP was 11.1% higher (with a COP of 4.47) than CIATESA’s comparable reference unit (whose COP is 4.02).

The prototypes that were developed under this project will be sold commercially.

The researchers behind the project are optimistic that the market will change. They write, “it should be noted that propane experienced three-digit growth in 2014 in light commercial equipment (vending machines, remote display cabinets)”.

- ▶ Case One is a 40 kW hydrocarbon air-to-water heat pump (HP) for the production of hot water for heating, also covering low demand for domestic hot water (DHW) with the use of a desuperheater. The unit is reversible on the refrigerant circuit, providing either heating in winter and cooling in summer.
- ▶ Case Two is a 60 kW geothermal hydrocarbon HP for hot water production for heating also covering low demand for DHW with the use of a desuperheater. The unit is reversible on the refrigerant circuit, providing either heating in winter and cooling in summer.
- ▶ Case Three consists of a 50 kW HP CO₂ booster from a neutral water loop (10-30°C) – for example, recovery of waste heat from condensation (25-30°C) or sewage water (10-15°C) producing DHW at up to 60°C.
- ▶ Case Four is a 30 kW air-to-water CO₂ HP for sanitary water production at 60°C or up to 80°C for high temperature applications.
- ▶ Case Five is a 50 kW air-to-water CO₂ HP for heating applications. It targets the replacement of old gas boiler heating systems.

▶ The times they are a-changin'

In a clear sign of the transformation underlying the heating and cooling sector in Europe, brand new propane heat pumps saw the light at a big German trade show in Frankfurt.

ISH – the Bathroom Experience, Building, Energy, Air-conditioning Technology, and Renewable Energies tradeshow – held on 12-16 March 2017, showed off R290 models from manufacturers like Heliotherm, Glen Dimplex, Alpha Innotec, and NIBE.

The most eye-catching heat pump on show was the so-called “world’s most efficient geothermal heat pump, thanks to the use of R290,” according to Rudi Bellinger, who works in sales support at Heliotherm. Its seasonal coefficient of performance (SCOP) reaches a record high of 6.7.

The AIT (Austrian Institute of Technology) research institute and Germany’s TÜV (an international certification organisation) tested the heat pumps in early 2016. The first units were sold in mid-2016.

Heliotherm’s primary motivation for investing in propane technology was “the energy efficiency advantages it brings,” Bellinger told *Accelerate Europe*.

Glen Dimplex, a consumer electrical goods firm headquartered in Dublin, Ireland, also presented a new R290 heat pump at the show – the System Zero HP. “The unit can be used for both heating and cooling,” says Volker Rühle, director of international sales – heating & ventilation at Glen Dimplex.

Sweden’s NIBE has been producing an exhaust air source heat pump with R290 since 1998. The exhaust heat pump works by taking the heat from waste air leaving the building, pumping it back in to provide heating and hot water.

The latest models use 400g of the refrigerant R290 and are for outside placement.

Roger Johnsson, NIBE’s product manager, says: “We are not talking about the refrigerant when we talk to our customers. We want to offer the best products, and R290 allows us to do so.”

Johnsson believes that the climate change dimension will become more significant for consumers as the EU’s f-gas phase-down continues. “We believe customers will become more aware of the environmental dimension of the refrigerant being used,” he says.

“The lack of components can of course also be a reason why not that many unit manufacturers offer units with natural refrigerants,” he warns.

He feels NIBE is well positioned to take on this challenge, with nearly 20 years of experience in natural refrigerants. “It’s no secret that we are actively looking into R290, because we see propane as one the refrigerants of the future.”

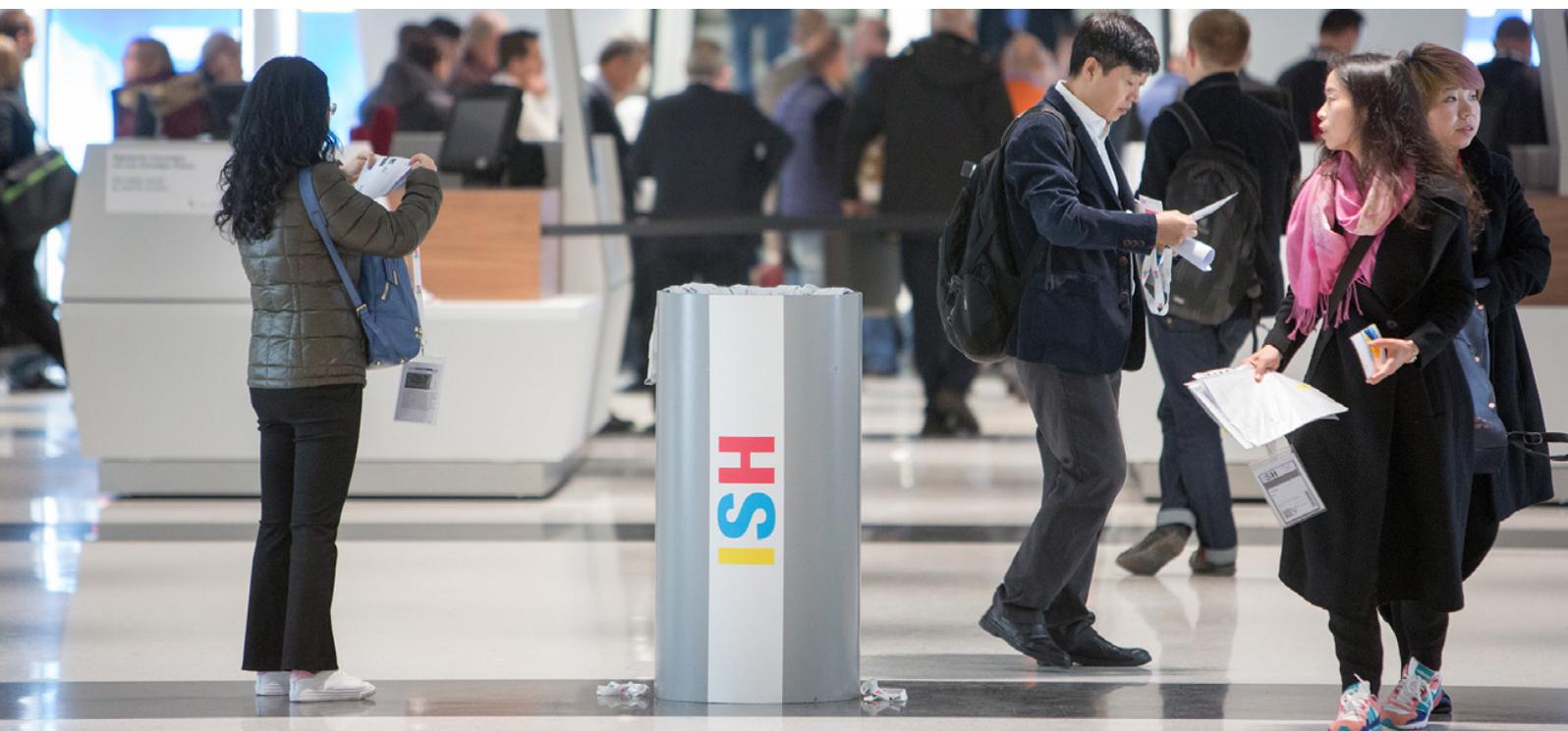
Germany-based company Alpha Innotec (AIT) also presented a heat pump model using propane. Andreas Schrof, area sales manager at AIT, says the company’s 20 years of experience in developing R290 in heat pumps has paid off. “The system is our most popular product overall,” Schrof says.

With a very silent operation at 61 dB, AIT’s heat pump is available in 5 kW, 7 kW and 9 kW models, which can then be combined into two units to achieve a total combined capacity of 18 kW. It provides cooling as well as heating.

The product AIT presented at ISH – the alira LWDV air-water heat pump – uses inverter technology, something new in the European heat pump market.

“We have an industry-leading position for natural refrigerant-based heat pumps, which we intend to keep. To our knowledge, we are the first to launch an R290 heat pump using inverter technology,” Schrof says.

Propane, then, is increasingly looked upon as the refrigerant of the future for heat pumps. ■ CM & NM



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AHT banking on propane for food retail

The Austrian company sees propane as a flexible, energy-efficient and cost-effective choice for retailers looking for future-proof cooling solutions. It already has over one million propane-based food and beverage retail cabinets in operation worldwide. *Accelerate Europe* reports.

– By Andrew Williams



Having used propane for over two decades already, AHT Cooling Systems GmbH remains 100% committed to this natural refrigerant as a means of reducing the energy consumption and environmental impact of its retail cabinets. *Accelerate Europe* spoke to Reinhold Resch, vice-president (research and development) at the Austrian firm, to find out more.

Over one million propane-based AHT cabinets are already operating in retail stores worldwide. "We think propane is the best solution on the market for supermarket units," Resch says.

At the EuroShop retail tradeshow in Düsseldorf, Germany in March, AHT presented its newest environmentally friendly cooling solutions for supermarkets. Chief among these is the new Vento Green refrigerated shelf, which took pride of place at AHT's booth. Produced in Austria, it naturally uses propane as the refrigerant.

The company has focused solely on providing propane solutions since 2000, when it supplied the Olympic Games in Australia. It did its first test installations in the mid-1990s. "The decision to go for propane was very easy for us. We focused on two important things – one is the environmentally friendly gas, and the other is low energy consumption. Propane fulfils these two points very well," Resch says.

Did AHT consider alternative hydrocarbons to propane, such as isobutane? "No, not at that time, because we were also keeping an eye on the service organisations. As long as we only have one refrigerant, it's easy for them to handle all this," the company vice-president says.

"The decision was to go for the strongest and best refrigerant available in those days, with the focus on those two important points – low energy consumption and the most environmentally friendly solution," Resch explains.

Opting for a plug-in solution dispenses with the need for both external production of the cold and a secondary circuit to transport it.

Resch is also confident that propane is powerful enough to support larger cabinets as well as smaller ones. "We cover everything: from the smallest ice-cream chest to the biggest supermarket freezer," he says.

Firm commitment to plug-in solutions

Asked whether AHT would consider moving away from its sole focus on plug-ins to produce fixed cabinets compatible with remote refrigerant circuits, Resch answers with a firm "no, never".

"There is a simple reason for this. AHT is famous for its flexible, modular, independently operating, industrially produced cabinets. We started this technology in the early 1980s. We wanted to keep this sense of AHT, because our clients loved having this – because they were also then flexible in their stores," he says.

Resch is convinced that independent plug-in cabinets are the way to go. Their leakage rates are less than 0.1%. "This is why we decided to stay in modular plug-in solutions, rather than going for a remote solution whereby you externally 'produce the cold', and then have to transport it with a fluid like glycol," he explains.

In remote systems, AHT considers the energy required to pump coolants such as glycol through the pipes to be wasted energy. By focusing on plug-in cabinets, "we can lower the total energy consumption of the supermarket to a level that nobody can reach with other technologies," Resch argues.

Towards a higher charge limit

Standards by the International Electrotechnical Commission (IEC), a worldwide body that proposes rules governing how to use electrical, electronic and related technologies, influence the development of the market by providing manufacturers and customers with guidelines as to what is safe to use and buy.

An IEC working group on household and similar electrical appliances is currently working to increase the charge limit on hydrocarbons. The limit is expected to change from 150g to a higher level; this could shift the market towards bigger, more efficient hydrocarbon cabinets once it is adopted by the full IEC.

The 26 working group members – comprising 13 countries, including Germany, New Zealand, Japan, and the United States – are expected to decide for a higher level by 2018.

AHT is keen to see hydrocarbon charge limits increase. “We’re working very strongly with different organisations to go for a higher limit,” Resch says, adding: “Today we have 150g. Maybe in the future it will be 350g, 500g or even 1kg. For us that would be a big step forward,” Resch says.

“My personal expectation is that there will be a move, but we don’t know yet to what level,” he adds.

As the global HFC phase-down continues, AHT sees hydrocarbons increasingly competing with CO₂ to become the natural refrigerant solution of choice for other, smaller-scale applications – such as bottle coolers and vending machines.

Resch argues that CO₂ is generally less energy efficient than propane, particularly in high ambient temperature regions.

He identifies noise levels as another factor giving propane the edge. “Most CO₂ compressors are noisier than hydrocarbon ones. In the sizes we need, it’s also much easier to find manufacturers offering hydrocarbon compressors than it is for CO₂,” he argues.

HFOs mired in regulatory uncertainty

Some supermarkets are turning to new synthetic refrigerants – so-called HFOs – as alternative refrigerants to HFCs in view of the global HFC phase-down.

AHT, however, is not tempted to go down this route. “One of the simplest reasons is that HFOs are again chemical substances. Nobody knows exactly what will happen with HFOs 50 years from now,” Resch says.

“50 years ago, everybody thought that HFCs were the best solution. They were even called ‘safe refrigerants’. It is very difficult to predict what will happen with HFOs in the future” because their long-term impact on the climate is not yet fully understood by scientists, he argues.

Resch also points out that the structure of standards governing the use of HFOs is not yet clear. Despite steps being taken to address this – for example, by introducing the A2L category of refrigerant – HFOs nonetheless remain flammable. “And then you have to do the same things as you do with propane,” Resch says.

“Why would I change from propane, where I can find as many components as I need, all over the world, to HFOs – where I don’t have all this available?” he wonders aloud.

“HFOs are not a good alternative, and they’re not a suitable alternative for us. They’re like a fourth alternative to the HFCs being offered on the market – you have hydrocarbons, CO₂, ammonia and only then HFOs,” Resch argues.

He points out that there are currently more components available for natural refrigerant-based HVAC&R systems than for HFO installations.

Asked what obstacles are stopping hydrocarbons from taking over completely as the plug-in solution, Resch replies: “The charge limit, for example.”

Another is the wide range of applications for refrigeration equipment in the marketplace. “The spectrum of different uses for refrigerants is very wide. I’m only looking at the retail sector. I’m not sure if hydrocarbons are the best solution for every other application as well,” he says.

Why don’t all supermarkets adopt 100% hydrocarbons? “I don’t understand why they’re not – that’s my honest and frank answer! All supermarkets are able to use hydrocarbons – from the smallest kiosks right up to hypermarkets,” Resch argues.

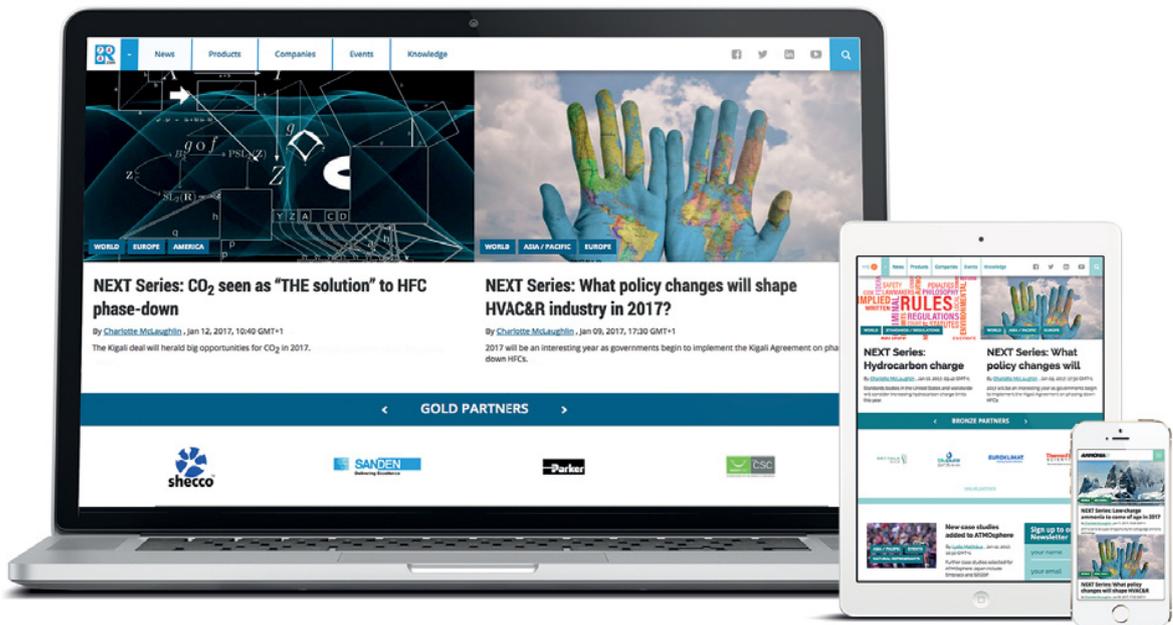
For AHT, the sky is the limit. “There is no limitation to hydrocarbons, nor for plug-in units. So far, the biggest installation we’ve done is almost 200 cabinets in one supermarket – and they do not have any heat problems. No chocolate melts!” ■ AW

AHT Cooling Systems, based in Rottenmann, Austria, is a leading global manufacturer of plug-in commercial cooler and freezer systems, delivering an innovative product range to many of the world’s biggest supermarket and discount store chains as well as ice cream and drink producers worldwide.

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