FEBRUARY 2020

ACCELERATE

ADVANCING HVAC&R SUSTAINABLY MAGAZINE

~~EURO~~GLOBAL SHOP 2020:

Meet the Future of Retail Refrigeration

p.24

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ACCELERATE NEWS

ADVANCING HVAC&R SUSTAINABLY WORLDWIDE

The Three Mega Trends Shaping HVAC&R

— By Marc Chasserot

Our focus in *Accelerate Magazine* and in our previous regional *Accelerate* publications has been reporting on the transition from synthetic to natural refrigerants. It's a key trend, indeed a "mega trend," that began with refrigeration but is now happening with air conditioning and heat pumps.

But there are two other mega trends taking place that are creating a lot of uncertainty but also opportunity within the cooling sector.

As a relatively new technology, natural refrigerant systems have faced the CapEx challenge common to all new technologies. In most cases, they don't yet have economies of scale, and are therefore at a disadvantage competing with incumbent technologies that are a lot cheaper.

This is where the second big mega trend comes in: Cooling as a Service (CaaS). This is a relatively new business model for HVAC&R equipment whereby end users effectively pay a fee for cooling, and avoid the burden of a large up-front capital expenditure. It offers the possibility for end users – including those in developing countries where new technology is particularly cost prohibitive – to gain access to highly efficient, sustainable and future-proof equipment.

The third mega trend – one that has been taking the industry by storm – is the digitalization of cooling. We see this in the proliferation of smart systems that leverage the massive amount of data generated by cooling technology in order to monitor and optimize performance, improve efficiency and save energy. All of the buzzword technologies – the Internet of Things (IoT), artificial intelligence (AI), the cloud – come into play as a means to manage and make sense of the data. End users are able to predict problems before they happen, lowering their maintenance costs and lengthening the life of their equipment.

These three mega trends – natural refrigerants, CaaS and digitalization – are all intertwined and reinforce each other. Moreover, the organizations that address these trends are increasingly crossing paths and working together. This is going to further disrupt the status quo in heating and cooling, and lead to more change.

Recognizing the importance of these trends, we intend to make *Accelerate Magazine* the prime source of information and insight for understanding the opportunities and challenges that lie ahead.

In fact, we have already been hard at work covering Cooling as a Service and digitalization. In this issue, we have a story (page 57) on plans by Switzerland-based Basel Agency for Sustainable Energy (BASE) to educate the HVAC&R community in Cape Town, South Africa, on the CaaS business model. And on page 50, we report on a discussion about "Industry 4.0," the way smart digitalization is changing our industry, while on page 74, we describe how Whole Foods Market is using the "Axiom Cloud."

We will continue to offer our industry-leading coverage of natural refrigerants and sustainable cooling and heating technologies – but with new insights on how to pay for them and how to make them smarter.

Marc Chasserot
Publisher

In this issue

// Europe, Middle East & Africa

// Australia & New Zealand

// Asia Pacific

The Epicenter of Natural Refrigerants

— By Michael Garry

When I attended my first European HVAC&R trade show – Chillventa, in Nuremberg, Germany, in October 2016 – it was an eye-opening experience.

In contrast to some of the major U.S. trade shows I've attended, Chillventa was replete with an endless array of natural refrigerant technologies; everywhere you looked was CO_2, ammonia, hydrocarbons! I felt as though I had arrived at the mecca of natural refrigeration.

Of course, Europe is the place where the modern natural refrigerants industry, in particular the part focused on CO_2 and hydrocarbons, was born and, aided by legislation, took off. It started in the late 1980s and early 1990s, as the world retreated from ozone-depleting CFCs and later HCFCs under the Montreal Protocol, and Norwegian thermodynamic scientist Gustav Lorentzen reinvented the way CO_2 could be used as a safe and cost-effective refrigerant.

That tradition continues February 16-20 at EuroShop, in Düsseldorf, Germany, which calls itself "the world's No 1 retail trade fair," attracting attendees from all over the world. In three of its 17 exhibition halls, attendees can examine a plethora of the latest natural refrigerant technologies for retail stores.

For our cover story this month (page 24), we surveyed 18 major natural refrigerant equipment manufacturers to determine what they will be introducing and showcasing at EuroShop. You can see these products described on pages 32-39. We also queried them on how they see the retail natural refrigeration industry evolving; a report on their feedback starts on page 24. The manufacturers point to the growth of CO_2 and propane systems in a range of store formats, improving energy efficiency and greater adoption of integrated systems.

Many of the manufacturers commented on the growth of the small-store format in urban areas, which seems to favor the uptake of air-cooled plug-in display cases and water-cooled semi-plug-in cabinets that employ self-contained refrigeration systems using propane (R290) refrigerant. On the other hand, CO_2, though primarily employed in rack systems in larger stores, is increasingly being used in condensing units in small stores.

Meanwhile, the use of efficiency-enhancing technologies like ejectors and parallel compression in transcritical CO_2 rack systems for medium- and large stores continues to grow, enabling them to be used efficiently in high ambient climates. And another notable driver of efficiency in retail refrigeration is system integration: refrigeration, air conditioning and heating served by one rack system.

For many HVAC&R companies and end users alike, the adoption of efficient natural refrigeration technology is a vital part of confronting the climate emergency. As Francesco Mastrapasqua. Marketing Manager Refrigeration Systems for Epta, put it, "We are living in an era of change and transformation towards a more environmentally friendly model."

To get a quick but thorough understanding of this transformation in retail refrigeration, check out our cover story and refer to it at EuroShop, if you attend. We hope our readers from all over the world benefit from this education.

Michael Garry
Editor in Chief

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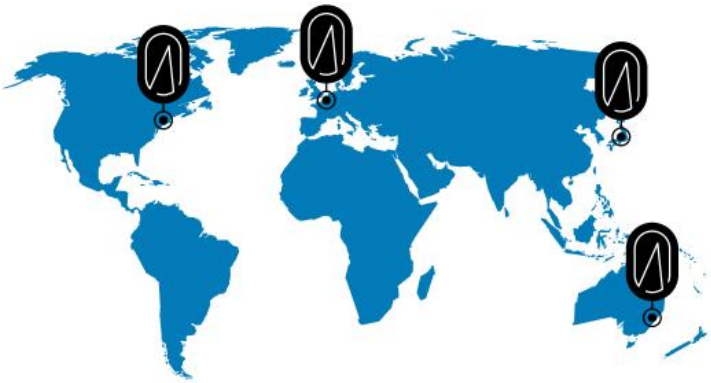
// Volume 1, Issue #107



shecco's network spans the globe with offices in Brussels, Tokyo, New York and Sydney.

About *Accelerate Magazine*

Brought to you by the worldwide experts in natural refrigerant news, *Accelerate Magazine* is the first global news magazine written for and about the most progressive business leaders working with natural refrigerant solutions in all HVAC&R sectors. It builds on the legacies of five regional magazines: *Accelerate America, Accelerate Europe, Accelerate Australia/ New Zealand, Accelerate China* and *Accelerate Asia*, and is published in coordination with the Japanese language magazine, *Accelerate Japan*.

About Accelerate24.news

Accelerate24.news is a 24-hour global website providing up-to-the-minute news on sustainable cooling and heating, with a focus on natural refrigerant-based technologies. Leveraging the expertise of our journalists and analysts in North America, Europe and Japan, Accelerate24.news covers in one place what is found on R744.com, Hydrocarbons21.com and Ammonia21.com, the leading websites on CO_2, hydrocarbons and ammonia over the past decade.

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/ Editor in Chief

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Editorial Calendar, 2019-2020, Volume 1

// ISSUE #101
June 2019
Cover Story:
NatRefs 101: Tracing the growth of natural refrigerants through the first 100 issues of *Accelerate* magazines from around the world.
Print distribution: ATMOsphere America (Atlanta, June 17-18)

// ISSUE #102
July/August 2019
Cover Story:
Impact of IEC's new 500-g charge limit for hydrocarbons. What are the next steps?

// ISSUE #103
September 2019
Cover Story:
HFOs: How Much is Too Much?
Print Distribution: FMI Energy & Store Development Conference (Dallas, September 8-11); ATMOsphere Asia (Bangkok, Thailand, September 25)

// ISSUE #104
October 2019
Cover Story:
How Do We Cool a Warming World (Without Making It Warmer)?
Print Distribution: ATMOsphere Europe (Warsaw, Poland, October 16-17)

// ISSUE #105
November/ December 2019
Cover Story:
Year One of Kigali: Is it enough?

// ISSUE #106
January 2020
Cover Story:
Women in Natural Refrigerants
Print Distribution:
AHR Expo (Orlando, Florida, February 3-5); ATMOsphere Japan (Tokyo, February 10)

// ISSUE #107
February 2020
Cover Story:
EuroShop 2020: Meet the Future of Retail Refrigeration
Print Distribution:
EuroShop (Düsseldorf, Germany, February 16-20); ATMOsphere Cape Town (Cape Town, South Africa, March 10)

// ISSUE #108
March 2020
Cover Story:
The battle for industrial refrigeration: ammonia vs. CO2.
Publication Date: March 10
Ad Deadline: March 3
Marketplace Advertising for IIAR Natural Refrigeration Conference and Heavy Equipment Expo and Mostra Convegno ExpoComfort.
Print Distribution: IIAR Natural Refrigeration Conference and Heavy Equipment Expo (Orlando, Florida, U.S., March 15-18); Mostra Convegno ExpoComfort (Milan, Italy, March 17-20); ATMOsphere Ibérica (Málaga, Spain, March 31)

// ISSUE #109
April 2020
Cover Story:
How are NatRefs transforming heating and cooling of buildings?
Publication Date: April 7
Ad Deadline: March 31

// ISSUE #110
May 2020
Cover Story:
The Training Revolution: How IoT, AI, virtual reality and robotics will fill the technician void
Publication Date: May 5
Ad Deadline: April 28
Marketplace Advertising for ARBS
Print Distribution:
ATMOsphere Australia (Melbourne, May 18); ARBS (Melbourne, May 19-21)

The editorial calendar is subject to change by the publisher.

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We Need Better Safety and Compliance Procedures for Hydrocarbon Equipment in Australia

Only Queensland has proper regulations, leaving an unsafe scenario in the rest of the country.

— By Lindsay Pelser

While we all agree that hydrocarbons are the future, we need to be professional when it comes to safety and compliance.

Australia is a case in point.

Australia is made up of the following states: New South Wales (NSW), Western Australia (WA), Victoria, Northern Territory, South Australia (SA) and Queensland. Each state has its own rules and regulations when it comes to the compliance of equipment, treating compliance, safety, and licensing as if the states were actually separate countries within Australia.

What you will find is that while Australia has all the relevant International Standards such as ISO 5149-1, EN 60335-2-40, etc., only Queensland will enforce compliance of equipment to these relevant standards for hydrocarbons.

All equipment sold should carry the relevant compliance labels and be registered, but this does not happen in any state except Queensland.

What we see in the other states are regulators who are supposed to enforce safety and compliance of equipment but have failed in their duty of care.

For example, in Victoria, electrical regulators have failed in their duty of care and compliance. They now have no control of whether a noncompliant product has been sold, or whether equipment not designed for hydrocarbons has been converted, and then advertised without the compliance labels required for converted units.

Victoria is part of the EESS (Electrical Equipment Safety Scheme) compliance database, yet it has not listed one unit that has been certified compliant; thus it has failed in its duty of care to the public and to businesses.

In NSW, compliance is handled by the Department of Fair Trading Regulators. It too has failed in its duty of care and compliance. Even when notified of noncompliance, the department allows the product to be sold and converted.

In WA, compliance of hydrocarbon equipment is handled by the Department of Mines and Natural Resources. It has failed when it comes to compliance and safety, even when sent photos of noncompliant products and conversions – another regulator that is a public-service department failure.

By contrast, Queensland, where Compliance and Safety is handled by the Department of Mines and Natural Resources, is the only state in Australia that enforces compliance, safety and the Australian Standards. This is the only state that will prosecute a company or person for doing noncompliant work. As a result, air-conditioning and refrigeration suppliers from other states do not sell their products in Queensland.

Queensland is also the only state with a database for companies to see if a product is compliant, and the only state that requires any person working with hydrocarbons to have a license.

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TRAINING ISSUES

There are many fly-by-night hydrocarbon-training providers in Australia. Some companies that offer hydrocarbon training are not registered, and even use other registered providers' numbers to issue certificates.

At one of the so-called hydrocarbon training companies, I sat in, and found the level of training so poor it wouldn't even be found in third-world countries.

At one such training company, the trainer spoke for two days about everything except compliance and safety, and then gave a test with all the answers provided. The practical exam was sitting on a step with a small-fridge compressor in your hand, blowing a refrigerant into it and out of the pipe, while the trainer took a photo. There has never been a person who has failed any of the hydrocarbon-training courses because the trainers know that no license is required for hydrocarbon work. Anyone can walk into a hardware shop, purchase hydrocarbon and a set of gauges, and go out and convert systems, all with the blessing of regulators in all states except Queensland.

In these states, it is okay to replace the refrigerant in any chiller with hydrocarbons, regardless of whether the compressors or electrical is suited for hydrocarbons. So you have buildings with chillers half way up the building, or in the basement, with enough hydrocarbon refrigerants to bring the building down in the event of an explosion.

We see units from many manufacturers that have been retrofitted with hydrocarbons showing a compliance label. This means that if there is an accident, the inspectors are going to look at the manufacturer's compliance label and number, not the person who converted the system.

A BETTER FUTURE

So what should the future look like?

All states must have the same compliance standards as Queensland, where the product supplier issues a certificate and test report from a National Association of Testing Authorities (NATA) laboratory showing that the system has been tested and certified compliant to all relevant standards. The product would then be listed in a national compliance database. Any product that is found not listed and that does not have compliance certification would be recalled before we have more accidents.

Proper training needs to be put in place where everyone works from the same page. This needs to cover all compliance and safety. Now, we see different groups putting out videos and trainings that fail in the most basic safety requirement – personal protection equipment (PPE). One must show the technician why it is important to read the safety data sheet (SDS) for all refrigerants.

Everyone working with hydrocarbon refrigerants needs to be licensed, and must issue an installation compliance certificate after installing any equipment. This only takes place in Queensland and needs to be national.

Over the last two years, I have been writing many emails to government officials in Australia regarding compliance and noncompliance. (If you contact me at lindsay.pelser@aaptgroup.com, I can provide a list of their email addresses.) Since then, there has been yet another explosion in South Australia, where someone working on a fridge unit caused a hydrocarbon explosion and landed up in the hospital with the business owner. This was preventable. Let's push for change to prevent future accidents. ■ LP

Lindsay Pelser is the Senior Compliance Officer at AAPT (Air Conditioning, Air Purification Technologies) Group, a chiller, heat pump and HVAC supplier in Brisbane, Australia.

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Letters to the Editor

REACTIONS TO 'WOMEN IN NATURAL REFRIGERANTS'

I love the profiles in the article. ("Women in Natural Refrigerants," *Accelerate Magazine*, January 2020.)

Congrats to all you wonderful women out there in the industry!

Stephanie Smith
Senior Engineer
Risk Management Professionals
Irvine, California (U.S.)

As we move forward with our mission, we in the trades have believed for quite some time that women, along with their passion, attention to detail and their ability to multi-task, possess skills that we require in order to be successful.

Thank you for showing their efforts.

I am honored to have met many of these fine ladies, and continue to support natural refrigerant adoption here and worldwide.

Joe Kokinda
President & CEO
Professional HVAC/R Services
Avon Lake, Ohio

I am honored to be one of 29 women recognized in *Accelerate Magazine*. I am proud to be part of #NATREFS.

Thanks to shecco and *Accelerate Magazine* for this huge honor. Thanks to all my mentors and colleagues. And thanks Kysor Warren for the opportunity.

Lidia Perez
Mechanical Engineer IV,
Kysor Warren Epta U.S.
Columbus, Georgia (U.S.)

I really enjoyed the last issue, especially the article about Women in Natural Refrigerants! The cover art was impressive, also. Thank you for the inspiration and solid information.

Debbie Koske
Marketing Department
Calibration Technologies Inc. (CTI)
Columbia, Missouri (U.S.)

The "Women in Natural Refrigerants" cover story was excellent. It was a great way to highlight the many women who are driving progress within the industry.

I am proud to be highlighted alongside the many inspiring women who are advancing natural refrigerants.

Morgan Smith
Manager of Programs & Operations
North American Sustainable Refrigeration Council
Rochester, New York (U.S.)

LETTERS ARE WELCOMED!

Accelerate Magazine invites readers to submit letters to the editor to michael.garry@shecco.com. Letters may be edited for clarity or length.

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The European Green Deal: **What Will It Do?**

On December 11, the European Commission (EC) unveiled the European Green Deal, a wide-ranging set of sustainability goals. If approved by the European Parliament and Council of the European Union (EU), it would aim to accomplish the following:

Energy:

Decarbonize the Energy Sector

The production and use of energy accounts for more than 75% of the EU's greenhouse gas emissions.

Buildings:

Renovate buildings to help people cut their energy bills and energy use.

Forty percent of EU's energy consumption is from buildings.

Mobility:

Roll out cleaner, cheaper and healthier forms of private and public transportation.

Transport represents 25% of EU emissions.

Industry:

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/ R290 RANSTAheat – heat pump

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Kigali Update

Ninety-two countries (plus the European Union) have accepted, ratified or approved the Kigali Amendment to the Montreal Protocol as of February 5, 2020.*

The countries that have done so since September 27 include: Bhutan, Vietnam, New Zealand, Mauritius, Lesotho, São Tomé and Príncipe, Jordan, Argentina, Guinea Somalia, Mozambique and Lebanon.

The Kigali Amendment was enacted on October 15, 2016, by 197 countries (plus the EU) in Kigali, Rwanda; it took effect on January 1, 2019. The Amendment calls for the phase down of the production and use of HFCs by developed and developing countries following the acceptance, ratification or approval of the amendment by each country.

The 49 developed (Non-Article 5) countries started with a 10% HFC phase down in 2019 (compared to a baseline of average HFC production/use in 2011-2013), except for Belarus, the Russian Federation, Kazakhstan, Tajikistan and Uzbekistan, which start with a 5% phase down in 2020. All developed countries will end with an 85% HFC phase down by 2036. Thirty-one plus the EU have so far accepted, ratified or approved the Amendment.

The 148 developing (Article 5) countries fall into two groups. The majority will start a freeze in 2024 at a baseline of average HFC production/use in 2020-2022; those countries will end with an 80% HFC phase down by 2045. The other Article 5 countries (Bahrain, India, Iran, Iraq, Kuwait, Oman, Pakistan, Qatar, Saudi Arabia, and the United Arab Emirates) will start a freeze in 2028 at a baseline of average HFC production/use in 2024-2026; those countries will end with an 85% HFC phase down by 2047. So far, 61 Article 5 countries (both groups) have accepted, ratified or approved the Amendment.

Here is a list of the 92 countries along with the EU that have accepted, ratified or approved the Kigali Amendment as of February 5.

* Based on data from United Nations Treaty Collection (https://bit.ly/2pg0sgF)

** With territorial exclusion in respect of Greenland

*** For the European part of the Netherlands

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Developed (Non-Article 5) Countries

Participant	Acceptance(A), Ratification, Approval(AA)
Andorra	Jan 23, 2019 A
Australia	Oct 27, 2017 A
Austria	Sep 27, 2018
Belgium	Jun 4, 2018
Bulgaria	May 1, 2018
Canada	Nov 3, 2017
Croatia	Dec 6, 2018
Czech Republic	Sep 27, 2018 A
Cyprus	July 22, 2019
Denmark**	Dec 6, 2018 AA
Estonia	Sep 27, 2018
European Union	Sep 27, 2018 AA
Finland	Nov 14, 2017 A
France	Mar 29, 2018 AA
Germany	Nov 14, 2017 A
Greece	Oct 5, 2018
Hungary	Sep 14, 2018 AA
Ireland	Mar 12, 2018
Japan	Dec 18, 2018 A
Latvia	Aug 17, 2018
Lithuania	Jul 24, 2018
Luxembourg	Nov 16, 2017
Netherlands***	Feb 8, 2018 A
New Zealand	Oct 3, 2019
Norway	Sep 6, 2017
Poland	Jan 7, 2019
Portugal	Jul 17, 2018 AA
Slovakia	Nov 16, 2017
Slovenia	Dec 7, 2018
Sweden	Nov 17, 2017
Switzerland	Nov 7, 2018
United Kingdom of Great Britain and Northern Ireland	Nov 14, 2017

Developing Countries (Article 5)

Participant	Acceptance(A), Ratification, Approval(AA)
Albania	Jan 18, 2019
Argentina	Nov 22, 2019
Armenia	May 2, 2019 A
Barbados	Apr 19, 2018
Benin	Mar 19, 2018
Bhutan	Sep 27, 2019
Burkina Faso	Jul 26, 2018
Chad	Mar 26, 2019
Chile	Sep 19, 2017
Comoros	Nov 16, 2017
Cook Islands	Aug 22, 2019 A
Costa Rica	May 23, 2018
Côte d'Ivoire	Nov 29, 2017 A
Cuba	June 20, 2019
Democratic People's Republic of Korea	Sep 21, 2017
Ecuador	Jan 22, 2018
Ethiopia	July 5, 2019
Gabon	Feb 28, 2018 A
Ghana	Aug 2, 2019
Grenada	May 29, 2018
Guinea	Dec 5, 2019
Guinea-Bissau	Oct 22, 2018
Honduras	Jan 28, 2019
Jordan	Oct 16, 2019
Kiribati	Oct 26, 2018
Lao People's Democratic Republic	Nov 16, 2017 A
Lebanon	February 5, 2020
Lesotho	Oct 7, 2019
Malawi	Nov 21 , 2017
Maldives	Nov 13, 2017
Mali	Mar 31, 2017 A

Participant	Acceptance(A), Ratification, Approval(AA)
Marshall Islands	May 15, 2017
Mauritius	Oct 1, 2019
Mexico	Sep 25, 2018 A
Micronesia (Federated States of)	May 12, 2017
Montenegro	Apr 23, 2019
Mozambique	January 16, 2020
Namibia	May 16, 2019 A
Niger	Aug 29, 2018
Nigeria	Dec 20, 2018
Niue	Apr 24, 2018
Palau	Aug 29, 2017
Panama	Sep 28, 2018
Paraguay	Nov 1, 2018 A
Peru	Aug 7, 2019
Rwanda	May 23, 2017
Samoa	Mar 23, 2018
São Tomé and Príncipe	Oct 1, 2019
Seychelles	Aug 20, 2019 A
Senegal	Aug 31, 2018
Somalia	Nov 27, 2019
South Africa	Aug 1, 2019
Sri Lanka	Sep 28, 2018
Togo	Mar 8, 2018 A
Tonga	Sep 17, 2018
Trinidad and Tobago	Nov 17, 2017
Tuvalu	Sep 21, 2017
Uganda	Jun 21, 2018
Uruguay	Sep 12, 2018
Vanuatu	Apr 20, 2018
Vietnam	Sep 27, 2019 AA

Refrigeration Repair in Space

The Alpha Magnetic Spectrometer outside the International Space Station. Credit: NASA.

It took four spacewalks by NASA and ESA astronauts to repair the CO_2 cooling system outside the International Space Station.

— By Ilana Koegelenberg

Repairing refrigeration systems is always a challenge, but imagine doing it weightless in space.

That's what astronauts Luca Parmitano of the European Space Agency (ESA) and Andrew Morgan of the National Aeronautics and Space Administration (NASA) managed to do in four space walks outside of the International Space Station between November and January.

Their task was to replace a CO_2 cooling system in the Alpha Magnetic Spectrometer (AMS), a $2 billion instrument that sits outside of the space station.

Launched in 2011, the AMS captures high-energy particles in order to identify what they are and where they come from. This sheds light on the nature of antimatter, dark matter and dark energy – some of the biggest mysteries of the cosmos.

The AMS cooling system includes four small CO_2 refrigerant pumps to keep its detectors at the proper temperature. Each is outfitted with an impeller the size of a U.S. quarter that spins at 6,000 revolutions per minute to move 6g (0.2oz) of CO_2 through the system, explained Scientific American (http://bit.ly/36zEzw6).

Only one pump is used at a time, and each has a three-year design life, so, theoretically, the system should last 12 years. Ammonia is also used for cooling. (More detail on the cooling technology is available at an MIT research site, http://bit.ly/36Afvou).

It turned out the pumps did not have enough internal lubrication and were slowly grinding themselves up, which caused them to jam, according to the Scientific American article. They began failing in 2014. NASA kicked off an effort to figure out if replacing the cooling system by space-walking astronauts was even possible.

By the time the astronauts floated outside the station's airlock for the first of four planned spacewalks, the AMS was down to just one pump and nearly out of CO_2 coolant. Had nothing been done, the final original pump was expected to fail within a matter of months, explained an article in the online publication collectSPACE (http://bit.ly/2Rxr4sj).

REPAIRING THE SYSTEM

During the first two spacewalks, on November 15 and 22, Parmitano and Morgan eliminated a protective panel from the AMS, exposing the thermal control system. They then cut zip ties and drew back insulation, cut through a line to vent recurring coolant overboard, and ultimately cut eight coolant flow lines. It was all broadcast live on NASA Television.

In the third spacewalk on December 2, they installed the new cooling system, which involved clean cuts of eight stainless steel tubes attached to the defective cooling system and the welding of new tubes from the replacement system. Twenty new tools were developed specifically for this installation.

The system was pressurized and the fittings were tightened during the fourth and final spacewalk on January 25, in an effort to guarantee leak-free performance. The journey continues. ■ IK

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World in Brief

Australian University Seeks Industrial Partners

The Royal Melbourne Institute of Technology (RMIT) in Australia is inviting industrial HVAC&R companies to work with its undergraduate engineering students to research issues affecting the industry, including the feasibility of CO_2 heat pumps and chillers.

The main requirement for the projects is that they are sufficiently suited for undergraduate students and that they offer enough of a technical challenge to occupy four or five students for eight months.

Projects will commence in early March 2020 and should be completed by late October 2020.

For more information or to propose a project, contact Dr. Cameron Stanley of RMIT at cameron.stanley@rmit.edu.au or +61 (03) 9925 4146. ■ IK

Deadline Near for Gustav Lorentzen Abstracts

The deadline for submitting abstracts for the upcoming 14th IIR-Gustav Lorentzen Conference on Natural Refrigerants is February 15.

The conference, named after Norwegian CO_2 refrigeration pioneer Gustav Lorentzen, is a biennial gathering of the world's leading researchers in the field of natural working fluids for the refrigeration, heating and cooling sectors. This year, the event will be held from December 6-9 at the Kyoto International Conference Center and Doshisha University in Kyoto, Japan.

The event, organized by the Japan Society of Refrigerating and Air Conditioning Engineers, is inviting all researchers to submit their abstracts and join the discussion on the latest progress in the field of natural refrigerants. ■ DY

Supermarket Boosts CO_2 Efficiency With Groundwater

An Italian supermarket chain is using groundwater as a cooling fluid to condense the CO_2 in a transcritical system in a remodeled store in Milan, according to Italian OEM Crea, the system provider.

This allows the system to run subcritically in the warm summer months, and reduces the electricity consumption of the compressors.

The groundwater used in the system is 15-20°C (59-68°F) year round. This allowed Crea to set a 25°C (77°F) condensing temperature in the system, using a plate heat exchanger. The use of groundwater, instead of air, to condense the CO_2, allows the system to run in subcritical mode even during the hottest summer months.

The 400m² (4,306ft²) remodeled store was officially opened in December 2019, after a two-month refurbishment period.

In the winter months, the system is designed to run in transcritical mode to satisfy the supermarket's need for hot water. To achieve the required hot water, the system employs heat recovery, which can recover up to 42kW in winter, equaling "total" heat recovery, and increasing the system's COP to 4.2, according to Stefano Tortorici, Technical Engineer at Crea.

Crea experienced several challenges in designing the system, including limited space and local noise-level requirements, due to its location in the historic center of Milan. ■ TS

Growing Use of Heat Pumps Seen in Buildings

The "State of Green Business 2020" report, published by U.S.-based GreenBiz Group, notes the growing use of electric heat pumps in commercial buildings as these facilities go "all-electric" and abandon fossil fuels for space and hot-water heating.

"While using electricity for heating was once inefficient, the equipment itself has become significantly better," said the report, published on January 13. "For example, there are several electric heat pumps on the market that are two to three times more efficient at converting electricity into heat than conventional models."

The report, which takes a cautionary look at the response of major businesses to climate change, acknowledged that the upfront costs of electric appliances can be more than for gas appliances. But it added that a study from the Natural Resource Defense Council (NRDC) shows that added costs are "more than offset by avoiding plumbing the building for gas. And as more buildings go electric, appliance costs are sure to fall." ■ MG

New Jersey Enacts Bill to Regulate HFCs

Governor Phil Murphy of New Jersey (U.S.) on January 21 signed into law a bill that prohibits the sale or installation of certain equipment containing HFCs, in accordance with previously vacated federal regulations.

New Jersey joins California, New York, Washington and Vermont as U.S. states that have adopted the federal regulations, known as the Significant New Alternative Policy (SNAP) rules 20 and 21, administered by the U.S. Environmental Protection Agency (EPA). The EPA abandoned the rules following a 2017 U.S. Court of Appeals ruling that said they were not supported by federal law. Other states have plans to regulate HFCs, including Connecticut, Delaware and Maryland.

New Jersey is also one of 24 states (plus Puerto Rico) making up the U.S. Climate Alliance, which has pledged as a group to reduce HFC emissions.

Among its provisions, the bill would apply high-GWP bans to supermarket systems, remote condensing units and stand-along units as of July 1, 2020, and to cold-storage warehouses as of January 1, 2023.

The bill also contains language adopting EPA Section 608 refrigerant management regulations as it applies to HFCs. "This makes New Jersey the first state to tackle the refrigerant management aspects in response to the federal rollback," said Christina Starr, Climate Policy Analyst, Environmental Investigation Agency, Washington, D.C. (U.S.) . ■ MG

Secop Appoints Elsen as New CFO

Secop Group, a German hydrocarbon-compressor manufacturer, has appointed Frank Elsen as its new chief financial officer and shareholder, effective January 16, 2020.

Elsen was previously the CEO of AHT Cooling Systems, one of Secop's commercial refrigeration customers.

"I am confident that Frank Elsen, with his experience from AHT, is a great addition to the Secop leadership team," said Ricardo Maciel, CEO of the Secop Group, in a statement. "Under his leadership, our finance team will continue to be an excellent business partner to all business divisions, to the management of Secop, and to its shareholders."

Secop Group develops and produces compressors, and has an extensive line of propane (R290) and isobutane (R600a) models. ■ TS

Australia's HFC Import Quota Drops 10%

On January 1, 2020, legal restrictions on HFCs and HCFCs in Australia were tightened.

On that date, Australia's bulk HFC import limit for 2020-2021 was set at 7.25 million metric tons of CO_2e — almost 10% less than 2018-2019, when it was 8 million metric tons of CO_2e. This schedule is more aggressive than that set by the Kigali Amendment to the Montreal Protocol, which Australia has ratified.

In addition, the import and manufacturing of all types of HCFC equipment is now banned. "From 1 January 2020, importing or manufacturing all types of HCFC equipment (including, for example, HCFC aerosols and HCFC fire protection equipment) is banned, except in certain circumstances," said the Australian Government Department of Environment and Energy website. ■ DY

Metro AG Converts Last Russian R22 Store to CO_2

Metro AG has converted all of its R22 stores in Russia to CO_2 refrigeration; it now has 31 CO_2 stores, 23 with subcritical systems (installed since 2015) and eight with transcritical systems, the first installed in 2018. In total, Metro AG runs 97 stores in Russia, and one storage facility that uses ammonia.

Next on Metro AG's to-do list is the conversion of all of its R404A stores to CO_2. "The R22 is dead, now we will kill softly the R404A," said Olaf Schulze, Metro AG's Director for Energy, Facility and Resource Management.

The conversions are part of Metro AG's F-Gas Exit Program, initiated in 2013, which aims to reduce the company's f-gas emissions by 90% by 2030. The progress has been good so far: as of May 2019, 27% of Metro's stores were using natural refrigerants, including 95 with transcritical CO_2.

Not all of the company's CO_2 systems in Russia are configured identically. Compressors are mainly made by Dorin, but some shops also use Bitzer or Copeland compressors. ■ TS

GLOBAL ~~EUROSHOP~~ 2020

Meet the Future of Retail Refrigeration

A survey of manufacturers exhibiting natural refrigerant systems at the giant trade show points to the growth of CO_2 and propane systems in a range of store formats, improving energy efficiency and greater adoption of integrated systems.

— By Michael Garry, Tine Stausholm, Devin Yoshimoto and Ilana Koegelenberg

Every three years, the retail world converges in Düsseldorf, Germany, to attend EuroShop, which bills itself as "the World's No. 1 Retail Trade Fair."

In 2017, EuroShop attracted almost 114,000 visitors, 84% from Europe, and the rest from Asia, America, Africa and Australia/Oceania – a total of 138 countries. More than 2,300 exhibitors filled out the many exhibit halls.

Three years is practically a lifetime in retail, and so the 2020 edition of EuroShop, taking place February 16-20, should prove to be a melting pot of new trends and development in natural refrigeration as well as retail in general.

To find out what key industry players are seeing for retail refrigeration now and in the future, *Accelerate Magazine* surveyed 18 HVAC&R manufacturers that supply natural refrigerant equipment. They discussed trends in everything from refrigerants and system configurations to efficiency and store formats, and more. On pages 32-39, you can see what they will be showcasing at EuroShop this year.

THE SHIFT TO SMALL

One of the major shifts taking place in food retail is the proliferation of small-format stores, particularly in urban areas. U.K. market research firm BSRIA has a new report – "Impact of the changing food retail market on the HVAC&R and control segments" – that sheds light on this trend in the French marketplace.

"In France, a shift is taking place from the past model of large hypermarkets to a model with more convenience stores located in city centers," the report said. In addition, Internet shopping and the "click & drive" model "are having a strong impact on the format of stores and consequently on the type of equipment."

The growth of the small-store format could favor the uptake of air-cooled plug-in display cases and water-cooled semi-plug-in cabinets that employ self-contained refrigeration systems using propane (R290) refrigerant.

"Stores with a sales area greater than 1000m² (10,794ft²) will prefer CO_2 as a refrigerant, but stores with an area less than 1,000m² will consider R290 or HFOs," said Elisa Argenta, Marketing & Communications Manager for Frascold.

Similarly, from a systems perspective, "stores with a sales area greater than 1,000m² will prefer racks, while stores with a sales area less than 1,000m² will choose condensing units, plug-ins, or water circuits," she said.

Lithuanian manufacturer Freor also sees "a growing number of CO_2-operated stores for large-size sales areas and a growing number of R290 waterloop systems for small to medium-sized stores," said Jūratė Mizarė, Freor's Marketing Manager.

> "I believe there will be a shift towards self-contained R290 cases due to lower service and installation time and skill requirements."
>
> —Eoin Lennon, Novum

The latter are as easy to install and maintain, he said. "Space-saving, easy maintenance, low energy consumption, and residual heat reuse for the store's heating and hot water will become more and more important for retailers." And by removing heat from the store, water-loop self-contained cases don't force the use of additional air conditioning in the summer, as air-cooled cases might.

Novum, an Irish manufacturer of self-contained, glass lid/door display cases using R290, offers "LEAP" units that have removable cassette-based refrigeration units; these can be serviced at the factory rather than in the store. "This solves any 'propane service concerns' customers may have," said Eoin Lennon, Chief Technical Officer, Novum.

The lower maintenance demands of plug-in cases lessen the need for skilled technicians at a time when their numbers are diminishing, Lennon noted. "I believe there will be a shift towards self-contained R290 cases due to lower service and installation time and skill requirements."

Novum's plug-in cases are now able to meet the entire low-temperature requirement for any store, said Lennon. "For new stores, or especially refurbishments of old existing stores, this means there is now a serious credible alternative to remote low-temperature systems, he said. "Simply decommission the old and wheel in the new, job done!"

Last year, the prospects for propane in commercial refrigeration improved when the International Electrotechnical Commission (IEC) increased the amount allowed in self-contained cases to 500g from 150g. "We believe it will now be easier to implement propane thanks to approval of the increase in refrigerant charge to 500g," said Sebastiano Di Lena, Group Marketing Manager - Food Retail for, Italian component maker Carel.

Italian OEM Epta offers both air- and water-cooled R290 self-contained case. Francesco Mastrapasqua. Marketing Manager Refrigeration Systems for Epta, noted that the merchandising flexibility and easy movement of self-contained cases offer retailers "unlimited store concepts and designs."

CO_2 FOR SMALL STORES

Despite its popularity, propane will not be unopposed in the small-format store arena. CO_2, though primarily used in rack systems in larger stores, is increasingly being used in condensing units in small stores.

For example, since introducing outdoor CO_2 condensing units in Europe in 2017, Japanese OEM Panasonic, has sold 600 units as of last October, according to Gaku Shimada, Overseas Sales Manager for Panasonic's Refrigeration System Sales Department. In marketing these units, Panasonic has targeted small-format stores, gas stations, fast-food chains and restaurants, said Shimada during a presentation at ATMOsphere Europe, in Warsaw, Poland, on October 16.

This year, Panasonic Heating and Cooling Europe will introduce a 4HP CO_2 condensing unit for medium-temperature and low-temperature cases. With this new model, Panasonic's line-up (2HP/4HP/10HP) for medium- and low-temperature applications "can meet almost all the requirements for small stores," said Lena Ansorge, Communications Manager to Koichiro Arakawa, Product Planning & Technical Support (Cold Chain).

Meanwhile, in December, OEM Daikin Europe completed the installation of a prototype "Conveni-Pack" integrated refrigeration/air conditioning/heating system for convenience stores, using CO_2 refrigerant, at a demonstration shop at its headquarters in Ostend, Belgium. (See sidebar, page 29.)

In another example, Area Cooling Solutions, based in Barcelona, Spain, has developed an indoor CO_2 condensing unit, the iCool Max CO_2, for small urban stores. The system is designed for retail outlets such as supermarkets, grocery stores, markets, petrol stations and convenience stores up to 200m² (2,153ft²).

Even Danish OEM Advansor, which has installed more than 6,000 transcritical CO_2 racks, is catering to small stores with its Minibooster and Tower units, which have a small footprint for stores where space is limited, said Jasmine Lange, marketing coordinator for Advansor.

IMPROVING RACK EFFICIENCY

Despite the inroads made by CO_2 condensing units in smaller stores, in medium- to-large supermarkets, CO_2 rack systems are still king.

CO_2 racks "have been growing a lot and fast in the past few years, not only in the commercial retail segment but also with growing interest from the industrial market, for example in food manufacturing such as bakeries and meat processing," said Lydia Matthäus-Wiltink, Business Development Manager for German OEM Teko, which had installed more than 4,000 CO_2 racks in the market by the end of 2019. "We expect this trend to continue and most likely to grow even further in 2020 and beyond."

The use of efficiency-enhancing technologies like ejectors and parallel compression in transcritical CO_2 systems continues to grow, enabling the systems to be used efficiently in high ambient climates. "The efficiency of transcritical CO_2 systems is improving year over year," said Advansor's Lange. "Ejectors are playing a role in warmer climates, and we believe very strongly in this technology. We are also introducing it on smaller systems now."

Last year, Carel supported the start-up of modern centralized transcritical CO_2 systems in China, South America, South Africa and Australia, some of which equipped with modulating ejectors, said Carel's Di Lena.

Enrico Zambotto, Refrigeration Director, for Italian OEM Arneg expects parallel compressors to become a "standard" feature in transcritical systems, while in warm climates, ejectors will increase in use.

Manufacturers are continuing to come up with new ways to improve efficiency of refrigeration systems. For example, Advansor is seeing "very good efficiency gains with permanent magnet motors in compressors," said Lange. With all efficiency measures taken into account, "there can be a difference of more than 25% (SEPR) in warm climates between a standard solution that was top of the line five years ago and a high-end solution today."

Epta has developed its own energy-saving transcritical technology, the full transcritical efficiency (FTE) system. The company is promoting this technology through its participation in the Life-C4R (Carbon 4 Retail) project, which is co-funded by the EU and coordinated by Epta.

Life-C4R was created "to accelerate the dissemination and implementation of very-high-efficiency CO_2 refrigeration systems as a way of reducing GHG emissions and cutting energy consumption," said Epta's Mastrapasqua.

In 2020, Epta plans to complete a full lifecycle analysis of a transcritical system using FTE according to the standards of lifecycle climate performance (LCCP) "to certify the project's carbon footprint and environmental performances," said Mastrapasqua. "We expect the total lifecycle environmental impact of the store to become the main technology trend and key decision factor."

In Europe, Ecodesign and Energy Labeling requirements, adopted in 2019, will enter into force next year. The new regulations "are game-changers for the commercial refrigeration sector," said Francesco Scuderi, Deputy Secretary General of industry group, Eurovent. "They are expected to result in a phase out of certain products on the European market and increase the demand for the best market-available technologies." (Eurovent will host a seminar at EuroShop titled "European Ecodesign and Energy Labeling Regulations for Commercial Refrigeration Equipment" on February 17.)

Epta uses the new Ecodesign and Energy Labeling schemes, said Mastrapasqua. This "will introduce bans on the most energy-demanding products and push our clients in the direction of more efficient products."

Energy-efficient HVAC&R products will become part of the "circular economy," Mastrapasqua said. "This will be more and more crucial in our sector. The challenge is to respect the principles of this model, based on re-use, greater efficiency, durability of products, new technologies and materials capable of reducing consumption and the exploitation of resources."

THE GROWTH OF INTEGRATION

Another driver of efficiency in retail refrigeration is system integration: refrigeration, air conditioning and heating served by one rack system. Bitzer is expecting growing market share for integrated systems in stores greater than 1,000m² (10,764ft²) in size, said Patrick Koops , head of public relations for Bitzer.

Frascold sees "an incredible growing demand for compressors used in integrated systems, because stores are really focused on maximizing system efficiency," said Argenta.

"System integration is something we've already been doing for some time in partnership with WURM Systems and GTM Gebäudetechnik Management," said Teko's Matthäus-Wiltink. The partnership "combines heating, cooling, lighting, controls, etc. all in one system, right from first design."

Integrating systems increases the overall store efficiency and reduces costs, noted Matthäus-Wiltink. "This makes total sense for supermarkets and others, and many successful installations we've been involved in are proof that this concept is the right way forward."

Advansor has been selling integrated transcritical systems for many years with its Sigma units, "and this is a standard for us now," said Lange.

Meanwhile Danfoss is participating in the MultiPACK project funded by the EU, which focuses on integrated systems in warmer climates, said Carina Brandt, Senior Director Marketing Communication Danfoss Cooling.

For many HVAC&R companies, the adoption of efficient natural refrigeration technology is a vital part of confronting the climate emergency. "We are living in an era of change and transformation towards a more environmentally friendly model," said Epta's Mastrapasqua. "We must support our clients who share our same vision in creating climate-neutral stores." ■ MG

> "The efficiency of transcritical CO_2 systems is improving year over year."
>
> —Jasmin Lange, Advansor

NATURAL REFRIGERANTS VS. HFOs

As HFCs continue to be phased down, food retailers are faced with a choice of two primary alternatives: natural refrigerants and HFOs/HFO blends.

"Depending on the applications and capacities, various natural solutions and also HFO blends can be the right solutions," said Manuel Fröschle, Product Manager, Natural Refrigerants for German manufacturer, GEA. "However, we strongly support switching most applications to natural refrigerants where it makes sense for the specific application and the customer."

In 2020, the EU F-Gas Regulation will further restrict the use of refrigerants with a GWP of more than 150, depending on the type and capacity of the installation, said Sebastiano Di Lena, Group Marketing Manager - Food Retail for Carel. As a result, "life for HFC/HFO blends will start to get quite hard in Europe, but not in the rest of the world, where there will still be more possibilities for these refrigerants."

Danfoss doesn't see a strong value proposition for HFO blends "given the competitiveness of natural refrigerant options," said Danfoss Carina Brandt, Senior Director Marketing Communication Danfoss Cooling. "HFO blends will primarily be used in retrofits of the dwindling base of HFC stores."

DAIKIN TO TEST INTEGRATED CO_2 SYSTEM FOR C-STORES

Last month, OEM Daikin Europe completed the installation of a prototype "Conveni-Pack" integrated refrigeration/air conditioning/heating system for convenience stores, using CO_2 refrigerant, at a demonstration shop at its headquarters in Ostend, Belgium.

Daikin Europe developed the CO_2-based Conveni-Pack for Natural HVACR 4 LIFE, a sustainability-focused research project exploring the use of CO_2 as a natural refrigerant. Co-funded by the European Union (EU), the project is led by Daikin Europe in partnership with Daikin Air conditioning Germany GmbH and Daikin AC Spain S.A., according to https://www.naturalhvacr4life.eu.

Daikin Europe will discuss the Natural HVACR 4 LIFE project at its stand at EuroShop.

Daikin Europe officially launched Natural HVACR 4 LIFE on January 20, – though the European Commission (EC) set the parameters for the project last year –and expects it to run for three years.

The CO_2 version of the Conveni-Pack is based on an existing version that employs R410A as the refrigerant.

Daikin Europe will test the CO_2 prototype in a simulated convenience store, followed by demonstration and monitoring in stores in Germany and Spain, in average and warm climates, respectively. According to the EC, the project intends to install and monitor the system in 20 European stores; it will mainly examine the energy efficiency and safety performance of the equipment "to provide a risk mitigation strategy as the basis for a large-scale application of CO_2 as a natural refrigerant."

The CO_2 Conveni-Pack, which comes as a preassembled system, recovers heat from the refrigeration display cabinets and evaporators and reuses it to heat other areas of the building at no extra cost, according to the Natural HVACR 4 LIFE website. It uses inverter controls to maximize efficiency; an optional booster unit can be used for low-temperature cases.

Through Natural HVACR 4 LIFE, Daikin intends to remove market barriers by exploring the viability (in terms of energy and safety) of an integrated refrigeration, heating and comfort cooling system that uses CO_2 as a natural refrigerant, according to the website. The company will raise awareness among installers, engineers, customers and the general public on the potential benefits of using CO_2 as a natural refrigerant in convenience stores through exhibitions, conferences and online tools.

Daikin also plans to develop an "economically viable" cassette indoor CO_2 unit for comfort cooling and heating, and may add a cold storage test at a later stage.

To support the project, Daikin will establish CO_2 Conveni-Pack training and training materials for installers and customers, as well as share project insights with policymakers and standardization bodies to facilitate the update of safety and energy-related standards and labels.

The Natural HVACR 4 LIFE project seeks to contribute to the implementation of the EU F-Gas Regulation, according to the EC. "It intends to invite policymakers to take into consideration the characteristics of natural refrigerants in the definition of standards and energy labeling schemes, by providing information on tested risk management procedures to deal with the flammability or the toxicity of natural refrigerants."

The project's reduction in GHG emissions should reach 24% after three years of operation, 12% after six years and 6% at the end of the lifetime of the system (10 years), the EC said.

MARKETPLACE

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Rivacold chooses the most cutting-edge technology on its historical product: the **Blocksystem becomes BEST** and will be unveiled to all customers in preview at **EUROSHOP 2020** fair. A great job of industrial design, a revolutionary electronics and an integrated connectivity system will make this product, already a great commercial success, **aesthetically appealing**, **functional** and **digitally innovative**.
A fundamental step for the future of Rivacold brand and products, in the direction of the **maximum energy efficiency** in order to give a contribution, in collaboration with all company's partners, to *make a better world, not only in refrigeration.*

HALL 17
STAND D01
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Natural Refrigerant Products at EuroShop

Hall 15

Area: CO_2 Inverter Condensing Units

Hall 15/A39

Spanish OEM Area Cooling Solutions will showcase its iCOOL series of transcritical CO_2 inverter condensing units. The iCOOL series has more than 6,000 units installed in Europe, and it is up to 30% more energy efficient than non-inverter technology, says Area.

The newest addition to the series is the iCOOL 30D, which has a capacity range from 7kW to 30kW (2TR to 8.5TR). In addition to the 30D, Area will also introduce a new heat recovery system that can be applied to all the company's units.

Area is also joining the ranks of HVAC&R companies offering intelligent controls for its products. At EuroShop, the company will launch its new BMS system, software that will allow end users to control an entire shop online.

Area's iCOOL 30D CO_2 unit

Epta: the Life-C4R Project

Hall 15/C24-C42

Italian OEM Epta will showcase the Life-C4R (Carbon 4 Retail) project, which is co-funded by the EU and coordinated by Epta. Life-C4R was created to accelerate the dissemination and implementation of very-high-efficiency CO_2 refrigeration systems as a way of reducing GHG emissions and cutting energy consumption.

The technology promoted by the project is based on Epta's full transcritical efficiency (FTE) 2.0 system, the second generation of its patented FTE technology for CO_2 transcritical systems, which has so far been installed throughout the world, even in very warm climates.

Compared to standard transcritical CO_2 booster racks, the FTE technology delivers an energy saving of 10%, and 20% lower installation and maintenance costs, said Epta.

Epta's first Italian pilot system for Life-C4R project

Frascold's Z-TK transcritical CO_2 compressor

Frascold: New Transcritical CO_2 Compressor

Hall 15/F32

Italian compressor manufacturer Frascold will be exhibiting its latest six-cylinder transcritical CO_2 compressor, dubbed Z-TK, which increases displacement to 38 m³/h at 50Hz.

At its stand, a compact condensing unit that works in the transcritical CO_2 cycle will produce cold air "to show the incredible low noise of the machine's operation," said Elisa Argenta Marketing & Communication Manager for Frascold.

In addition, Frascold will also be exhibiting the first screw compressor of its new FVR series, which can be used with R290.

ebm-papst's ESM (energy-saving motor) fan

Wieland's customized heat exchangers

Wieland: Heat Exchangers, Copper Tubes for CO_2

Hall 15 / E46

Euroshop first-timer Wieland will be presenting its original K65 system of high pressure copper tubes for transcritical CO_2 systems. Wieland will also be showcasing its custom heat exchanger solutions for heat recovery systems and domestic hot water applications. Wieland's heat exchanger portfolio includes air-cooled gas-coolers.

ebm-papst: Hydrocarbon-Compatible Fans

Hall 15, F55

German fan and motor manufacturer ebm-papst will highlight the safety aspects of its equipment, especially in relation to the use of flammable natural refrigerants.

"When developing air conditioners, refrigerating plants, domestic refrigerators, and heat pumps, manufacturers should make an effort to use only product components which satisfy all established standards concerning the use of flammable refrigerants," said Bernd Kistner, Sales Director Refrigeration & Air Conditioning for ebm-papst.

In addition, ebm-papst aims to address the impact of the EU F-Gas Regulation on its fans, Kistner said. ebm-papst recently published an animated video (https://bit.ly/2RJa3f8) showing how the F-Gas Regulation will drive more uptake of natural refrigerants.

"At EuroShop, we will show how we handle natural refrigerants and how we can support our customers," Kistner said.

Hall 16

Carrier: CO_2 for Stores and Warehouses

Hall 16/A02-B02

Carrier Commercial Refrigeration Europe plans to feature an elaborate stand at EuroShop, including a series of "cool spots" representing a convenience store, supermarket and warehouse. The Carrier stand's supermarket area will consist of four sections: fresh, frozen, gourmet and systems. The systems section "will demonstrate new-dimension, high-performance mechanical systems for retail, regardless of application size or climate, featuring carbon dioxide (CO_2) as a natural refrigerant," Carrier said in a statement.

The stand's warehouse section will feature its PowerCO_2OL transcritical CO_2 system for large applications such as medium-to-large warehouses, distribution centers and food processing sites.

Carrier's PowerCO_2OL transcritical CO_2 system

Arneg's transcritical CO_2 rack

Arneg: CO_2 Racks for Supermarkets

Hall 16/A56-C56

Italian OEM Arneg will be exhibiting its range of transcritical CO_2 booster rack systems. The company will exhibit three transcritical CO_2 racks designed for supermarkets of different sizes, according to Enrico Zambotto, Refrigeration Director for Arneg. "Two of them are [outfitted] with inverters and ejectors," Zambotto said. Arneg will also be exhibiting its small R290 water chiller designed for small-format retail and convenience stores.

Danfoss: New Case Controls with Smartphone App

Hall 16/C59

Danish component maker Danfoss will focus on small format stores and their needs, with a special emphasis on intelligent cloud-based monitoring and management technologies, a key component of the company's Smart Store concept. One of the products to be introduced is the new ADAP-KOOL Case Controls Solution, which aims to decrease cost and increase user friendliness with a smartphone app that can help simplify design, installation, service and use of food retail systems. The solution includes a new case controller platform, electric expansion valve, pressure transmitter, and a temperature sensor.

Danfoss' ADAP-KOOL case control system

Frost-trol's water condensation R290 case

Frost-trol: R290 Waterloop Case

Hall 16/B22

Spanish display case manufacturer Frost-trol has worked closely with Carel to develop a flexible refrigerated case that combines waterloop condensation with natural refrigerants. This system has an evaporator designed for refrigerant charge requirements, as well as the implementation of BDLC compressors, electronic valves, and the electronic management of Carel's Heos platform. At EuroShop, Fros-trol will showcase its waterloop condensation unit, using R290 as a working fluid.

Carel's pRack controllers for racks and condensing units

Carel: R290 Controllers and IoT

Hall 16/E01

Among the products Italian component maker Carel is bringing to the table are new equipment for plug-in R290 cases, including inverter compressors and integrated controllers, for both chest freezers and showcases.

Carel will also premiere a brand new range of controllers, called the iJ, for food service, display cases and merchandising options. These include options to control R290 compressors. Along with the iJ controllers, Carel will also be presenting an upgraded suite of IoT (Internet of Things)-related services, with devices for local and remote monitoring of air conditioning and supermarket refrigeration units. The new IoT services extend the connectivity of electronic controllers by transferring data to a remote server for the creation of advanced dashboards to help boost system efficiency.

Novum's Panama Green R290 cases

Novum: New R290 Upright Display Case

Hall 16/E02

Novum, an Irish commercial refrigeration cabinet manufacturer, will introduce its first upright, full glass-door, low-temperature display case called the Panama Green. All of Novum's refrigerated cabinets use R290. The new display case "complements our chest freezer range," said Eoin Lennon, Chief Technical Officer for Novum.

The new case also employs Novum's LEAP technology, designed to ensure stable food temperatures with no defrost cycles and removable refrigeration "cassettes," which solves any "propane service concerns customers may have," Lennon added.

Panasonic's CO_2 condensing unit (OCU CR200VF5)

Panasonic: CO_2 Condensing Units for Small Stores

Hall 16/E32

Panasonic Heating and Cooling Europe will be focusing on "efficient solutions for small retail stores" such as mini supermarkets, fueling stations, fast food chains and restaurants, said Lena Ansorge, Communications Manager to Koichiro Arakawa, Product Planning & Technical Support (Cold Chain). The natural refrigerant solutions for this format include Panasonic's line of 2HP and 10HP CO_2 outdoor condensing units.

In addition, the company also plans to introduce its 4HP CO_2 outdoor condensing unit for medium- and low-temperatures.

Also making its debut at EuroShop is Panasonic's CO_2 Refrigeration Designer, which supports engineers, installers, and technicians in specifying solutions for commercial refrigeration systems.

Emerson: R290 and CO_2 Compressors

Hall 16/E56

Component maker Emerson Climate Technologies, with European headquarters in Aachen, Germany, is planning to focus on both centralized and decentralized refrigeration systems at Euroshop, and will also showcase its integral display cases.

The company will promote the Copeland Scroll YBVH variable-speed horizontal compressor and frequency inverter for medium- and low-temperature cabinets. The Copeland Scroll is optimized for single circuit cabinets with a 500g hydrocarbon refrigerant charge. The Copeland compressor can be combined with a new full-touch refrigeration controller compatible with R290, thus enabling efficient energy management. The parametric and programmable controller is tailored to control variable-speed systems.

Emerson will also showcase its CO_2 EasyCool condensing units for shops less than 2,500m² (26,910ft²) that need a decentralized refrigeration system, and its CO_2 Stream compressor and CoreSense Diagnostic module with matching flow controls, electronics and monitoring systems, for larger store formats.

Copeland Scroll variable-speed compressor

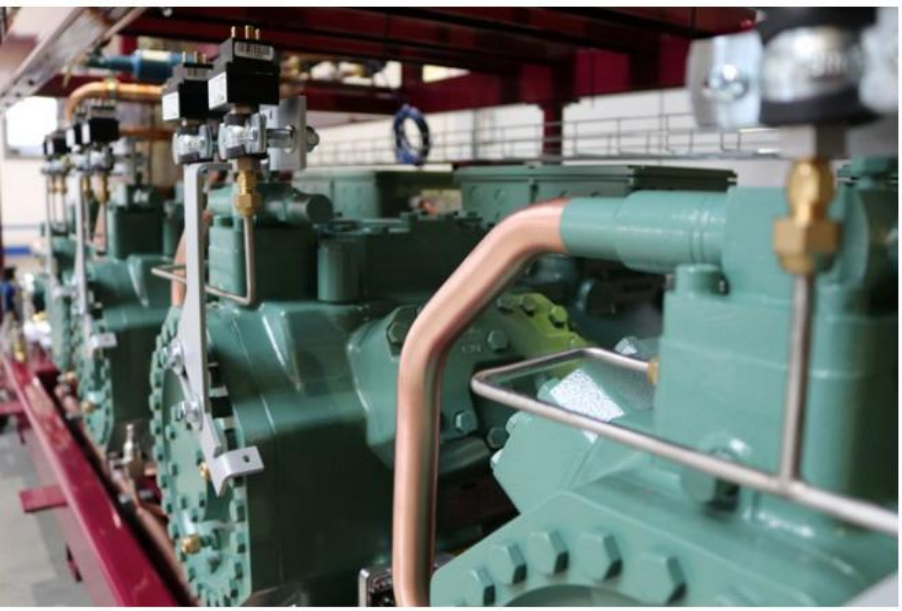
Hall 17

Teko: New CO_2 Racks and R290 Heat Pump

Hall 17/A60

German OEM Teko will be introducing CO_2 rack systems: the "ROXSTAmicro" CO_2 air- and water-cooled plug-and-play units for up to 3kW (0.85TR), and the "ROXSTAG6" large capacity CO_2 system for up to 530kW (150TR). It will also unveil its "RANSTAheat" propane heat pump, which is rated for down to -20°C ambient temperatures.

In 2020, the company will focus mainly on expansion of its CO_2 business, having reached 4,000+ successfully installed CO_2 racks in the market, as of the end of 2019. In addition, the company will also focus on training, energy efficiency and safety for all its CO_2 systems in order to "offer the best reliability to the end customer and therefore ensure more and more adoption of natural refrigerants in general," said Lydia Matthäus-Wiltink, Business Development Manager for Teko.



Teko's ROXSTAG6 CO_2 rack system

Freor's semi-vertical Pluton Space Island

Freor: R290 Display Cases

Hall 17/A74

The theme at Freor's stand at EuroShop will be "Rethink Refrigeration." The Lithuanian company will exhibit propane (R290) plug-in refrigerated display showcases. The spotlight will be on its R290 semi-vertical modular islands, including the Pluton Space Island semi-vertical, medium-temperature cabinet, and the newly designed Orion Island semi-vertical freezer cabinet. These operate with modular air condensers. In addition, the company will showcase promotional R290 plug-ins, including the latest model, the double-sided EXO chiller. Freor's Hydroloop R290-based waterloop system will also be on display. All of Freor's remote refrigeration showcases can accommodate CO_2.

Advansor: CO_2 for Small Stores

Hall 17/D38

Danish OEM Advansor will present its CO_2 refrigeration systems for large and small retail stores. For the latter, it will exhibit its Minibooster and Tower CO_2 systems, which are designed for stores up to 1,200m² (12,917ft²). "What we see is a very strong growth in CO_2 and we believe that transcritical CO_2 systems are the future solution in food retail and in light industry," said Jasmin Lange, Marketing Coordinator for Advansor. Lange added that Advansor will be exhibiting a "new interesting compact modular rack with a new set-up of technologies" that incorporates Advansor's knowledge from its 6,000+ installed transcritical CO_2 racks.

Advansor's Minibooster CO_2 system

Bitzer's OS.95 screw compressor

Bitzer: Energy-Efficient CO_2 Compressors

Hall 17/D59

At EuroShop, German compressor maker Bitzer, will bring attention to product efficiency improvements and high recycling capacity, especially for CO_2 refrigeration. For example, the ECOLINE reciprocating compressors are highly energy-efficient both in full, and part load, and are designed for a wide range of applications going beyond supermarket applications, said Bitzer. The ECOLINE series includes the ME compressor series, which was especially designed for subcritical CO_2 applications with high standstill pressures up to 100 bar. Bitzer has now supplemented this series with two 6-cylinder models. With 54 m³/h and 64.9 m³/h delivery volume at 50 Hz, the two larger models are particularly suitable for large refrigeration systems in hypermarkets and distribution warehouses.

Bitzer will also be showcasing the latest in its ECOLINE+ reciprocating compressors, available as four- and six-cylinder versions for CO_2, and particularly suitable for supermarket applications. The ECOLINE+ is equipped with line-start permanent magnet motors. This technology gives it up to 14% higher seasonal energy performance ratio (SEPR) than traditional models, due to the increased motor efficiency.

Bitzer will also be exhibiting its OS.95 screw compressor series, designed especially for ammonia applications needing large cooling capacities. The series includes OSKA models for all applications and the OSNA models for low-temperature applications.

GEA's HGX44e CO_2 compressor

GEA: New Subcritical CO_2 Compressors

Hall 17/D77

With the motto "The Clever Art of Cooling," German manufacturer, GEA, will present GEA Bock compressors for natural refrigerants in customized solutions for supermarket and cold storage applications, in possible combination with heat recovery. This will include the world premiere of HGX44 CO_2, a new generation of subcritical CO_2 compressors for industrial low-temperature applications such as cold storage. GEA will also unveil the HGX24 CO_2 (L)T transcritical CO_2 compressor series for smaller capacity applications, especially supermarkets and convenience stores.

The exhibit will also feature GEA's complete hydrocarbon compressor series, including commercial reciprocating compressors for refrigerants such as propane and propylene.

Americas

Policy
Looking for Skilled Technicians? Try the Military

End User
Transcritical CO_2 in Warm, Muggy Florida

Events

1. **February 23-26**
   NGA Show
   San Diego, California U.S.

2. **March 15-18**
   IIAR Natural Refrigeration Conference & Heavy Equipment Expo
   Orlando, Florida, U.S.

3. **March 15-19**
   MCAA Annual Convention
   Wailea, Maui, Hawaii, U.S.

4. **March 16-18**
   ACCA Conference & Expo
   St. Louis, Missouri, U.S.

5. **March 16-18**
   National HVACR Educators and Trainers Conference
   Las Vegas, Nevada, U.S.

Transcritical CO2 in Warm, Muggy Florida

Seed to Table's refrigeration system helps the store deal with the substantial humidity of the Sunshine State while operating in high ambient temperatures.

— By Michael Garry

The first U.S. supermarket to install a transcritical CO_2 was a Hannaford store in Turner, Maine (U.S.), which opened in July 2013. As the most northeastern state in the U.S., Maine was considered a good location and climate for a transcritical system, which at that time worked less efficiently in warmer ambient temperatures.

But since then, technology – notably adiabatic gas coolers, parallel compression, ejectors, subcoolers, and more – has evolved to support the operation of transcritical CO_2 systems in warm climates. Now stores well below the "CO_2 equator" are opening with transcritical CO_2 as their refrigeration system.

A recent example is a 75,000ft² (6,968m²) Seed to Table Market, a refurbished Albertsons store that opened in December in North Naples, Florida, the most southeastern state in the U.S. The system, provided by OEM Hillphoenix, Conyers, Georgia (U.S.), includes three rooftop adiabatic gas coolers from Baltimore Aircoil (BAC), which helps the system function efficiently in the balmy climes of southwest Florida.

Having recently been installed, the energy usage of the transcritical system has yet to be assessed. But, despite the high ambient of North Naples, the energy consumption of the system as compared to that of a traditional DX system is "parity, probably using a little more," said Glenn Williams, sales manager, Supermarket Source, a Hialeah, Florida (U.S.)-based distributor of supermarket equipment, which arranged the purchase of the transcritical system for Seed to Table. The company services independent stores in Florida, with a division that supplies stores in New York City.

Seed to Table is Williams' and Supermarket Source's first transcritical CO_2 project, though the company has handled subcritical CO_2 systems for several stores. Williams, who previously worked for Hillphoenix in the U.S. South, suggested to Seed to Table's owner, Alfie Oakes, that he should use CO_2 refrigeration if he "wanted to go all natural," though it would cost more up front. "But he was happy that CO_2 was only 10% the cost of R448A refrigerant," Williams said.

Williams described the owner as "sophisticated" about refrigeration, which he uses for his farms and warehouses. "When we explained it, he got it immediately," he said.

Seed to Table's corporate owner, Oakes Farms, is an independent agribusiness operation based in Collier County, which encompasses Naples in southwest Florida. Its businesses include farming, packing, shipping, retail stores, and food service and seafood distribution. In addition to Seed to Table, Oakes Farms runs an Oakes Farms Market and a Food & Thought Organic General Store in Naples, and two stores in Delaware (U.S.).

Oakes Farms says on its website (www.oakesfarms.com) that it operates its farming divisions "in a manner that respects the long-term health and well-being of the environment, the land, our partners and the community."

The Seed to Table store, which Williams calls a "destination" as well as a grocery store, features produce from the company farms, a large all-organic section, two-story wine section, ice cream shop, a fresh bakery and many other culinary favorites.

Given its organic and environmental ethos, Oakes Farms was a good candidate for a natural refrigerant, in this case CO_2.

Dealing with humidity

The challenge posed by the weather in coastal South Florida is not just warm temperatures, but high humidity. So Seed to Table's HVAC&R systems had to be designed to minimize the latter. SESCO, a North Carolina-based engineering and equipment supply company, designed a complete store AC system using R410A to accomplish this.

The Seed to Table store presented a particular challenge. Because the store does a lot of cooking, it has more than 100ft of exhaust hoods that are configured to utilize at least 80% of their supply air to help to lower outside air requirements. However, it is still necessary to pressurize the store by introducing outside air, and treating it as well as the inside air to maintain a 75°F (24°C) dry-bulb temperature and 55% relative humidity (ASHRAE conditions that cases are designed for). But in subcooling the air to remove humidity, the temperature may drop below 75°F; in that case, hot discharged CO_2 is channeled to a heat exchanger coil in the AC system to warm the air, also helping to keep the refrigeration system in a more efficient, subcritical operational mode, said Williams.

In the event of cool outside temperatures where heat is needed, the heat reclaim can also be used to warm up the store. (Gas heat is also available). CPC (Emerson) controls manage cooling, heating and dehumidification as well as refrigeration.

Destratification fans are also used to "keep the aisles from getting too cold from open case spillage," he said. "We move a lot of air around to make the store more comfortable, and to have a smoother more efficient operation of the AC system."

The transcritical system also provides heat by which the store preheats potable water that is further heated by a gas water heater (though sometimes the preheated water is sufficient). The two-step preheating takes place by means of two Swep heat exchangers; one is a blazed plate unit that employs glycol to grab heat from discharged CO_2; the other uses the warm glycol to preheat potable water. "The water tank that we use can't handle the CO_2 pressure, so we needed another heat exchanger to heat the water and circulate it through the tank," said Williams.

Meanwhile, at the display cases, up to four case controllers – tied to the rack controller – are used to manage the evaporators and electronic expansion valves.

A company called Cogent Enterprises monitors the cases remotely and contacts the store in the event of an issue. "They also use analytics to ensure proper operation and maximize energy saving where possible," said Williams.

Seed to Table may be Supermarket Source's first transcritical project, but it likely won't be its last. Many stores in its distribution network are still using HFC DX systems with HFCs (some even with R22), noted Williams. He hears discussion about needing to "start talking to them about natural refrigerants – we want people to be more prepared." ■ MG

Transcritical CO_2 rack at Seed to Table

System Specs

The transcritical CO_2 system at the Seed to Table store in North Naples, Fla., includes the following:

- **Rack:** Hillphoenix
- **Glycol, water heat exchangers:** Swep
- **AC air heat exchanger:** Super Radiator Coil
- **Adiabatic Gas Cooler:** Baltimore Aircoil (BAC)
- **Medium-temperature capacity:** 1,300 MBH at 11°F SST
- **Low-temperature capacity:** 100 MBH at -15°F SST
- **Total heat rejected:** 2,150 MBH when water and air heat reclaim are not used.

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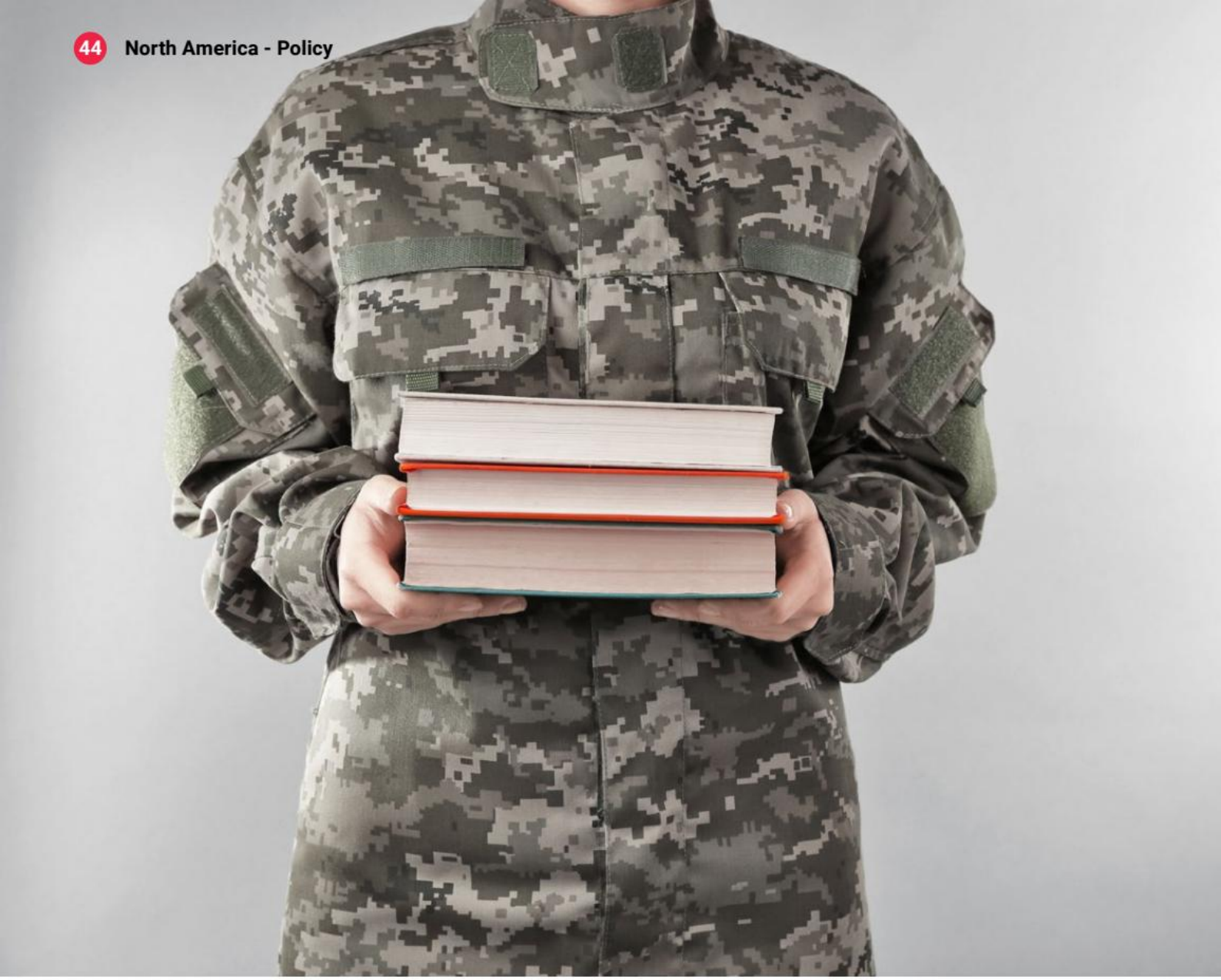

Looking for Skilled Technicians? Try the Military

RETA's new Red White and Cool project is training military personnel who are approaching the end of their service period, addressing the shortage of qualified technicians in HVAC&R.

— by Tine Stausholm

FIVE-WEEK PROGRAM

The Refrigerating Engineers and Technicians Association (RETA), based in Albany, Oregon (U.S.), is launching a program to recruit, train and hire military veterans to work as technicians in industrial refrigeration, focusing on ammonia and CO_2 refrigerants. The program's name: Red White and Cool.

Red White and Cool aims to attract people already equipped with skills prized by the HVAC&R industry, thereby helping companies struggling with the shortage of qualified refrigeration technicians.

"If you've worked on aircraft, or if you've worked on a ship, then you've got that technical skillset already, so it would be a perfect transition," said Lois Stirewalt, Workforce Development Program Director at RETA, who is spearheading the Red White and Cool program. She was one of 29 women profiled in *Accelerate Magazine*'s "Women in Natural Refrigerants" cover story in the January 2020 issue.

Stirewalt began working on military recruitment for industrial refrigeration jobs in 2018 while Executive Director of the Ammonia Refrigeration Foundation (ARF). Last year, she struck up a working relationship with the human resources department at Smithfield Foods, a meat-processor based in Smithfield, Virginia. The company, which already had an initiative to attract former service personnel, eventually became Red White and Cool's founding sponsor.

The Red White and Cool program is organized by the newly formed RETA Training Institute (RETA TI), a nonprofit arm of RETA that focuses on workforce development issues. RETA TI is also running two other programs, one for women (Women in Natural Refrigeration, which Stirewalt also helped organize) and one to attract young adults and youth. RETA TI was announced at the RETA conference in October 2019.

Red White and Cool has been approved by the U.S. Department of Defense (DoD), and it is a part of a broader DoD program called SkillBridge, which aims to help connect transitioning service personnel to career, job and training opportunities.

The SkillBridge program is present on military bases around the U.S., offering career advice and allowing transitioning personnel the opportunity to spend the last 90 days of their service undergoing training and preparing for a civilian job.

Red White and Cool's initial training program starts on March 23. It includes four weeks of classroom training at the Joint Base Langley-Eustis, located adjacent to Hampton and Newport News, Virginia – about 30 minutes from Smithfield's headquarters – followed by a week of hands-on training at a Smithfield facility. Refrigeration training specialist Wagner-Meinert is providing the classroom training.

The course will mainly focus on ammonia refrigeration, but also includes elements of CO_2, according to Stirewalt. At the end of the course, candidates will take the Certified Assistant Refrigeration Operator (CARO) certification test, administered by RETA.

Smithfield has agreed to hire all the graduates from the first five-week training program. Should any of the graduates come from an area where Smithfield is unable to offer a job, RETA has made a "gentleman's agreement" that the U.S. government will help them find a job. "I don't think that's going to be hard at all given the fact that there are 40,000 job openings," Stirewalt said.

RETA Executive Director Jim Barron, a navy veteran, has a personal interest in the success of the program. "He's committed to making sure, if somebody's falling behind, they'll [get] personal coaching to make sure everybody can complete the course," Stirewalt said.

The Red White and Cool program is targeting a minimum of eight candidates, with a maximum of 18, but "at this point we've had so much interest, we're trying to figure out how we're going to cap it," Stirewalt said.

The state of Virginia has also helped get the word out on social media through its Virginia Values Veterans program, and the U.S. Army has promoted the program on its job boards.

Other industrial refrigeration companies have expressed interest in the program, seeing it as a cost-efficient way of recruiting qualified technicians, a process that can often cost more than $10,000 per person, according to Stirewalt.

Stirewalt has high hopes for the program. "The army loves the name of it, they love everything that we've done," Stirewalt said. "Once we finally got through all the bureaucracy and got approved, they were already talking with us about implementing the same program in Germany and other military bases around the country."

"We want to make sure we do this really well the first time so we can implement this in other places," she added.

For more information about the program, email redwhiteandcool@RETA.com ■ TS

> *"If you've worked on aircraft, or if you worked on a ship, then you've got that technical skillset already, so it would be a perfect transition."*
>
> – Lois Stirewalt, RETA

Europe, Middle East & Africa

Events

1. **February 11-13**
   HVAC R Expo Saudi
   Riyadh, Saudi Arabia
2. **February 16-20**
   EuroShop
   Düsseldorf, Germany
3. **March 10**
   ATMOsphere Cape Town
   Cape Town, South Africa
4. **March 17-20**
   Mostra Convegno
   Milan, Italy
5. **March 31**
   ATMOsphere Ibérica
   Málaga, Spain

Wojciech Polak, Biedronka

King of the Retrofits

By the end of 2020, Polish retailer Biedronka expects to convert 900 stores to transcritical CO_2 as it strives to be HFC-free in refrigeration by 2025.

— By Tine Stausholm and Marc Chasserot

While many food retailers around the world have installed transcritical CO_2 refrigeration in new stores, fewer have undertaken a major effort to retrofit existing stores with the technology, preferring to get more use out of legacy systems.

But giant Polish discount retailer Biedronka, part of the Portugal-based Jerónimo Martins Group – and winner of the *Accelerate Magazine*/Europe 2019 Best in Sector/Food Retail award – has taken a different approach. Out of its more than 2,900 stores, around 600 were retrofitted with transcritical CO_2 between 2017 and October of last year, with another 300 existing stores slated to be equipped with the technology this year. The company is also converting its 16 distribution centers to CO_2.

Biedronka, a 25-year-old chain based in Kostrzyn, Poland, has also installed transcritical systems in new stores, including 350 as of last October, and another 150 planned for 2020. In December 2019 alone, the company opened 80 new stores with CO_2 equipment, according to Wojciech Polak, Technical Director for Biedronka, who recently spoke to *Accelerate Magazine*.

CO_2 is not Biedronka's only natural refrigerant. About 20% of its display cases use propane (R290) plug-in units. In a natural refrigerant store, a common configuration includes 10-12 medium-temperature cabinets using CO_2 (along with medium-temperature and low-temperature cold rooms), 10-11 medium-temperature R290 coolers, and 10 R290 freezers.

Biedronka's goal is to become 100% HFC-free in its supermarket refrigeration by 2025.

"It is still the majority of our stores [that uses HFCs], but I would say that we will soon come to a level at which we will have a 50-50 split," Polak said.

Refrigeration is not the only element of the chain's environmental program. "We understand our contribution to society in terms of environmental protection and in carbon footprint, so we are trying to do our best in every possible sector, not only in refrigerants, but also in food collection, waste reduction, and shifting from plastics to other packaging," Polak said.

One economic benefit of Biedronka's retrofit program is the recovery and recycling of HFCs from the refurbished stores, which are then re-used in the stores that have yet to be converted. "The amount of the refrigerant which we recover during refurbishment gives us a base for servicing the stores that are still remaining," Polak said.

This serves as a hedge against HFC price increases. "We are really happy that a large part of our stores was based on natural refrigerants [when HFC prices began to go up] because they are the future," Polak noted. "Nobody is resistant to an increase of a refrigerant price 10 times within a year, and that was the reality."

SIGNIFICANT INVESTMENT

Polak acknowledged that changing from HFCs to natural refrigerants has been a "significant investment." In 2018, the chain spent 65 million euros (US$72 million) on refrigeration. But the additional expense has also been "partially justified by the higher energy efficiency," he said, adding that the chain also benefits from the scale of its business. "So we've been able to drive the cost down to a reasonable level."

Another challenge is Biedronka's position as an early adopter of natural refrigerants in Poland. "I think that we underestimated, mainly in terms of CO_2, that the technology is relatively young in the market, which has an impact on maintenance, especially in relation to brushless DC (BLDC) compressors, where the breakdown rate is slightly bigger than we expected," Polak explained.

"We need to put a lot more focus on controlling, managing and maintaining it," he said. "If you have one compressor, one breakdown, you can live with it, but if you have many thousands of stores, then it becomes visible."

Polak was asked whether Cooling as a Service (CaaS) – a model by which end users essentially lease equipment rather than buy it upfront – would be helpful to a major user of transcritical CO_2 like Biedronka. He said CaaS is not something Biedronka is planning to adopt. "CaaS is a very effective solution for entities where they need to balance properly their capital expenditure," Polak acknowledged. But he added that adding "another stakeholder into the equation" makes it less effective since "everybody needs to make money."

In addition, by using CaaS, "you impact your profit and loss more than you would just by depreciation," Polak said.

Once Biedronka finds itself in a situation in which it will no longer be able to manage capital expenditures, "then we will look at it," he said. "But as far as I know, we're not at that moment yet." ■ TS & MC

TO INTEGRATE, OR NOT TO INTEGRATE

A number of European retailers have been integrating refrigeration and air conditioning in the same transcritical CO_2 system. But Polish retailer Biedronka prefers to keep things separate.

"It is fairly easy to adapt air conditioning and connect it to the refrigeration system, but then it is vulnerable to breakdowns and exposing your [store], and [making you] vulnerable to loss of goods," said Wojciech Polak, Technical Director for Biedronka. "If you consider the breakdown rate in refrigeration and air conditioning separately, you have X amount of breakdowns on average, if you combine it together, you have twice as many."

The risk of breakdowns is not the only issue keeping Biedronka from adopting integrated systems. Different optimal strategies for the two areas also play a part.

"From a thermodynamic perspective, there are different set points and requirements for the refrigeration perspective and for the air conditioning perspective, which means that either you set it up for the reasons of refrigeration or for those of air conditioning," Polak said. "Normally you do it for refrigeration, and air conditioning is not perfectly optimized considering energy efficiency, so we'd rather keep it separate."

This choice means that Biedronka does not expect to be HFC-free on the HVAC side by the time the refrigeration side uses only natural refrigerants. "We are actively looking for [natural refrigerant] solutions in terms of air conditioning," Polak said. "I don't think we will become HVAC natural in terms of the whole portfolio of stores that we have because there are no AC solutions available," he said, though Biedronka is on the lookout for such solutions.

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HVAC&R MOVES TO 'INDUSTRY 4.0'

End users and manufacturers explain how smart digitization is making cooling systems more efficient and cost effective.

— By Tine Stausholm

Last year, shecco, organizer of ATMOsphere conferences, asked its advisory committee what topics should be addressed at ATMOsphere Europe, held in Warsaw, Poland, in October.

The committee said it wanted to "understand [more about] smart systems, the ones that have all these sensors, all these controls, all this IT and data management and how that helps make our systems more efficient," said Marc Chasserot, CEO of shecco and publisher of *Accelerate Magazine*.

This is the technology driving the fourth industrial revolution, or "Industry 4.0," which is, once again, changing the way we manufacture, store and transport goods. Smart digitization, leveraging artificial intelligence (AI) and the Internet of Things (IoT), is being used to optimize processes, minimize wastage and reduce energy consumption in HVAC&R and many other industries.

The following is a selection of comments made by the members of a panel assembled to analyze Industry 4.0 at ATMOsphere Europe. The panel, moderated by Chasserot, consisted of representatives from end users (Nestlé and Ahold Delhaize), manufacturers (Carrier, Carel, Eliwell and Resource Data Management) and an energy efficiency consultant (Crowley Carbon).

Marc Chasserot: When you approach your customers and tell them "you need to invest in better controls, and better software and data management," what's the big reason for doing that?

From left: Enrico Mirandola, Resource Data Management; Vincent Grass, Nestlé; David Schalenbourg, Ahold Delhaize; Ladislav Strojil, Carrier; Mauro de Barba, Eliwell; Serena Ometto, Carel; Michael McDaid, Crowley Carbon; and Marc Chasserot, shecco.

Vincent Grass, Nestlé: Well, when I go and visit factories, I see a lot of systems that are not operating well, not at their best efficiency, because efficiency is not necessarily sustained.

We don't have a refrigeration expert in each factory and we don't have data analytics experts locally. So I think there is huge potential for systems to actually model digital [streams] so that we provide insight for the operator, but in a manner in which the information is useful for the operator - not a specialist.

If you actually quantify this information in cost and energy, then the decision and the action might be totally different. I see an opportunity for us to save some costs [and] reduce energy. I think that this is actually the driving force: to implement changes and to make your systems more efficient.

Michael McDaid, Crowley Carbon: It boils down to efficiency and savings. If technologies are only providing features, they're not much use. It's about user experience and asking whether or not we can make money from this. Can we save money on this? Can we deliver huge benefits to the ecosystem and the environment thereafter?

Because, this is what the industrial IoT is really all about for me. It's all about how data becomes systems of tangible results in business outcomes. Each one of us in this room today has a number we have to hit in production, efficiencies, reductions – the bottom line management for the business.

We have to monetize the data, we've got to use that data in a smart fashion. How can we improve throughput by using the data? How can we improve the efficiency of the machines, the life cycle of the machines, and the reliability and placement of the machines?

In one recent case in the U.K., we have identified an almost 15% reduction in energy consumption just by looking at a four-tank process chilling system, and there's a number to that [percentage] — it equals £132,000 (US$173,085) of savings in electricity.

Enrico Mirandola, Resource Data Management: It is all about how we present our data, which needs to provide actionable information, for the right people at the right time. In other words, real data in a fast manner.

Ladislav Strojil, Carrier: For us, it is important to distinguish between normal behavior, normal deviations and abnormal deviations.

Marc Chasserot: You could go really cheap with really low data, or you could go super 5G, right?

Mauro de Barba, Eliwell: You've got networking and you've got wireless that can be upgraded to 5G, but today wireless cabling is what we use. The problem is actually sometimes that client infrastructure is not fast enough. So this limitation is the biggest issue at the moment.

I think there is huge potential for systems to actually model digital [streams] so that we provide insight for the operator.

– Vincent Grass, Nestlé

Your data can help us to avoid food waste and CO_2 emissions.

– David Schalenbourg, Ahold Delhaize

Michael McDaid, Crowley Carbon: Yeah, I think the availability of data and the way to bring that data is to talk of 5G; there are many different ways that we can bring data through, and we are seeing an increase in new technologies today.

But we must have low-cost ways of reaching that data, and getting that data to where we are going to deliver results. In addition, we should not look in the past to predict the future but instead we should deliver value today.

Marc Chasserot: Do you want an open system? You don't want to be locked into one solution, one type of software, one relationship?

Enrico Mirandola, Resource Data Management: An open system is key. We cannot have just one supplier deliver the data. So, because there are very different data that can be put together, having an open system enables us to put all of it together and make it available for more people in a nice way. That could be remote, like on the Cloud, but not necessarily.

Serena Ometto, Carel: In the past, the trend was really to just take all the data available on the bottom side and transfer it to the Cloud. But again, in terms of sustainability, this is not the most effective solution. So it's true that, in terms of making an analysis, it's useful to have the most important information on an enterprise solution.

It is therefore important to design the right [message] to do what is necessary locally and to transform what is really relevant for the deeper analysis. Then for sure, share the information.

David Schalenbourg, Delhaize: Your data can help us avoid food waste and CO_2 emissions. So it's where we have this common goal to reduce losses. But if we can have better follow-up on refrigeration systems, which become more intelligent, and we also have other intelligent equipment entering our stores, it takes a lot of time and IT security.

From the industry, I think you can give a generic answer to all of those food retailers, because we all face the same problem. I always hear, if I'm your customer, you will give me a tailor-made solution. But in fact, you can make a tailor-made solution for the whole food retail sector, and then you end up addressing food waste on a much larger scale.

Marc Chasserot: Food retailers reduce food wastage, but could you have a system that's used right from the supplier on the farm to your store – and one that is connecting the whole range?

Vincent Grass, Nestlé: We hear and we see the new technologies being used but, to be honest, I've been in refrigeration now for 20 years and while I see improvements in efficiency, these are not enough to actually address climate change.

What is happening now — and this is really a call to arms — is that there's a lot of wastage of energy out there, and this is probably a much bigger opportunity than what we are going to achieve in replacing an old system with a new system that is 5% to 10% more efficient.

If you sell a product, please also work on the model that can be used to sustain performance and actually improve it. ■ TS


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The system has a total ammonia charge of approximately 1,400kg (3,086.5lbs).

Kenyan Fish Processing Facility Upgrades from R22 to Ammonia

East Africa Sea Foods employs an efficient two-stage system from German manufacturer GEA that increases production capacity.

— By Ilana Koegelenberg

East Africa Sea Foods (EASF), a fish processing facility located in Kisumu, Kenya, recently replaced its aging R22 refrigeration system with a two-stage ammonia system from GEA, improving efficiencies and expanding production capacity.

The previous system had two separate units on R22, which is still being phased out in developing countries such as Kenya. These units consisted of old equipment that was removed from a previous site and reinstalled at EASF, explained Paul Le Gros, Proposal Engineer at GEA Africa, who worked on the project. This included R22 Grasso compressors that were manufactured in 1987 and reinstalled at EASF between 1990 and 1993.

As such, the time had come for an upgrade of the refrigeration system. GEA Africa supplied the compressor sets, evaporative condenser, piping, valves and electrical main control panels. EASF, along with its in-house team, did the installation with a complete set of schematic and piping and instrumentation diagram (P&ID) drawings provided by GEA Africa. In addition, GEA Africa offered technical or best-practice advice. The project took 11 months from order date to commissioning.

"This collaboration with EASF culminated in a successful installation and commission of an environmentally friendly ammonia refrigeration plant, capable of providing responsible cooling energy for years to come," said Le Gros.

EASF falls under Alpha Group Limited, based in Nairobi, Kenya, with extended operation in Tanzania and Uganda. All of its sites have achieved Hazard Analysis and Critical Control Points (HACCP) certification, BRC certification and its ISO 22000:2005 (for a food safety management system).

When asked about why it switched to ammonia, Ismail Nathoo, Director of Alpha Group, listed the main reason as environmental responsibility. The second was energy management. "Due to its highly favorable thermodynamic properties, ammonia requires less energy to produce refrigeration cooling capacity compared to other common refrigerants," explained Nathoo. "In addition, it is a better refrigerant at better cost and easily available in the market."

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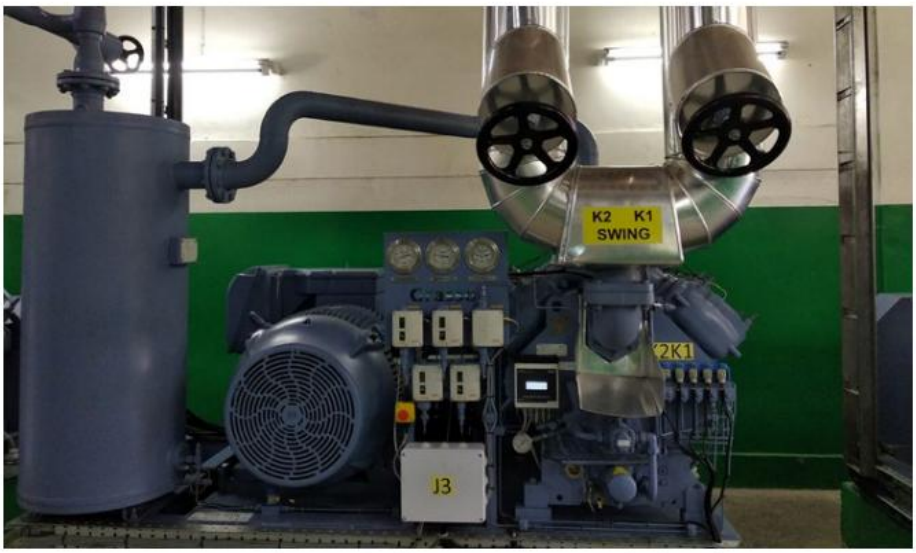

GEA Africa supplied the compressor sets and other refrigeration equipment.

"The conversion from general CFC and HCFC refrigerants to ammonia forms part of the upgrading policy of the company," added Nathoo. "It improves the product's quality and helps satisfy the market demand by allowing greater production."

One more time

This was not the first time that GEA had provided Alpha Group with a two-stage ammonia solution. "Based on the previous system's efficiency and reliability, the client opted for the same solution," said Le Gros.

"We have been using Grasso/GEA systems for nearly three decades now with great satisfaction on their reliability, performance, design and value to the investment," confirmed Nathoo.

However, the team still did their homework to make sure ammonia would be the best choice for this project. According to Le Gros, they did a calculation comparing the same installation making use of R507 refrigerant on the existing compressors; the result was an average compressor/shaft power coefficient of performance (COP) of 1.42 as opposed to the current system's compressor/shaft power COP of 1.68, he noted.

Two other options were to use a screw compressor on R507 with a compressor/shaft power COP of 1.04, or a multiplex rack using 11 commercial Bock compressors with a combined compressor/shaft power COP of 1.07. "This clearly indicates that the booster/compound configuration not only yields better efficiencies, but so does the use of ammonia," said Le Gros.

The current system has a total ammonia charge of approximately 1,400kg (3,086.5lbs). "Considering that ammonia has no GWP and no ODP, compared to R507's GWP of 3,985, it is clear that the responsible option would be to use ammonia as a refrigerant," said Le Gros.

At the same time, EASF is very focused on safety and has a comprehensive plan when it comes to managing the potential dangers of using ammonia as a refrigerant. "It starts by ensuring that the current valves, piping and fittings meet code requirements and are installed according to best practices," explained Rajaram Prakash, Project Manager at Alpha Group.

During the design phase, EASF worked with GEA to ensure that extra safety controls and vents were included. In addition, it spent a great deal of time on training on the correct use of personal protective equipment (PPE) in the event of an ammonia leak, and on risk-assessment analysis.

EASF also ensures that all staff and sites are equipped with the correct safety equipment such as facemasks, gloves, and tools to ensure safe working conditions in the event of an ammonia leak. ■ IK

Ammonia System's Design

The new ammonia refrigeration system at East Africa Sea Foods (EASF), a fish processing facility located in Kisumu, Kenya, serves two plate freezers, one blast freezer, one freezer airlock room, and one freezer room that also requires refrigeration, explained Paul Le Gros, Proposal Engineer at GEA Africa, which supplied the system.

The refrigeration system design is a two-stage configuration where the low-stage compressors discharge into a high-stage accumulator vessel. This induced load is then handled by the dedicated high-stage compressor circuit.

The new refrigeration system still makes use of two Grasso V1400 reciprocating compressors for the low-stage side, one Grasso V1400 reciprocating compressor for the high-stage side, and another as a standby swing compressor. All the compressors are belt-drive models, as per EASF's request.

The low-stage side of the system has a load of 364kW (103.5TR) operating at a -42°C (-43.6°F) suction temperature with a -10°C (14°F) condensing temperature. The high-stage operates at a -12°C (10.4°F) suction temperature and a 35°C (95°F) condensing temperature handling a total induced load of 451kW (128.2TR).

Once the installation was completed, GEA Africa provided a specialist team to commission the system and ensure that it operated according to design specifications.

South Africa to Host 'Matchmaking' Educational Event on **Cooling-as-a-Service** Model

BASE will instruct stakeholders, who will have a chance to meet at the March event alongside ATMOsphere Cape Town.

— By Ilana Koegelenberg

Switzerland-based Basel Agency for Sustainable Energy (BASE) will head to Cape Town, South Africa, on March 9 to speak to the local HVAC&R industry about the cooling-as-a- service (CaaS) business model.

The BASE team will host two free roundtable sessions – taking place the afternoon before the first-ever ATMOsphere Cape Town event – to help South African equipment providers, end users and funders of HVAC&R technology learn more about CaaS and how to implement it. It's also a "matchmaking" opportunity, putting providers in contact with end users to discuss leveraging the CaaS model.

CaaS is a pay-per-service business model designed to overcome first-cost barriers and accelerate adoption of energy-efficient cooling technologies and climate-friendly refrigerant gases. "CaaS is a promising financial instrument that works to overcome key market barriers to clean and efficient cooling," said Daniel Magallón, Managing Director of BASE.

BASE leads what's called the CaaS Initiative (https://bit.ly/2TGYxlG), along with Kigali Cooling Efficiency Program (https://www.k-cep.org), with the endorsement of the Global Innovation Lab for Climate Finance (https://bit.ly/38rfu80). The initiative aims to decrease energy consumption and greenhouse gas emissions from cooling by using a pay-per-service model to finance more efficient cooling systems.

Market accelerator shecco, publisher of *Accelerate Magazine* and organizer of ATMOsphere Cape Town, and BASE signed an official Memorandum of Understanding (MoU) on November 20, 2019 to promote the CaaS Initiative.

Two discussion sessions

BASE's first roundtable-discussion session, open to technology providers and investors, will look at the opportunities and challenges surrounding the CaaS model in South Africa.

After a break, technology providers and end users managing commercial and/or industrial HVAC&R systems will participate in the second session; end users will learn about how to apply CaaS to their own projects, as well as interact with providers.

Registration for this event is free but must be completed before Wednesday, February 26, 2020, at (http://bit.ly/38FnNgm) ■ IK

Deadline Nearing for Applications for Cooling-as-a-Service Projects

To mainstream the Cooling-as-a-Service (CaaS) model around the world, Switzerland-based Basel Agency for Sustainable Energy (BASE) is seeking applications, until February 14, to receive free support for incubator projects that use highly efficient air-conditioning or refrigeration solutions with low-GWP or natural refrigerants.

Five companies will be selected to receive free support from BASE to integrate CaaS into their business lines. The selected companies will receive assistance on technical, legal and financial aspects to implement the CaaS model, such as contractual arrangement, pricing strategy, and financial structuring, including risk mitigation mechanisms, among others.

The application deadline is February 14, 2020, and the winners will be announced on February 28, 2020. Interested parties can apply through the CaaS website (https://bit.ly/2Rf0e8u).

Australia & New Zealand

Events

1. **March 19-20**
   Sydney Build Expo
   Sydney, Australia

2. **March 23-24**
   Airah Refrigeration
   Melbourne, Australia

Meeting the 'Living Building Challenge'

The new Woolworths Burwood Brickworks store east of Melbourne.

A Woolworths store near Melbourne uses transcritical CO_2 refrigeration and doors on all display cases as part of a successful effort to become the first supermarket associated with the highly demanding performance standard.

— By Ilana Koegelenberg and Caroline Rham

A recently opened Woolworths Supermarket in Burwood, a suburb of Melbourne, Australia, is the first supermarket in the world to become associated with certification from the stringent Living Building Challenge (LBC) performance standard, in part by employing two transcritical CO_2 refrigeration systems and doors on all meat and dairy cases.

The supermarket is located in the Burwood Brickworks shopping center, which is in the process of completing its certification.

The LBC is a green-building certification program and sustainable-design framework that visualizes an "ideal" built environment. It is marketed as "the world's most rigorous proven performance standard for buildings." Successful certification requires net positive energy and water usage, among many other criteria.

The Woolworths store will incorporate a range of sustainability initiatives that aim to reduce the environmental impact of the store's operations and help customers live more sustainably, too. The Burwood Brickworks development incorporates a large solar PV system and an embedded electricity network.

"The Woolworths store, located in the Burwood Brickworks [shopping center], is the next step in our journey to create a neighborhood food store, with sustainability and the needs of local customers

at the heart of its design," explained Claire Peters, Woolworths Supermarkets Managing Director, in a statement. "As Australia's largest retailer, we recognize our responsibility to minimize our environmental footprint and are committed to playing our part in creating a greener, more sustainable future."

The new store uses 100% renewable energy, which is equivalent to taking 700 cars off the road each year. "From store lighting and air-conditioning to food refrigeration and preparation, we have looked at all angles to see how we can build and run this store more sustainably," said Peters.

Three transcritical CO_2 refrigeration racks are being used by Woolworths in the shopping center, two from Kirby for the supermarket's chillers and freezers, and one from SCM Frigo (Beijer Ref) for the Dan Murphy's liquor store (part of the Woolworths group) located inside the center. Both systems include parallel compression.

Doors have also been included on all meat and dairy cases, which will reduce the energy consumption by around 30%, by preventing cold air from spilling from the cases, noted Woolworths. Energy is also further reduced by use of waste heat from refrigeration to heat the store and switching off lights after hours.

The refrigeration design criteria "was aimed at achieving the required product performance temperatures in all cool rooms and showcases, at peak outdoor ambient conditions, in a manner which optimized energy consumption, minimized site installation complexity and operated without employing synthetic refrigerants," said Dario Ferlin, Refrigeration Engineer at Woolworths Food Group Australia. In addition to the Kirby racks, the refrigeration equipment for both systems included display cases from Hussmann, LUVE gas coolers from Kirby, and controls from Emerson.

LBC compliance included a "red list" of undesirable materials, such as PVC. This proved quite a challenge for the team as the material is usually widespread throughout electrical insulation and drain piping, explained Ferlin. "Kirby contacted over 40 suppliers to obtain component composition details to ensure compliance. Through such measures and close consultation with the Woolworths engineers, we were able to achieve a significant reduction in PVC across both racks," explains Douglas Herkess, Segment Engineer, Kirby.

Another challenge was installing doors on virtually all showcases, including the low-height, semi-vertical ones – which is quite uncommon and required some bespoke design work.

> *"From store lighting and air-conditioning to food refrigeration and preparation, we have looked at all angles to see how we can build and run this store more sustainably.*
>
> – Claire Peters, Woolworths

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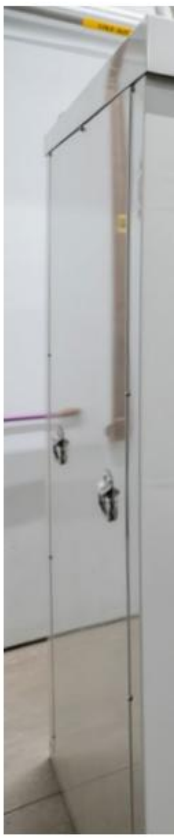
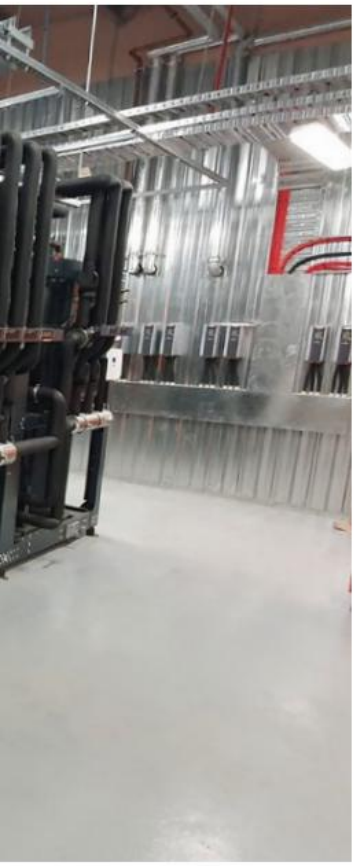


1 / Mayekawa CO_2 heat pumps used by Silver Oaks Cellars' winery.

2 /

2 / The CO_2 racks from Kirby.



The shopping center was developed by Frasers Property Australia, with first engagement with Woolworths dating back as far as January 2017, confirmed Ferlin. The refrigeration installations were undertaken by Woolworths installation team WRI, with work beginning around June 2019 and commissioning completed by late November 2019 – in time for the store opening on December 6.

Refrigeration leads HVAC

According to Ferlin, the refrigeration sector in Australia is several steps ahead of the local HVAC industry when it comes to sustainability and natural refrigerant systems. This is in part because of build and lease agreements where the ownership of the HVAC assets generally sit with the landlord, unlike the refrigeration assets. At the Burwood Brickworks store, the AC system, which uses HFCs, is provided by the shopping center.

Ferlin sees great potential in using natural refrigerants in retail applications. "Wearing an engineering hat alone, it's fair to say the opportunities are enormous. Particularly with propane self-contained systems (refrigeration and AC)," he explained. "However, a broader view requires other non-engineering challenges to be addressed, including governance of technicians suitably qualified to work on flammable and/or toxic refrigerant systems."

In Australia, Woolworths presently operates 13 transcritical CO_2 stores – 12 supermarkets and one liquor store. "I expect we will be approaching 20 by year's end," said Ferlin.

But the Woolworths Burwood Brickworks store remains "the culmination of all our efforts to date in one store," said Peters. "We will continue to try initiatives that help us reduce our environmental impact and look forward to the feedback from our teams and customers as we do." ■ IK & CR

Winery Pursues Living Building Challenge

Silver Oak Cellars, a family-owned Northern California (U.S.) wine producer, is focused on making superb Cabernet Sauvignon, and doing so in the most environmentally friendly way possible.

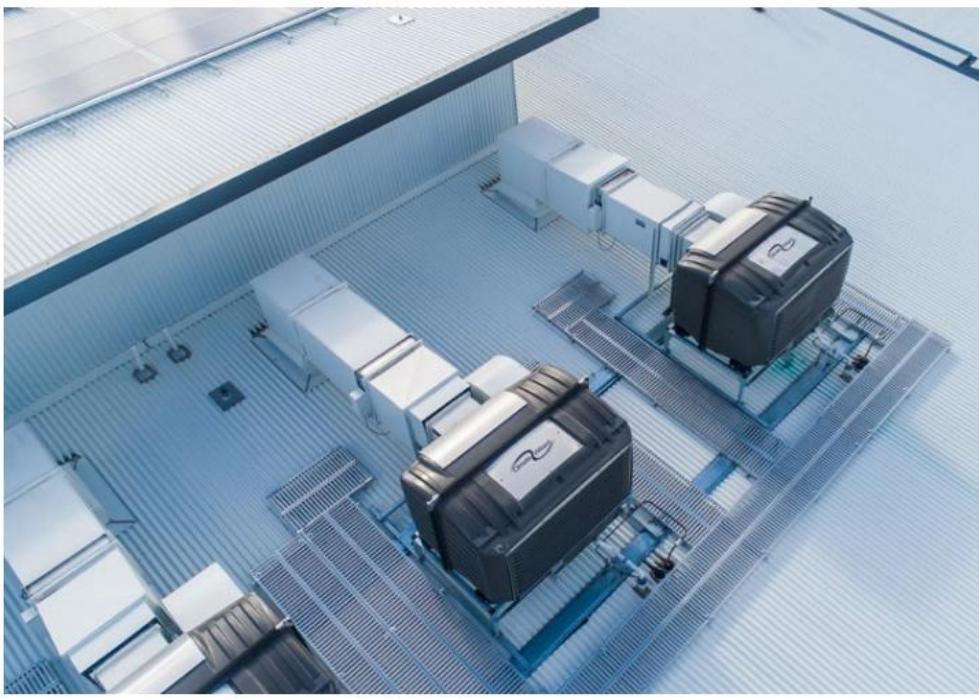
Silver Oak's 110,000 ft² production facility and tasting room, located in Healdsburg (Alexander Valley), California, is the first new production winery to be designated LEED platinum, and is being considered for an even more exacting certification by the Living Building Challenge, which will be determined in March. (See "NatRef Heat Pumps: A Key piece in a Decarbonized Future," *Accelerate America*, April-May 2019.)

To meet the Living Building Challenge (becoming the first winery to do so), Silver Oak chose two Mayekawa water-source CO_2 heat pumps (each providing up to 146.2 MBH on the hot side, with an average heating COP of 2.1), as well as a solar thermal heating system, in lieu of a traditional boiler system.

EVAPORATING WATER FOR AC

Seeley's Climate Wizard indirect evaporative cooler is being used for air conditioning by thousands of commercial and industrial locations in Australia and beyond.

— By Ilana Koegelenberg and Caroline Rham



Climate Wizard machines installed on a roof.

Since successfully installing its first Climate Wizard indirect evaporative cooler that runs completely on water (R718) in 2009, Australian manufacturer Seeley International has been rapidly expanding deployment of the energy-efficient air conditioning system in Australia and around the world.

Thousands of commercial and industrial locations – from resorts and wineries to data centers and government offices – are using it.

Seeley has more than 500 employees and a sales office in each state capital city in Australia. Its head office and main manufacturing facility is in Lonsdale, South Australia, with other factories in Albury, New South Wales Wales as well as Denver, Colorado, and Sacramento, California, in the U.S.. The company exports to over 120 countries and has sales offices in the U.S., U.K., Europe, and South Africa. It holds more than 300 patents.

To get a picture of Seeley's technology and business, *Accelerate Magazine* talked to Michael Hamilton, its General Manager – Commercial Sales in Australia and South Africa.

//Accelerate Magazine: How does the Climate Wizard work?

Michael Hamilton: Hot outside air enters the cooler via the inlet, after which a powerful, energy-efficient, electric fan moves the air towards and through the core. The core is an air-to-air heat exchanger consisting of alternating dry and wet channels. All of the air passes along the dry channels and gains no additional moisture.

As the air exits the dry channels, a portion of the conditioned air is returned through the wet channels. Through evaporation and conduction, it gains both moisture and heat. The channels are continuously soaked with water, and this moist, warm air is then exhausted to the outside of the building.

Heat – but not moisture – is transferred across the membranes between the dry and wet channels. The heat passes out of the air in the dry channels through the membrane and into the air passing through the wet channels. In this way, the air in the dry channels becomes progressively colder. Finally, this fresh, cool air passes into the building.

Water usage varies depending on where the unit is installed. But the most popular model uses between 20-50ltr (5.3-13.2gal) per hour. The water quality is controlled by a water management system, which includes salinity sensor and auto drain functions. These advanced monitoring systems minimize the amount of water required to bleed to waste. The water temperature in a Climate Wizard does not get anywhere near the level that legionella will breed; however, the Climate Wizard is fitted with a chlorinator to further mitigate this risk and also prevent microbial growth.

The Climate Wizard can operate in ambient temperatures up to 55°C (131°F) with an increase in performance the warmer it becomes. It uses a patented

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The Climate Wizard indirect evaporative cooler up close.

counterflow heat exchanger that allows supply temperatures to be delivered at 1-3°C (1.8-5.4°F) below the ambient wet bulb temperature.

//Accelerate Magazine: How widespread is evaporative cooling in commercial/industrial AC applications?

Michael Hamilton: The use of indirect evaporative cooling is still very popular and extensively used in a broad range of applications. We have also seen significant growth in the past several years of Climate Wizard Indirect and Indirect/Direct evaporative air conditioning. Even in the more humid climates, Climate Wizard is used for economically pre-cooling outside air to reduce the size and load of the refrigerated plant; therefore, Climate Wizard plays its role in the total HVAC solution.

//Accelerate Magazine: How does the Climate Wizard compare in cost and efficiency to commercial/industrial chillers?

Michael Hamilton: The best way to answer this question is to talk about a current project where Climate Wizard is being used in lieu of a chiller plant. In this case, we estimate that the energy saving will be approximately 80% while the peak electrical demand for the site was reduced by 60%. The total cost of the Climate Wizard installation was slightly less when compared to the equivalent chiller plant.

//Accelerate Magazine: In terms of the climate crisis, what impact does the Climate Wizard make?

Michael Hamilton: It offers a significant reduction in peak electrical demand and a significant reduction in energy consumption when compared to other air-conditioning technologies. Also, because the Climate Wizard uses water as its refrigerant, the system doesn't need any synthetic refrigerants or chemicals.

Other benefits include lower cost of replacement refrigerant and lower operating pressures, which reduce wear and tear on regrifgerated equipment and extend equipment longevity.

//Accelerate Magazine: What is the biggest challenge the Australian/NZ HVAC&R industry faces?

Michael Hamilton: The biggest challenge facing our industry is that we are not challenging the status quo from an HVAC and building-design viewpoint. Therefore, our products and services are not valued and this can reduce the profit of many of the HVAC&R businesses operating in our industry.

//Accelerate Magazine: What trends are you noticing in the Australian/NZ HVAC&R industry?

Michael Hamilton: I think our industry follows trends set in Europe or Japan. I don't think we create a trend of our own, which is a little disappointing. I would like to see a bigger movement towards the WELL Building Standard, a performance-based system for measuring, certifying and monitoring features of the built environment that impact human health through air, water, nourishment, light, fitness, comfort and mind. "Healthier people through better buildings."

//Accelerate Magazine: What are Seeley's plans for expansion?

Michael Hamilton: We are committed to a sustainable HVAC&R future. We invested AUS$25 million (US$16.8 million) in capital expenditure last year at our South Australian factory to support new product development in both existing and new categories. We want to continue to launch products and processes that are global firsts. ■ IK & CR

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End User
Japanese C-Store Chain Lawson Opens Its First NatRef Store in China

Market
'The Kitchen of the World' Grapples with Refrigeration Challenges

Events

1. **February 10**
   ATMOsphere Japan
   Tokyo, Japan

2. **February 12-14**
   SMTS (Supermarket Tradeshow)
   Tokyo, Japan

3. **February 18-21**
   HCJ2020
   Tokyo, Japan

4. **February 27-29**
   ACREX India
   Deli, India

5. **March 3**
   HVAC&R Japan
   Tokyo, Japan

Japanese C-Store Chain Lawson Opens Its First NatRef Store in China

A major user of CO_2 in Japan, Lawson employs both transcritical CO_2 and hydrocarbon cooling at Shanghai store.

— By Devin Yoshimoto and Rena Okabe

Lawson, a major Japanese convenience store chain that is a leading user of transcritical CO_2 systems in Japan, has installed its first transcritical CO_2 and hydrocarbon- based cooling systems at one of its stores in China, a Shanghai outlet that opened on January 15.

While some large-format supermarkets have installed transcritical CO_2 rack systems in China in the past few years, this is thought to be the first transcritical CO_2 system deployed in a small-format food retail store in the country.

Lawson, which operates 14,000 convenience stores, is considered the world's leading adopter of small-format transcritical CO_2 outdoor condensing units, with 3,700 stores expected to use this equipment in Japan by February 2020.

The use of transcritical CO_2 and hydrocarbon equipment at the Shanghai store is driven by Lawson's "commitment to fulfilling its corporate responsibility towards the UN Sustainable Development Goals — specifically goal 7 (affordable and clean energy) and goal 13 (climate action)," said Masaaki Kanbe, Director of Construction Headquarters for Lawson (China) Holdings.

In China, Lawson operates close to 2,000 stores spread across Beijing, Dalian, Shanghai, Chongqing, Wuhan and Hefei. More than half of these stores are located in Shanghai.

The new Shanghai store uses one Panasonic 2HP CO_2 outdoor condensing unit to supply cooling for one medium-temperature CO_2 display case inside the store. In addition, the store employs one propane-based plug-in ice cream cabinet. Kanbe said Lawson expects to see about 16% better energy performance, compared to conventional systems.

Installation went "smoothly and without any problems," said Kanbe, who credited prior and on-site technical guidance with making sure the installation of the CO_2 system went well. The challenge going forward, however, is "whether or not construction can be handled without technical guidance," he said.

Lawson's Continuing NatRef R&D

While Lawson is continuing to expand the number of stores that use transcritical CO_2 technology, the company is also actively testing hydrocarbon-based equipment and transcritical CO_2 equipment in warmer climates.

Lawson recently opened its first 100% natural refrigerants store in Japan at Keio University where, along with Panasonic-supplied CO_2 equipment, the store uses hydrocarbon plug-in upright and under-counter equipment provided by Japanese OEM Hoshizaki. (See "Japanese C-Store Chain Lawson Opens First 100% NatRefs Store," *Accelerate Magazine*, January 2020.)

While CO_2 systems have often been seen as less efficient in warm climates, Lawson has observed positive results at its Alfamidi stores in Indonesia.

During last year's ATMOsphere China conference in April (organized by shecco, publisher of *Accelerate Magazine*), Kanbe described Lawson's efforts to adopt natural refrigerants at 12 Alfamidi stores in Indonesia in 2015 and 2016. "All 12 stores attained the target based on yearly total power consumption of existing Alfamidi stores (a reduction of 30%-49%)," according to Kanbe's presentation. The equipment used by a comparison store was not specified.

Outside of Japan, China and Indonesia, Lawson operates stores in Hawaii, the Philippines, and Thailand. ■ DY & RO

Rice terrace field in Chiang Mai, Thailand.

'The Kitchen of the World' *Grapples with Refrigeration Challenges*

Thailand's robust food sector is trying to keep up with regulatory changes impacting refrigeration, explains the President of the Thai Refrigeration Association.

— By Devin Yoshimoto and Jan Dusek

Long promoted as "the kitchen of the world," Thailand produced over 2.4 million tons of chicken and over 200,000 tons of shrimp in 2016, "making it one of the top five countries globally for both chicken and shrimp exports," according to a 2018 report from the Thailand Board of Investment.

The food industry in Thailand continues to grow today due to the country's geographical location, its skilled workforce and its year-round growing season.

Yet to keep pace with this growth, Thailand's refrigeration industry faces daunting challenges in the next few years as it deals with increasing environmental regulatory pressures and the need to transition to low-GWP technology.

To better understand the changes Thailand is experiencing, *Accelerate Magazine* recently spoke with Komsan Sripavatakul, President of the Thai Refrigeration Association (TRA). Established in 1992, TRA strives to be "the embodiment of professional refrigeration engineering in order to support engineering knowledge, regulation and business opportunities for its members," said Sripavatakul.

// Accelerate Magazine: In your view, what is the current state of the industrial (food processing, cold storage, etc.) and commercial refrigeration (food retail) sectors in Thailand?

Komsan Sripavatakul: The industrial refrigeration industry in Thailand has seen a steady growth over the past few years. It is mainly driven by frozen food exporters setting up new processing facilities, especially in the poultry industry. The domestic demand for frozen foods, ready meals and ice cream, is also growing.

We don't think there will be any significant change in this industrial refrigeration segment in the next five years. The only concerns for the owners are electricity costs and new regulations that may come out in the future.

However, there are ice-making plants that use ammonia located in every province that need redevelopment. [The owners of] these plants really don't know much about new trends for refrigerants, technology or regulations.

The supermarket and convenience store segments are quite saturated. Almost no new stores are being built. They only renovate and are still using the same type of refrigerant (R404A).

// Accelerate Magazine: What is the approximate breakdown of refrigerants used in the cold storage and commercial food retail sectors in Thailand?

Komsan Sripavatakul: Around 80% of the large cold storage facilities are using ammonia pumped systems in Thailand. However, some old cold storage facilities are still running on R22. There are also a small number of new CO_2 installations (cascade systems and brine).

Small-sized cold rooms – 12,000m³ (424,000 ft³) or smaller – generally use R404A or R507A direct expansion systems.

In the commercial food retail sector, the approximate breakdown of refrigerants used is 70% HFC,10% HFO and 20% other.

// Accelerate Magazine: In your view, what is the biggest challenge that Thailand's refrigeration industry faces today?

Komsan Sripavatakul: The biggest challenge for Thailand's refrigeration industry is the regulation to change refrigerants from HCFCs and HFCs to low-GWP refrigerants. According to the Kigali Amendment, the next refrigerants have to be low-GWP. In this phase, there is a plan of limited and reduced usage of HFCs. Currently, there are no specific regulations regarding this.

However, we do have regulations that control the use of ammonia. New plants designed to use ammonia have to be in zoned areas that are quite far from residential areas, no matter how much ammonia charge is used. Existing ammonia plants can go on with their activity, but they need to implement more safety measures and they have to renew their licenses every few years from the Ministry of Industry.

// Accelerate Magazine: Are there any recent industrial or commercial refrigeration projects using natural refrigerants that you can highlight?

Komsan Sripavatakul: There are many ongoing and recent industrial projects using ammonia in Thailand and a few using CO_2 (cascade R404A and CO_2). Mostly, they are the cold storage rooms for food processing plants and ice making machines that use ammonia.

Regarding commercial food retail, I know that there is only one hypermarket using natural refrigerants but it is just for their market. There are no plans for others so far.

// Accelerate Magazine: What has been the main focus for the Thai Refrigeration Association? What are the biggest initiatives you are pursuing in 2020?

Komsan Sripavatakul: Over the last four years, we have engaged more with our members in order to understand global refrigerant trends as well as new regulations for the refrigeration industry. We have also supported our members regarding new technologies and how to reduce the consumption of electricity.

Going forward, as Thailand represents the biggest refrigeration industry in Southeast Asia, our goal is related to our vision of "enhancing the Thai Refrigeration Industry to be the leader in ASEAN [Association of Southeast Asia Nations]."

In order to help TRA members exchange technical knowledge and business opportunities, we are planning to participate in all related global associations and organizations. For example, since 2017, TRA has been a member of the Air Conditioning and Refrigeration European Association (AREA) as an international observer. In addition, we have recently started discussions and are seeking cooperation with related associations in ASEAN countries such as the Philippines and Malaysia. ■ DY & JD

THAI ENVIRONMENT MINISTER TO SPEAK AT NATREF EVENT IN BANGKOK

Varawut Silpa-archa will appear at the RAC NAMA meeting on February 17.

— By Devin Yoshimoto

Varawut Silpa-archa (center) on Thai TV in November 2019.

Varawut Silpa-archa, Thailand's Minister of Natural Resources and Environment, is scheduled to deliver the keynote speech at the Refrigeration and Air Conditioning Nationally Appropriate Mitigation Action (RAC NAMA) event, to be held in Bangkok on February 17.

The event, titled "Green Cooling Revolution: RAC NAMA Fund and the Future of the Thai Industry," will highlight the RAC NAMA Fund's achievements over the past two years as well as showcase the natural refrigerant-based technologies available in Thailand today.

"For the past two years, the [RAC NAMA] Fund has supported and accelerated the [Thailand] RAC industry's switchover to natural refrigerant-based technologies," said a statement released by GIZ, Germany's International Cooperation Agency, which is the main implementer of the RAC NAMA project.

Thailand is targeting a 20% reduction in its greenhouse gas (GHG) emissions by 2030 under its "NDC [Nationally Determined Contribution] Roadmap on Mitigation 2021-2030" plan. The increase in energy efficiency and the transition to natural refrigerants in Thailand's RAC sector is expected to make a significant contribution to this target.

Silpa-archa recently highlighted Thailand's intention to tackle Short Lived Climate Pollutants (SLCPs) as a part of its overall climate change mitigation actions at the COP25 conference in Madrid, Spain, last December.

"Recognizing the unprecedented and growing impact of climate change, the Royal Thai Government has integrated, for the first time, climate change into our development agenda," Silpa-archa said.

Thailand has already achieved a 14% reduction in GHG emissions as of 2017 in the energy and transport sectors, Silpa-archa said. Post-2020, the government is focused on "putting in place necessary NDC architecture to align our academic actions with the Paris Agreement goal."

"For instance we are formulating Thailand's first climate change act and a long-term low-GHG emission development strategy." In addition to enhancing its existing environmental fund to help leverage climate finance in the country's local authorities and private sector, the government is "energizing climate change actions with other pressing environmental issues such as biodiversity conservation, reduction of short-lived climate pollutants and marine plastic pollution," Silpa-archa said.

Silpa-archa is expected to speak further about the RAC industry's contribution to reducing GHG emissions at the RAC NAMA event on February 17.

For more information on the event, contact racnama@giz.de.

For more about how the RAC NAMA project is kick-starting Thailand's transition towards the use of natural refrigerants, see "Transforming Thailand's Cooling Sector with NatRefs," *Accelerate Magazine* November-December 2019. ■ DY

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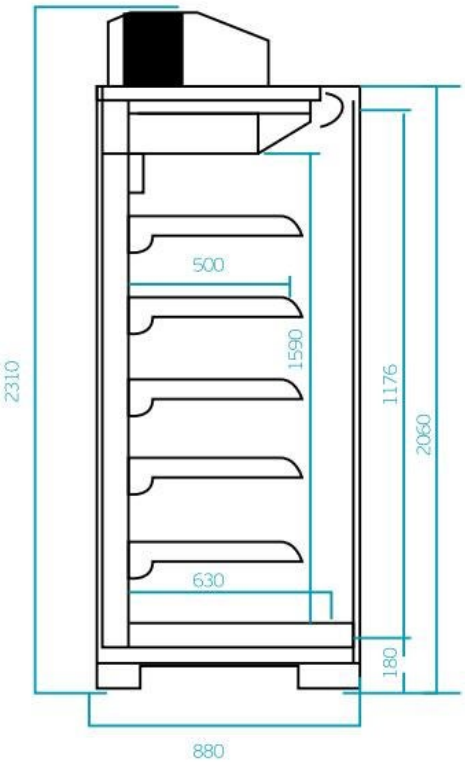

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INTRODUCING 3D PRINTING TO HVAC&R

re-generate, a startup company, is showing how the digitally driven manufacturing process can make better, more efficient heat exchangers

— By Tine Stausholm

German startup company re-generate (http://www.re-generate.co) is working with researchers and industry partners to introduce additive manufacturing into the HVAC&R industry. The process, more popularly known as 3D printing, creates three-dimensional solid objects from a digital file.

The initial focus is on developing market interest in small 3D-printed heat exchangers.

re-generate, based in Leipzig, wants to promote 3D printing as a way equipment manufacturers can create better products. The company is convinced that this manufacturing process, by using new materials and geometries, can deliver faster innovation cycles with immediate production of prototypes, save money by reducing the need for complex traditional tools, and reduce carbon footprint by re-using materials and employing decentralized production.

"We believe in efficient technology, better design and a lower environmental footprint in future HVAC&R solutions," said Nina Masson, Founder and CEO of re-generate. "3D printing helps our partners shape a smarter heating and cooling business, while delivering in all three areas."

One of the advantages of 3D printing, compared to traditional molding and casting methods, is that a much wider variety of materials can be used, including metals, ceramics, silica and plastic, increasing potential application areas. 3D printing is also cost effective, especially when manufacturing just a few units or prototypes.

FOCUS ON HEAT EXCHANGERS

re-generate is working in a joint project together with scientists from the Fraunhofer Institute for Machine Tools and Forming Technology IWU, Chemnitz, Germany, to develop the business potential for "miniature" 3D-printed heat exchangers. They project that these heat exchangers will be at minimum 50% more energy efficient than reference heat exchangers, and expect the production process to be at least 50% faster.

The potential applications for the small 3D-printed heat exchangers are currently viewed as any installation where space is at a premium, and where spatial flexibility is needed. Current proposed applications include residential and mobile air conditioning, heat pumps, and any application where microchannel heat exchangers are used today.

JOINT PROJECT SEEKS INDUSTRY PARTNERS

re-generate's role in the joint project will be to develop a set of parameters, like cost effectiveness and resource efficiency, for the new kind of 3D-printed miniature heat exchangers while the Fraunhofer IWU specifically aims to streamline the 3D design process.

re-generate will also identify the potential applications and business uses, and will act as a facilitator to the industry. The company also aims to develop new educational activities like workshops for engineers, research and commercial staff. For this, re-generate and the Fraunhofer IWU are looking for HVAC&R industry partners interested in comparing their current business case with the potential of the 3D printed miniature heat exchangers.

In a previous project, the Fraunhofer scientists already proved that 3D printing technology can reduce the size of heat exchangers, while at the same time increase efficiency. They improved the compactness of the 3D-printed heat exchangers by more than 50%, compared to reference heat exchangers, and increased the volume-dependent efficiency by 46% to 126%. In this project water was modeled as cooling agent.

These improvements were made possible by changing the shape of the heat exchanger channels and the thickness of the walls, as heat exchange and pressure loss directly depends on the geometric shape of the channels, and the 3D printing technology imposes no limits to the shape of these structures. ■ TS

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Whole Foods Contractors Opt for AI Software to Optimize Energy and Service

Axiom Exergy is providing "virtual" battery and technician service, driven by cloud platform.

— By Michael Garry

Axiom Exergy, a five-year-old company in Richmond, California (U.S.), that began as the provider of a "refrigeration battery" for supermarkets, is now marketing a "virtual" battery and technician service driven by a cloud-based artificial intelligence (AI) platform called Axiom Cloud.

Initial customers for Axiom Cloud include Whole Foods Market and commercial refrigeration contractors Arcticom, and Clima-Tech, as well as other North American supermarket chains and maintenance providers.

A Whole Foods Market and a Walmart outlet in the U.S. are using the original refrigeration battery, which overnight creates ice that is used during peak energy periods during the day, offsetting the refrigeration load.

The Axiom Cloud takes the concept one step further as a software-only solution, explained Amrit Robbins, CEO of Axiom Exergy. The system is simply "a computer inside a box on the wall that links to the refrigeration controls and sends data to the cloud." (More details at https://bit.ly/2sD4C7J.).

"We've been impressed with the performance of Axiom's Refrigeration Battery," said Tristam Coffin, Director of Sustainability at Whole Foods Market, in a statement provided by Axiom Exergy. "So when Axiom approached us with a proposal to provide similar benefits with just software, we were immediately interested in learning more."

Axiom Exergy says it has secured more than $1 million in orders for the Axiom Cloud, which have come within six months of launching the product, and include multi-site rollouts.

Axiom Exergy initially developed the Axiom Cloud software to operate its refrigeration battery system.

"It's clear that there is pent-up demand for real solutions to the tough energy and maintenance problems plaguing this industry," said Amrit Robbins, CEO of Axiom Exergy. We've been able to go from a proof of concept to significant market traction in a pretty short time period."

The Axiom Cloud platform can be deployed to existing and new commercial and industrial refrigeration systems (such as those found in supermarkets, cold storage facilities, and food processing plants). Currently, customers can subscribe to two automated services through the system:

- **Virtual Battery:** The Axiom Cloud predictively pre-cools low-temperature cases, followed by intelligent load shedding of the compressors and condensers. It provides the same benefits as an intelligent electrochemical battery (demand charge management, demand response) without the hardware, says Axiom Exergy.

- **Virtual Technician:** The Axiom Cloud leverages AI and machine learning to predict failures and autonomously improve system performance over time.

The predictive maintenance function anticipates compressor, condenser and evaporator failures and refrigerant leaks before they occur, according to Axiom Exergy.

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Axiom Exergy's refrigeration battery

> *We've been impressed with the performance of Axiom's Refrigeration Battery.*
>
> – Tristam Coffin, Whole Foods Market

The Virtual Technician feature offers what Robbins called ongoing retrocommissioning.

Most refrigeration systems allow only the head and suction pressure to be adjusted while other elements, such as valve positions, compressor settings and fan settings, are fixed, he noted. "With ongoing retrocommissioning we unlock those variables using an intelligent control strategy."

The holy grail of maintenance

The Virtual Technician service has generated interest from multiple refrigeration operations and maintenance (O&M) providers, says Axiom Exergy.

"Our customer's stores generate mountains of data, and we have been increasingly interested in using it to deliver higher levels of service to our customers," said Jim Pape, CEO of the Arcticom Group, Walnut Creek, California (U.S.), in a statement. "Axiom's AI solution is of particular interest to us because it is purpose-built for the specific needs of the commercial refrigeration market."

"Predicting system outages before they occur is the holy grail of refrigeration maintenance," said Ramez Naguib, CEO of Clima-Tech Refrigeration & HVAC, Norco, California (U.S.) in a statement. "The Axiom Cloud solution represents a significant opportunity for us to provide better maintenance, lower our costs, and increase the efficiency of the systems we service."

Axiom Exergy has already begun operating the Axiom Cloud at many of the contracted sites and has begun planning for additional deployments in 2020.

"The more sites we install, the smarter our algorithms are going to be and the more value we can provide to our customers," said Robbins.

Energy savings in case study

In a case study of a California store using the Axiom Cloud, the software runs the low-temperature compressors in the existing refrigeration system more often than normal between 9:30 am and 2 pm, thereby pre-cooling low-temperature display cases in preparation for a hot afternoon when peak demand is normally experienced.

Between 2 pm and 5:30 pm, the Axiom Cloud cycles individual compressors on and off as necessary to prevent "the building load from going above the forecasted optimal target of 230kW," the case study says. Concurrently, the Axiom Cloud "opens and closes EPRs [evaporator pressure regulators] on individual cases to ensure that no case temperature drifts above its set point."

During a 15-minute period starting at 2:30 pm, Axiom Cloud significantly decreases the rack load to prevent "a demand spike that would have increased demand charges for the entire billing period."

During an average summer month at the store, the retailer saves approximately $700 on demand charges, the case study says.

"We're unlocking the thermal storage capacity of the existing low-temperature system," said Robbins. ■ MG

STUDY SHOWS ENERGY ADVANTAGE OF ISOBUTANE OVER R134A IN DOMESTIC FRIDGE

In retrofit unit, the COP increased by 32.2% with R600a, while energy use dropped 4.5%.

— By Michael Garry

Since the 1990s, when NGO Greenpeace introduced its GreenFreeze concept, isobutane (R600a) has been widely used in domestic refrigerators in many countries around the world, with a maximum charge of 150g (5.3oz).

In the U.S., progress has been slower, because the Environmental Protection Agency (EPA) didn't increase the change limit for R600a in domestic refrigerators from 57g (2oz) to 150g until September 2018. But beginning last year, U.S. retailers began showing a range of full-size R600a refrigerator/freezers.

The wisdom of using R600a instead of a high-GWP HFC refrigerant has been recently demonstrated by Nigerian researchers in a study published in the Journal of Physics: Conference Series (see https://bit.ly/30NKa0o). The lead researcher was Solomon Banjo, engineer in the Mechanical Engineering Department, Covenant University, Ota, Nigeria.

The study, "Experimental analysis of the performance characteristic of an eco-friendly HC600a as a retrofitting refrigerant in a thermal system," investigated the performance characteristics of a domestic refrigerator using 46g (1.6oz) of R600a as an alternative to 70g (2.5oz) of R134a.

Notably, the researchers used the same system to test both refrigerants, first R134a, and then, with some retrofitting, R600a, at an ambient temperature of 28°C (82°F). "Some components of the system were altered such as the compressor, mineral oil, capillary tube and dryer so as [to] accommodate the new configuration," the study said.

The results of the study showed that the coefficient of performance (COP) of the system increased by 32.2% with R600a, including an energy reduction of 4.5%. In addition, the system with R600a attained an evaporating temperature of -21°C (-5.8°F) in 60 minutes (pull-down time), vs. 2 hours and 15 minutes with R134a.

During a five-hour test, the COP of the R600a system ranged from 7 to 8, while the COP of the R134a system varied from 5 to 6.5. During the last 150 minutes of the test, the power of the R600a system was 85W while the R134a system was 89W.

The study also found that the heat rejection of the condenser was 12.8% greater with R600a than with R134a.

"The energy conservation rate was improved with isobutane refrigerant (HC600a) and this serves as one of the parameters to justify isobutane as the best alternative refrigerant to [conventional] refrigerant (HFC134a)," the study concluded. ■ MG

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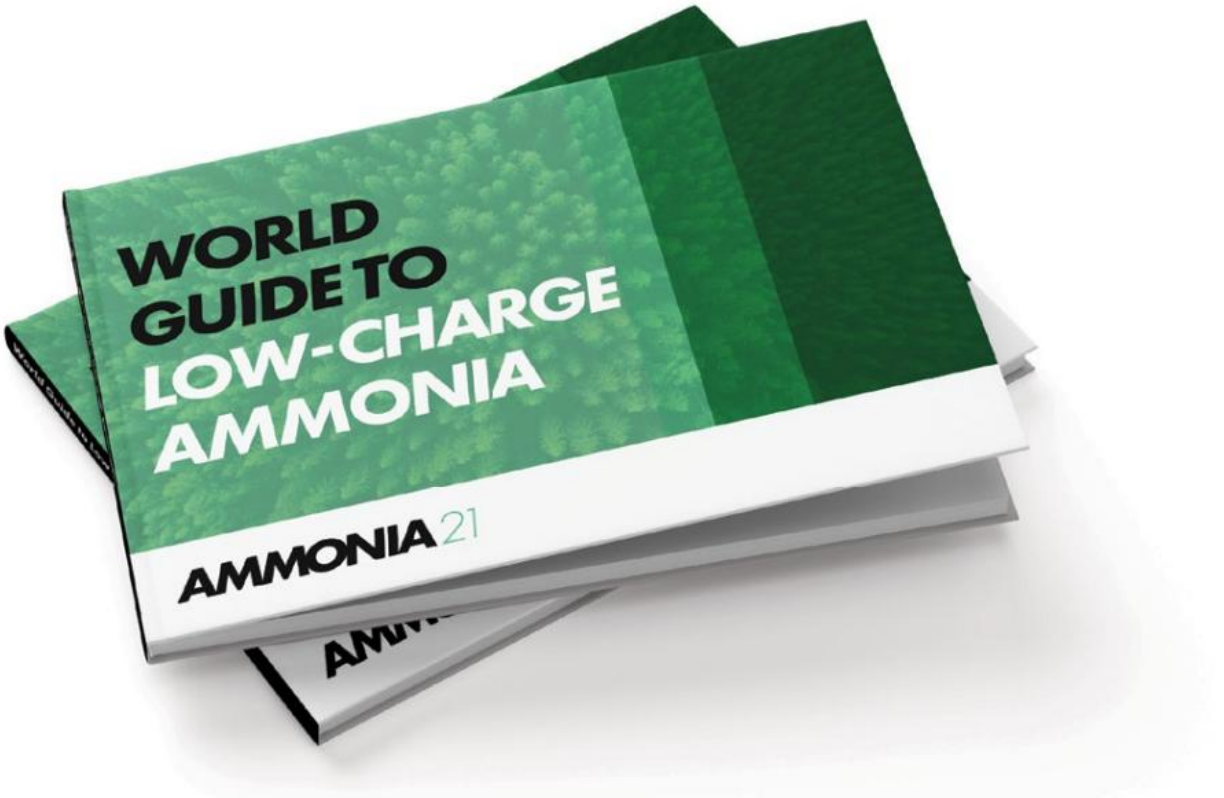

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Faith in Hydrocarbons

Herlin Herlianika

Indonesian consultant Herlin Herlianika believes that, with proper training, hydrocarbon refrigerants are safe, along with being highly efficient and environmentally friendly.

— By Devin Yoshimoto

Indonesia is fertile ground for hydrocarbon-based cooling, especially chiller and air conditioning applications, which are expected to grow in the next few years. In fact, Indonesia has identified the refrigeration and air conditioning (RAC) sector as a prime target for meeting the country's emission-reduction goals.

However, due to their flammability, hydrocarbons are largely perceived as risky which is holding the market back.

But Herlin Herlianika, a consultant in the Indonesian energy conservation and renewable energy sector – and one of the country's leading experts on hydrocarbon refrigeration – believes that hydrocarbons' risks, as with any other technology, can be minimized with the right "attitude, character, and skillset."

Herlianika, a former President of ASHRAE'S Indonesian chapter, has played an important role in the country's RAC sector for many years. Last month, she was one of 29 women from around the world profiled in *Accelerate Magazine*'s Women in Natural Refrigerants' cover story.

Accelerate Magazine spoke with Herlianika about her history with hydrocarbon systems and the standards, training, and certification she has helped put in place in the country, thereby laying the groundwork for further adoption.

// Accelerate Magazine: Can you tell us about how you started working with hydrocarbons?

Herlin Herlianika: I was introduced to hydrocarbons in 1996 through Swisscontact [a private Switzerland-based nonprofit that promotes international cooperation and economic

development] and its project phasing out R12 as part of a Montreal Protocol implementation program.

They taught us how to replace R12 with blended propane/isobutane (R290/R600a). Since then, I have believed that this NatRef is the most sustainable refrigerant because it exists in nature and will not harm the environment.

Together with my colleagues from both the business sector and academia, we continued to promote hydrocarbons as an environmentally friendly refrigerant with higher energy efficiency in the R12 phase-out program. We developed training and certification schemes on how to safely handle this flammable refrigerant.

In addition, I introduced hydrocarbons as a replacement to R12 for Unilever Indonesia since their ice cream division assets were still using R12 in 2004. Unilever Indonesia then decided to replace R12 with R290/R600a for all of their chest freezers throughout Indonesia with a retrofitting scheme. This was my first national project with this flammable NatRef.

When HCFCs were being phased out, I realized that everybody still doubted the use of R290 as a replacement refrigerant because of the flammability issue. I fully understood that Indonesian RAC technicians were not yet properly handling this flammable refrigerant, but I thought that this fact would not stop me from supporting my country in preparing a better structure for flammable refrigerant applications.

// Accelerate Magazine: As a technical expert for the Green Chillers NAMA (Nationally Appropriate Mitigation Action) R290 project in Indonesia in 2015, you helped specifically with technician training. Why do you believe training is so important?

Herlin Herlianika: We know that R290 is a flammable refrigerant and everybody says it is dangerous. But it is not that dangerous actually if [technicians] have the attitude and character needed to handle it safely and in an environmentally responsible manner.

However, one of the biggest issues we face today is that there are thousands of technicians in Indonesia who have no background in this sector and do not yet have this attitude. They mostly only learn by doing — on the job and with no formal education. This is why we are trying to upgrade their skills and their attitudes on how to handle this flammable refrigerant through establishing standards and providing training.

But training itself is not enough for the technicians because knowledge alone won't guarantee that they will apply it on the job. In addition to knowledge, they should also have the proper skills and attitude. After the training, we have to properly assess whether or not they have those three competencies. If they pass, then we certify them. That's the certification scheme and its structure is based on, and in line with, the national level of competencies for RAC technicians.

// Accelerate Magazine: Hydrocarbons have been used in the past and continue to be seen today as quick fix drop-in replacement refrigerants for certain types of equipment. What is your opinion of this activity in the industry?

Herlin Herlianika: Since most technicians only use hydrocarbon refrigerants as drop-in replacements for equipment that is not designed for flammable refrigerants — which is not totally safe — I am continuing to promote this flammable refrigerant application for initial charging in equipment for which it is designed.

One local Indonesian manufacturer has provided chillers designed for R290 use that have already proven their energy performance and have been certified as safe installations. They are getting orders for many industrial chiller applications, so it is a good sign for me to keep my faith in this refrigerant.

We are waiting for R290 single split air conditioners to be produced locally in Indonesia and I hope that this will have a big impact in the world, showing that it is time to use this refrigerant as a sustainable green technology.

Many pilot projects with R290 chillers and packaged units have already demonstrated good energy performance and have been certified as safe installations. These pilots can be used as energy efficiency models for the RAC sector, and they will ultimately support Indonesia in achieving its national energy conservation targets. ■ DY

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