APRIL-MAY 2020

ACCELERATE

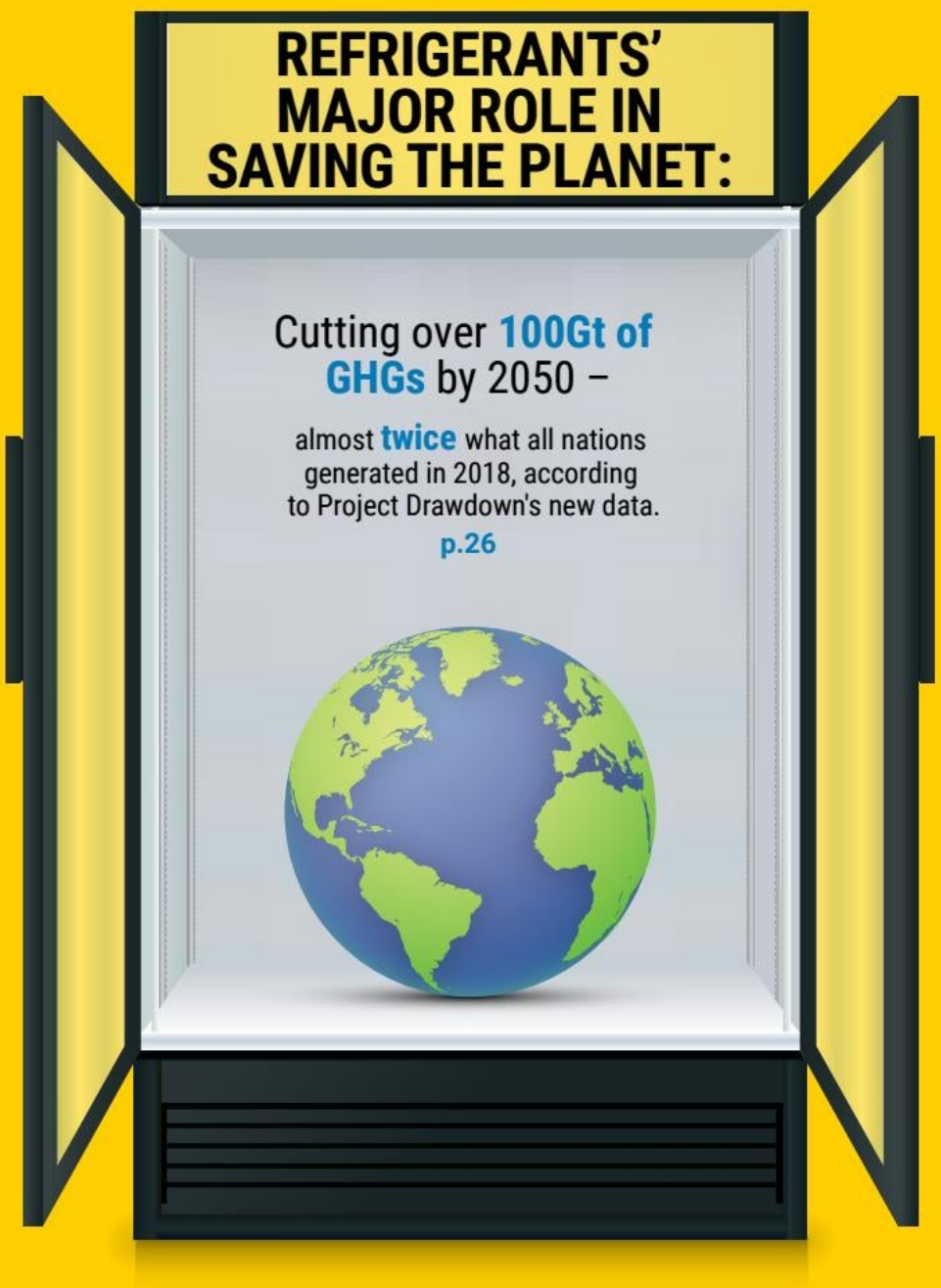
ADVANCING HVAC&R SUSTAINABLY

MAGAZINE

North America
Analyzing Ammonia Accidents - **p.40**

Europe
NH_3 Heat Pump Taps London Underground - **p.43**

Japan
CO_2 Water-Loop in Tokyo Skyscraper - **p.61**



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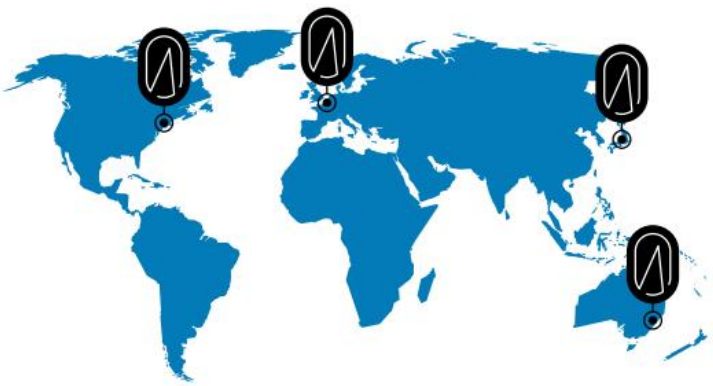
ACCELERATE NEWS

ADVANCING HVAC&R SUSTAINABLY WORLDWIDE

ACCELERATE
ADVANCING CLEAN COOLING MAGAZINE

April-May 2020
// Volume 1, Issue #109



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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In this issue

03 **About Us**

06 **Editor in Chief's Note**
The Lessons of COVID-19

08 **Editorial Calendar**

10 **Opinion**
Mitigating the Labor Shortage in HVAC

By Mike Gallagher and Karine Leblanc

14 **Letters to the Editor**

16 **Infographic**
Top 10 Climate Solutions, According to Latest Project Drawdown Analysis

// Global Trends

18 **Kigali Update**

20 **Meeting the COVID-19 Challenge**

22 **shecco Launches 'World Guide to Transcritical CO_2'**

24 **World in Brief**

26 **Cover Story**
Refrigerants' Major Role in Saving the Planet

// Americas

34 **Region Intro**
Events April - June

35 End User
Hillphoenix to Do Its First Low-Charge Ammonia Project in Latin America

36 Technology
CO_2 Delivers Low Operating Costs in Ice Rink Chiller Study

40 Technology
Study Cites Faulty Line Opening as Cause of Lethal Ammonia Accidents

// Europe, Middle East & Africa

42 **Region Intro**
Events April - June

43 End User
NH_3 Heat Pump Taps Warm Air from London Underground for District Heating

46 Market
Estonia Builds Training Facility for NatRefs

48 Event
South African Retailers Share Advantages of Switching to CO_2

// Australia & New Zealand

52 **Region Intro**
Events April - June

53 End User
Produce Warehouse Drops in Low-Charge Ammonia Package for Expansion

54 Event
Green Building Council of Australia Takes Conference Online

58 Profile
Sales Engineer Working With CO_2 Makes Her Mark in New Zealand

// Asia Pacific

60 **Region Intro**
Events April - June

61 End User
Tokyo Department Store Puts CO_2 Water-Loop System in High Rise

64 Market
More Cold Storage Facilities Needed in Philippines to Curb Food Waste

66 Digitalization
Smart Buildings Can Help Europe Meet Energy Reduction Targets

68 Servitization
Workshop in South Africa Stirs Interest in Cooling-as-a-Service Model

70 Alternative Technology
Magnetocaloric Refrigeration Forges Ahead Under New Licensing Program

71 New Research
Boosting the Efficiency of TC CO_2 Systems With Economizers

72 Thought Leader Q&A
In The Running
Interview with Kamal Nandi, Godrej Appliances

74 **Editorial Corner**

The Lessons of COVID-19

Way back in early February, I attended what is likely to be the last HVAC&R trade show that I will be covering in person for a while, the AHR Expo in Orlando, Florida (U.S.). There was some discussion there of the coronavirus (COVID-19), but it still seemed like something that was far away in China and not likely to have a significant impact on the U.S., where I live (in Connecticut), or other parts of the world.

A month later, I was preparing to travel again to Orlando, this time for the IIAR (International Institute of Ammonia Refrigeration) Natural Refrigeration Conference & Heavy Equipment Expo, scheduled for March 15-18. By then, the coronavirus had spread around the world and was beginning to escalate in the U.S. On March 12, IIAR canceled the show.

Of course, since then countless events and gatherings have been cancelled or postponed as the world hunkers down in an effort to contain this dreadful virus. We can only hope that our efforts are successful, and life can return to normal as soon as possible.

There will be many important, indeed profound, lessons to be learned from this experience. One of the most important is the need to pay attention to what science tells us about threats from nature, and prepare well in advance to prevent, or at least mitigate, bad outcomes.

Global warming – and the climate crisis it has caused – immediately comes to mind. Perhaps now, once we emerge from the current emergency, the world community will finally take the aggressive preemptive actions needed to head off what would be an even bigger, and longer lasting, disaster for humanity.

Sustainable cooling will have a large role to play in addressing global warming. This point is driven home by Project Drawdown's latest work, *The Drawdown Review* – the subject of our cover story (page 26). According to this study, refrigerant management and alternative refrigerants (in particular, natural refrigerants) can cut over 100Gt of GHG by 2050 – a huge amount, almost twice the GHG emissions that all nations generated in 2018.

Cooling's total impact is actually greater than that. Project Drawdown quantifies the climate-mitigation impact of several other cooling-related measures, such as insulation, building automation, and green and cool roofs.

Moreover, Project Drawdown has not yet incorporated GHG emissions cut via the improved efficiencies of natural refrigerant technology. But another new study – "Assessment of Climate and Development Benefits of Efficient and Climate-Friendly Cooling" – found that if both efficient equipment and climate-friendly refrigerants were adopted for stationary air conditioning and refrigeration equipment in 2030, it would be possible to avoid the equivalent of up to 210–460Gt of CO_2e emissions over the next three decades compared to current technologies.

There are, of course, many other climate-saving technologies and practices in addition to sustainable cooling. Project Drawdown assesses dozens related to electricity, food, transportation, health and education, land sinks, and more.

The solutions to climate change exist; we just have to use them more proactively. Maybe now, in the wake of the pandemic, we will. Stay safe everybody. ■ MG

Michael Garry
Editor in Chief

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Editorial Calendar for Accelerate Magazine, 2019-2020

Each issue of *Accelerate Magazine*, published 10 times annually, covers natural refrigeration and sustainable cooling/heating across all major business sectors, including commercial, industrial and residential. The magazine targets end users and other key stakeholders, including manufacturers, contractors, policy makers, the financial community, academic experts and others.

Each issue features a Cover Story that addresses a major topic in the global natural refrigeration industry. It also contains a Global Trends section and other sections of worldwide relevance such as Servitization of Cooling, Digitalization, Alternative Technology, Saving Energy, New Research and Thought Leader Q&A.

In addition, the magazine offers regional sections on North America, Europe, Australia, Japan, China, Southeast Asia and Africa; each section covers End Users, Technology, Market, Events and Policy. Other regular sections include Editor in Chief's note, Opinion, Letters to the Editor, Global Events Guide, Infographic, Kigali Amendment Update and World in Brief. The magazine is available online at https://accelerate24.news/magazines; in addition print copies are distributed at major industry trade shows and conferences.

Accelerate Magazine takes full-page advertising as well as fractional ads for its Marketplace sections that target specific trade shows.

The editorial calendar is subject to change by the publisher.

// ISSUE #101
June 2019
Cover Story:
NatRefs 101: Tracing the growth of natural refrigerants through the first 100 issues of *Accelerate Magazine* 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, Texas, 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.
Marketplace Advertising for EuroShop.
Print Distribution: EuroShop (Düsseldorf, Germany, February 16-20); ATMOsphere Cape Town (Cape Town, South Africa, March 10)

// ISSUE #108
March 2020
Cover Story:
Finding the Right Natural Refrigerant System in Industrial Refrigeration.
Marketplace Advertising for IIAR Natural Refrigeration Conference and Heavy Equipment Expo.
Print Distribution: IIAR Natural Refrigeration Conference and Heavy Equipment Expo (Orlando, Florida, U.S., March 15-18); ATMOsphere Ibérica (Málaga, Spain, March 31)

// ISSUE #109
April-May 2020
Cover Story:
Project Drawdown Update: Refrigerants' Major Role in Saving the Planet
Publication Date: April 14
Ad Deadline: March 31

// ISSUE #110
June 2020
Cover Story:
The three mega trends transforming HVAC&R: natural refrigerants, servitization and digitalization.
Publication Date: June 9
Ad Deadline: June 2

// ISSUE #111
July 2020
Cover Story:
The Training Revolution: How IoT, AI, virtual reality and robotics will fill the technician void.
Publication Date: July 7
Ad Deadline: June 30

// ISSUE #112
August 2020
Cover Story:
The Clean Cooling revolution.
Publication Date: August 4
Ad Deadline: July 28

// ISSUE #113
September 2020
Cover Story:
How the servitization business model is enabling sustainable cooling worldwide.
Publication Date: September 8
Ad Deadline: August 31
Marketplace Advertising for Mostra Convegno ExpoComfort
Print Distribution: Mostra Convegno ExpoComfort (Milan, Italy, September 8-11); FMI Energy & Store Development Conference (Baltimore, Maryland, U.S., September 21-24); ATMOsphere America, Co-Located with Global Cold Chain Expo (Dallas, Texas, September 28-30)

// ISSUE #114
October 2020
Cover Story:
How natural refrigerants are changing the heating and cooling of buildings.
Publication Date: October 6
Ad Deadline: September 24
Marketplace Advertising for Chillventa
Print Distribution: Chillventa (Nuremberg, Germany, October 13-15)

// ISSUE #115
November 2020
Cover Story:
Making sustainable cooling smarter through digitalization.
Publication Date: November 10
Ad Deadline: November 2
Print Distribution: ChinaShop 2020 (Shanghai, November 19-21)

ISSUE #116
December 2020-January 2021
Cover Story:
CO_2 vs. hydrocarbons in commercial refrigeration.
Publication Date: December 15
Ad Deadline: December 7

Mitigating the Labor Shortage in HVAC

There are some proven, practical ways to bring talented people into the field

— By Mike Gallagher and Karine Leblanc

Getting the right people on the team has always been essential for any company, in any industry, and HVAC is no exception. Why, then, has the issue become more pressing in HVAC in the past decade? To understand the situation (and understanding is essential before any workable solutions can be generated), it is useful to view the issue in context.

We'll start with field labor, which is both the hardest to do without and the easiest to improve. Young adults graduating high school and contemplating their future career options are often simply unaware of HVAC as an option. While this is true for both field and office professionals, it is a far more pressing issue for field workers. This is likely because they tend to make their choices earlier.

Of course, that is not always the case, as we see a surprising number of apprentices now who are shifting careers to HVAC between the ages of 25-35, and sometimes older. At this point they are more settled than the younger age group and most have decided they like the better income and personal job satisfaction that comes with building and maintaining buildings.

Our society has, in large part, dropped vocational education classes in high school, spurred by the thought that one requires a four-year degree, or isn't on equal footing.

In doing so, roughly 40% of our young adults are left without clear direction. Investing in the trades helps every person in our society have a career option.

The knowledge, training requirements and earning potential within the trades, particularly as compared with devalued degrees (a devalued degree exists when a bachelor's degree alone is not sufficient to put someone on a viable career track) are not often obvious or even fully understood.

Mike Gallagher

Mike has been in the HVAC industry since 1980. Since 1994 he has been a contractor at Western Allied Corporation, of which he is currently President. He is also an ASHRAE fellow, a local Los Angeles MCA/ ARCA board member, and on the advisory committee for the Cypress College HVAC program.

The military has done a great job of communicating that its preparation of recent high school graduates for the job market is in some cases as good or better than college. With regard to HVAC, all major service branches of the military offer HVAC and refrigeration training. As a side note, about 10% of Mike's service techs came to the industry via learning the trade in the military.

For the high school graduate who is not on a path to a four-year school or military training, the options that remain are junior college, trade school and "OJT" (on the job training). For perspective, the last time Mike hired someone directly out of high school was around 1997. It differs somewhat for residential contractors, where any worker who has some experience with tools and proves to be a diligent worker is a viable option for hire. Commercial contractors often then hire technicians from the residential ranks. At some point in a residential tech's career, if he/she wishes to progress, they'll either need to transition from residential to commercial, or take on more business-focused responsibilities rather than remaining strictly technical. Often this means moving into residential contractor sales or management.

This leads us to the discussion of training options and what is currently available.

1. **A strong Junior College (JC) program** will teach students what they need to know to be a successful residential or very light commercial (5TR/17.6kW-and-under circuits) service tech, with some extras thrown in depending upon the program. If the student happens to be working during the day and going to school at night, the opportunities are greater, since each experience will reinforce the other.
2. **Traditional trade schools,** particularly private, have closed over the last decade as school funding scandals hit home, but those that remain seem to be somewhat improved as a result.
3. **A union apprenticeship** includes five years of night school, twice a week, in conjunction with working. The entrance exam for an apprenticeship typically requires proficiency with high school geometry for admittance. A tech can work in the union without the apprenticeship exam, but he/she can't take the traditional apprentice/journeyman/foreman training track without passing the exam. Those geometry classes are key to becoming proficient (much like engineering classes are for an engineering student) in their career. A JC graduate who can pass the apprenticeship entrance exam can generally test in and skip the first year of the apprenticeship; however, there is a lot more to learn during the remaining four years to become a journeyman.

With all of this in mind, below are some areas that can produce results for attracting the future field work force:

1. **High school level education describing the HVAC field**. We need to rethink this for our current society. What does HVAC entail? What would a typical day look like? Speakers and representatives from the local community are a good place to start.

   Finding a way to educate guidance counselors would also be helpful; often a visit directly to counselors at a school, or better yet an entire district, is a good approach, particularly in conjunction with a JC program instructor. Many of these instructors are not skilled at setting up this sort of visit, so bringing in HVAC champions from the area to speak about the trade and the opportunities it can offer is a way we can all support the trade.

Karine Leblanc

Karine has worked as an HVAC Sales Engineer for US Air Conditioning Distributors since 2001. She is an active member of ASHRAE, frequently speaking at chapter events and conferences. Since 2019, she has served as a member of the AHR Expo Expert Council.

2. **Industry support at the state level for technical training.** Contractor associations are positioned to do this well. More and better shop and vocational training classes in junior high and high school can also be supported. Connect with the high school in your school district (or the school district in which your office resides) that still offers shop; if they don't have shop classes, work with your district to launch one if you're in a position to do so! Befriend the instructors and offer guidance as many will never have enough equipment for volunteer helpers. We can also enhance Junior College level programs simply by reaching out to program directors and asking how we can help.

3. **Promotion of the trades as careers, both at the high school and JC levels**. Some of this is already happening from contractor groups and unions, but not enough. As champions of our industry, we need to get involved! Mike once saw a recruiting booth at a JC job fair with a banner that read, "Earn twice as much as a four-year college graduate." Under the banner was a table that sat three representatives from the local union. Any group from within our industry could help discuss the opportunities.

4. **Promote field trades as the best mid-career change.** This applies particularly to those looking to see the direct results of their hard work as well as increased earnings. One of Mike's field techs joined his crew as a new apprentice at the age of 38. He had previously spent nearly twenty years working as a grip in the film industry. The pay rate there wasn't the issue, but rather the hours varied significantly, and overtime hours were not voluntary. Now, he is in his early 50s and last year reported that he'd made three times what he made in his best years working as a grip. Of course, this was after 14 or 15 years of experience in the trade, but the difference is stark. The field trades welcome older apprentices. The financial and work security opportunity is here, but it isn't advertised enough.

5. **Interview folks leaving the military**. Due to the discipline required to serve in the military, a dedication to career and the trade is more often than not the case with workers matriculating into the field. We can support those leaving the military with a career in HVAC.

   Internships also offer a way to build connections and expand a professional network, even before a career has begun. Likewise, for employers, internships are a way to forge bonds with people who progress to become the future leaders of our industry.

Supporting student chapters such as those in ASHRAE, Mechanical Contractors Association (MCA) and other groups is also worthwhile, and it will provide early introduction to the 'stars' within an academic environment. Host a student for an internship and afterward you can both evaluate whether there is a future together. Having a student intern is the lowest risk, highest reward approach to recruiting. Another great way to become involved is to speak to the student chapters of the construction-related organizations in your area.

It took a long time to get to where we are in this industry, and it isn't an issue that will solve itself over night. However, there are simple things that directly benefit your company (student organization participation and the resulting internships, for example) while indirectly benefiting the entire industry (increased vocational training in high school and JC). ■ MG & KL

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* Data obtained for a medium glass door merchandiser

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Letters to the Editor

MANAGING AMMONIA/CO_2

Regarding "Nestlé Uses Natural Refrigerants to Reach Sustainability Goals" (*Accelerate Magazine*, January 2020), it's very true what is said about using ammonia/CO_2 systems. Many organizations are refraining from using these systems mainly due to safety aspects, but this can be managed very well with proper technical knowledge.

Vikas Gupta
Project Delivery Manager
Larsen and Toubro Technology
Vadodara, India

AMMONIA CHILLER COMPARISON

This is an interesting study. (page 36) But for a fair comparison with NH_3 chillers, air-cooled and adiabatic-cooled NH_3 technology is now available and greatly reduces water use vs. evaporative-cooled NH_3 systems, yet still maintain high efficiencies while reducing overall NH_3 charge.

Troy Davis
Energy Group Manager
Mayekawa USA MYCOM
San Francisco, California (U.S.)

CLEAN THOSE COILS

In regard to the coronavirus (page 20), we are encouraging restaurants forced to turn away dine-in customers to do coil cleaning on their refrigeration to slice away at their embedded electric costs caused by clogged coils. This relates to all coolers, whether HFC or natural refrigerants. Our guess regarding unneeded electric waste: 1,250kWh per cooler per year. We haven't seen uptake on our suggestion yet.

Richard Fennelley
Chief Operating Officer
CoilPod
Cortlandt Manor, N.Y. (U.S.)

OPERATING TRANSCRITICAL CO_2 IN HOT CLIMATES

South Coast Stores' transcritical CO_2 system has a generously sized adiabatic gas cooler/condenser as well as a desuperheater for the booster discharge. ("Australia Wholesaler Chooses CO_2 Over Ammonia and HFCs for Cold Storage," *Accelerate Magazine*, March 2020.) Our modeling predicts that transcritical operation will occur less than five days per year, and only for a few hours each day.

The plant has already operated through some of the worst conditions imaginable during the bush fire disaster period, which was during early commissioning. At that time it was very hot, but also very dry, and the plant was able to operate subcritically even during those conditions. I personally have not observed any transcritical operation since it was commissioned.

We hope to conduct extensive energy monitoring in the coming months to be able to answer this question with hard data. The plant was only commissioned in late January.

Michael Bellstedt
Chief Executive Officer
Metis Monitoring Pty Ltd
Castle Hill NSW, Australia

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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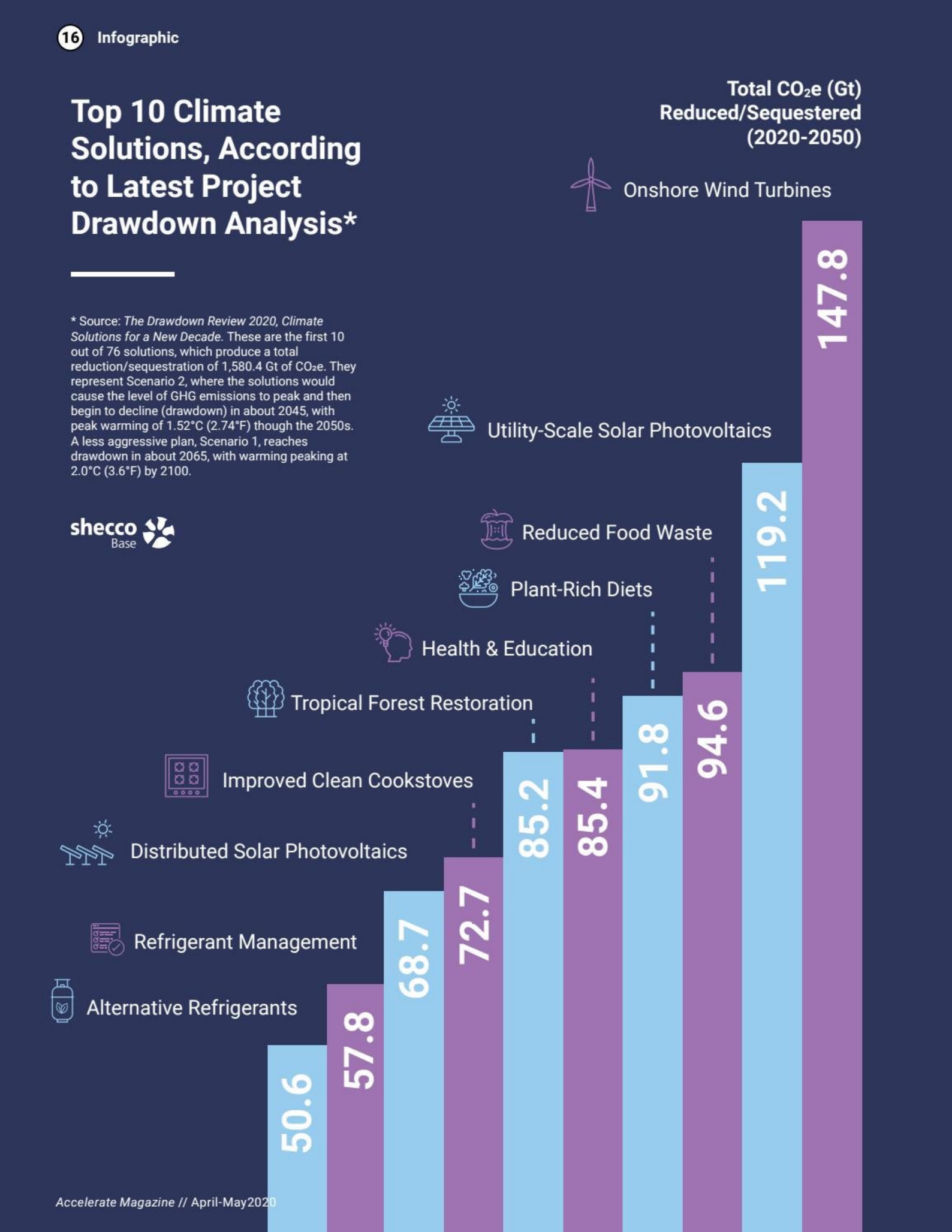
Top 10 Climate Solutions, According to Latest Project Drawdown Analysis*

* Source: *The Drawdown Review 2020, Climate Solutions for a New Decade.* These are the first 10 out of 76 solutions, which produce a total reduction/sequestration of 1,580.4 Gt of CO_2e. They represent Scenario 2, where the solutions would cause the level of GHG emissions to peak and then begin to decline (drawdown) in about 2045, with peak warming of 1.52°C (2.74°F) though the 2050s. A less aggressive plan, Scenario 1, reaches drawdown in about 2065, with warming peaking at 2.0°C (3.6°F) by 2100.

shecco Base



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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 **April 13**, 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 countries 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 April 13.

* 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

MEETING THE COVID-19 CHALLENGE

Natural refrigerant manufacturers, considered essential services, are continuing to operate under strict safety conditions, thanks to resolute employees.

— By Michael Garry

As the world grapples with the coronavirus (COVID-19) health emergency, HVAC&R companies that make natural refrigerant products have generally reported that they have been able to carry on most activities as "essential businesses," while taking comprehensive action to keep their employees safe.

In Italy, HVAC&R manufacturers had to close their factories for two weeks, in response to the Italian government's decree on March 22. But some factories began to reopen on April 6, leading up to an expected full reopening on April 14.

During the shutdown, Italian component maker Carel was able to rely on "significant production flexibility" offered by its five factories outside of Italy, some of which have been expanded recently. These are located in Croatia, Germany, Brazil, China and the U.S. Carel's factory in China reopened on February 11, said Eason Cheng Marketing Manager - Refrigeration, APAC for Carel Electronic (Suzhou) Co., Ltd.

Italian OEM Epta also has factories operating elsewhere in the world. "The support and dedication that we are seeing in these difficult days from our employees and stakeholders make us confident that soon we will return stronger than before," said William Pagani, Epta's Group Marketing Director. "This confidence comes also from the work already done in the past few weeks by our colleagues and business partners at Epta in Qingdao in the Shangdong Province of Greater China, who are now getting back to business normality in their domestic market."

"There is no mistaking the challenge of this moment," said Freor, a manufacturer in Vilnius, Lithuania. But the company said its manufacturing process would continue, as well as incoming and outgoing shipments, "while taking every precaution to ensure safe working conditions" for its employees, truck drivers, and others.

STAYING IN COMPLIANCE

OEM Heatcraft Refrigeration Products, based in Stone Mountain, Georgia (U.S.), is still on course to start producing in the coming weeks its new condensing units that are compliant with the U.S. Department of Energy's 2020 Annual Walk-in Energy Factor (AWEF) for walk-in coolers and freezers, said Sergio Castillejos the company's Vice President, General Manager. "In preparation for the line changeovers, we have built up an extensive inventory of our existing models and we invite you to take advantage of that stock."

Castillejos commended Heatcraft's factory workers, who "have consistently shown up to work in spite of the obvious challenges at a personal level. They do so knowing that the work they do keeps millions of our fellow Americans in isolation stocked with essential food, medical and daily supplies."

Tom Williams, Chairman and Chief Executive Officer Parker Hannifin, based in Cleveland, Ohio (U.S.) noted that Parker products and systems are helping with the effort to combat the spread of COVID-19 and support its treatment.

"Our team members are stepping up to deliver technologies used in ventilators to treat those who are sick; engine filters and transmission components for heavy-duty trucks to transport food, water and supplies; aerospace rotorcraft products to support emergency transport of patients; refrigeration technologies to help keep food fresh and medicine viable; and many other technologies essential to people's daily lives. ■ MG

COOL FORWARD THINKING

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shecco launches 'World Guide to Transcritical CO_2'

The first of three parts outlines key characteristics of CO_2 as a refrigerant and looks at installation examples around the world.

— By Michael Garry

The "World Guide to Transcritical CO_2" Part 1 (of 3) has been launched as a free online resource, highlighting the history of CO_2, its key characteristics, basic system descriptions, and a chapter on practical transcritical CO_2 applications around the world. (It can be downloaded at https://bit.ly/3bBZSzU.)

"As the use of transcritical CO_2 refrigeration systems increases at a rapid rate around the world, it has become apparent that there is great need for reliable information from a neutral source," explained Ilana Koegelenberg, Market Development Manager at shecco, publisher of the guide.

To that end, sheccoBase (the market development and research brand of shecco) has undertaken an extensive market study to analyze the current state of the global industry and various trends. "Our hope is that the guide will serve as a resource to help drive the accelerated uptake of this highly sustainable and energy efficient HVAC&R technology," Koegelenberg said.

When sheccoBASE started collecting data in 2008, the team counted only 140 transcritical CO_2 systems – all of which were in Europe. Today, this number is well beyond 30,000 globally as the accelerated phase down of harmful fluorinated refrigerants drives the search for a more climate-friendly alternative.

"Most notably we have found that this technology is no longer only used in commercial refrigeration installations," said Zita Laumen, Market Analyst at shecco. "More and more we are seeing success stories in small convenience stores and even large industrial installations."

"The global HVAC&R market is changing, and it is crucial to keep up with the latest industry trends and technologies," added Koegelenberg.

As such, this guide will specifically look at the potential of transcritical CO_2 – today and in the future. By sharing case-study examples, technical information, policy updates, challenges, opportunities, and data on the number of installations completed globally, the aim is to help accelerate the uptake of this climate-neutral, sustainable refrigeration technology around the world.

Coming soon!

Part 2 of the Guide will be launched by the end of May 2020 and will focus specifically on the transcritical CO_2 market today, as well as smaller convenience store applications, and commercial/retail applications. The complete guide, including Part 3, will be live by the end of June, and launched with a webinar. Part 3 will look at industrial applications as well as future market trends, including barriers and opportunities for the uptake of transcritical CO_2 around the world. ■ MG

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World in Brief

ARBS Exhibition Moves to Feb. 15-17, 2021

The Air Conditioning, Refrigeration Building Services (ARBS) exhibition, originally planned for May 19-21 in Melbourne, Australia, has been postponed to February 15-17, 2021, because of the global coronavirus pandemic.

More information will be coming soon, said ARBS.

The postponement had been previously announced, although the new date was only recently communicated by the ARBS board.

ARBS exhibitions generally host around 10,000–12,000 participants, including exhibitors, visitors, suppliers and contractors. "We are concerned for the health, well-being and safety of all participants during what will be a challenging time for the whole country," said Sue Falcke, Events Organizer for ARBS.■ IK

ATMOsphere Ibérica Postponed to June 9

Due to the current coronavirus pandemic, shecco, publisher of *Accelerate Magazine*, has made the difficult decision to postpone the upcoming ATMOsphere Ibérica conference (https://bit.ly/2UWbN6n).

The event, which was to be held at Hotel Barceló in Málaga, Spain, on March 31, will now take place on June 9. All other details will remain the same.

The conference provides a forum for discussing efficient and sustainable natural refrigerants solutions in commercial, industrial and HORECA (hotel, restaurant, café) applications, especially in the Iberian market.

Throughout the day, participants will hear about the latest developments in technology, regulations, standards and market trends, as well as case studies and panel discussions. Speakers will include end users as well as installers, both critical in the Iberian market. ■ TS&FD

NH_3 Heat Pump Boosts Dairy Production

An ammonia (NH_3) heat pump installed last year by Aurivo, Ireland's second largest milk producer, has increased processing capacity by 80% while cutting CO_2 emissions by 80% by improving efficiency and downgrading oil-burning boilers.

The heat pump, from GEA, is installed at the company's Killygordon site, where it leverages waste heat from a separate chiller to generate hot water for the pasteurization process.

"The GEA heat pump that collects and recycles what was waste energy from the chiller provides us with the remaining energy needed to take the water up to the pasteurization temperature of a max of 78°C (172.4°F)" said Stephen Carlin, Aurivo's Engineering Manager. "This has rendered our traditional fuel oil-burning boilers almost redundant for the pasteurization process. In fact, we now only have to turn the boilers on for one hour a week to kick-start each process cycle."

The ammonia system increases Aurivo's production with a 45,000ltr (11,888gal) per hour milk pasteurization system, and at the same time it has reduced the site's energy consumption by about 12%, said GEA. The CO_2 emissions have decreased by more than 181,000kg (399,037lbs) per year.

"The new refrigeration and heat pump solutions provide us with 1,200kW (341TR) of cooling, and roughly the same in heating capacity," Carlin said. ■ TS

World's First CO_2 Outdoor Ice Trail

Canadian contractor and manufacturer Cimco Refrigeration has installed what it calls the world's first transcritical CO_2 system for an outdoor ice trail in the College Park section of Toronto, Canada.

Opened last December, the Barbara Ann Scott Ice Trail – named after the Canadian Olympic figure skating champion – is an oval-shaped, 5.0m (16.4ft)-wide path that doubles as a walking loop in the summer.

According to Cimco's website, the 50TR (176kW) CO_2 system costs roughly half as much to operate as other options. In part that is because the CO_2 system is a direct system, making it more efficient than a secondary system.

In addition, the system's piping and CO_2 pumps are "much smaller and more efficient than standard rink systems," the site said. The pipes are just 2in (5.1cm) in diameter, while those of standard rinks are 6-8in (15.2-20.3cm). A CO_2 detection system sends out an alert if it senses high levels of CO_2, and then automatically turns on an exhaust fan. ■ MG

NatRef Progress in South Africa

The first-ever ATMOsphere Cape Town conference on March 10 attracted more than 150 end users, technology providers and government representatives, and offered more than 20 presentations.

Marc Chasserot, CEO of shecco (the organizer of the event and publisher of *Accelerate Magazine*) kicked things off by touching on some trends from the recent EuroShop trade show, showing how natural refrigerants are becoming the norm, especially in commercial refrigeration.

John Ackermann, Chairman of the South African Refrigeration Distribution Association (SARDA), gave a stirring talk on "Day Zero for Natural Refrigerants." He stressed that as synthetic refrigerants are phased out, South Africa needs to embrace natural refrigerants or end up with insufficient refrigeration and cooling capacity.

In the "technology trends" session, Maurice Robinson of local OEM Sphere Solutions presented on CO_2 trends, Hannes Steyn of GEA Refrigeration looked at ammonia, and Grant Laidlaw of the ACRA Training Academy considered hydrocarbons. Thomas Motmans of the Swiss Basel Agency for Sustainable Energy (BASE) spoke about the cooling-as-a-service business model and servitization, while Sean Doyle of Crowley Carbon discussed delivering energy savings with technology and expertise.

In the policy session, shecco presented on global policy progress. Then, looking more locally, Margaret Molefe, Department of Environmental Affairs, spoke about South Africa's progress with regards to phasing out HFCs and implementing the Kigali Amendment.

Following an end-users panel discussion (see page 48), the day concluded with seven case studies showing how natural refrigerants have improved reliability and energy efficiency. ■ IK

CFC Banks Slowing Ozone Hole Recovery

A new study reports that emissions from unrecovered sources, or "banks," of CFCs could delay the Antarctic ozone hole recovery by about six years and contribute nine billion metric tons (9Gt)of CO_2e emissions between 2020 and 2100.

The study was published on March 17 at nature.com.

"We find that bank sizes of CFC-11 and CFC-12 are larger than recent international scientific assessments suggested, and can account for much of current estimated CFC-11 and 12 emissions," the paper said.

The Environmental Investigation Agency (EIA), which has reported on illegal use of CFC-11, cited the study in calling for more aggressive destruction of CFC banks. ■ MG

Sanden Unveils 10HP CO_2 Outdoor Condensing Unit

Japanese OEM Sanden exhibited a new 10HP CO_2 outdoor condensing unit at the Supermarket Trade Show (SMTS) 2020 exhibition. The SMTS was held in Chiba, Japan, from February 12 to 14.

The 10HP unit is Sanden's largest-HP model in its lineup of outdoor CO_2 condensing units, which include small (2HP)- and medium-sized (6HP) systems with cooling capacities of 3kW (0.85TR) and 10kW (2.84TR), respectively.

The 10HP system's cooling capacity is under review. A release date has not yet been determined.

All three CO_2 units have an evaporating temperature of -5°C (23°F) and ambient temperature operating range of -25° to 43°C (-13° to 109°F). ■ DY

Makro Touts Green Refrigerants

SIAM MAKRO PLC. (Makro), one of Thailand's largest membership-based food wholesalers, spoke about the energy efficiency benefits and safety track record of the 10,000 propane (R290) plug-in display cases at its stores throughout Thailand during the RAC NAMA Fund event held on February 17 in Bangkok, Thailand.

The Refrigeration and Air Conditioning Nationally Appropriate Mitigation Action (RAC NAMA) project provides financial, technological and policy support to Thailand's refrigeration and air conditioning industry; the RAC NAMA Fund is the main financial instrument for the project.

"Energy efficiency and environmental consciousness are two key values that our company follows," said Anan Watcharapongvinij, Director-Construction and Facilities Management at Makro, during a panel session titled, "Green Cooling Talk — Global Trend and Thai Perspective." "We are truly supportive of this and have been following this trend of using green refrigerants in our cabinets and refrigerators for over 13 years. Today, we have about 10,000 plug-in R290 units running in our stores."

Makro, which has around 130 outlets, provides food products to retail businesses, restaurants, caterers, and other business operators throughout Thailand. ■ DY

Refrigerant management and alternative refrigerants can cut over 100Gt of GHG by 2050 – almost twice what all nations generated in 2018, according to Project Drawdown's new data. And cooling's total impact is even greater than that.

— by Michael Garry

REFRIGERANTS' MAJOR ROLE IN SAVING THE PLANET

In 2017, a new book, *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming*, documented and ranked 80 currently available climate-change mitigation technologies and practices based on their ability to reduce greenhouse gas (GHG) emissions between 2020 and 2050.

It became a *New York Times* bestseller and a touchstone for environmental activists, policymakers and ordinary citizens looking for guidance on dealing with climate change.

The book was the creation of Project Drawdown (https://drawdown.org), a research initiative founded in 2013 by Paul Hawken, a California-based environmentalist, author, entrepreneur and activist, who also edited the *Drawdown* book. In addition to its research and publications, supported by 250 researchers and scientists from 22 countries, Project Drawdown offers an open-source database created by a global coalition of stakeholders.

The climate-mitigation measures identified by Project Drawdown are grouped under six categories: electricity production; food, agriculture and land use; industry; transportation; buildings; and other energy-related emissions. More generally, solutions aim to reduce GHG emissions to zero, support carbon-absorbing sinks and address societal inequities.

The term "drawdown" refers to "that point where greenhouse gases go down on a year-to-year basis," explains Hawken on his LinkedIn page (https://bit.ly/2UHVWH2). (See sidebar, page 33.) By pinpointing when and how climate change can be reversed, Project Drawdown is offering a message of hope – that humanity can avoid catastrophic warming with climate solutions that are available today.

Perhaps because of its hopeful message, *Drawdown* has garnered widespread attention, especially for a book on the environment. "Project Drawdown has done a fabulous job getting the attention of policymakers and citizens on solutions, and supporting the critical narrative that we have the practical solutions we need at hand to bend the curve on climate change," said Gabrielle Dreyfus, Head of Policies, Standards & Programs for the Kigali Cooling Efficiency Program (K-CEP) and Senior Scientist, Institute for Governance & Sustainable Development (IGSD). "Their framework provides a useful sense of the relative magnitudes of different strategies."

"The results are presented in a way that is accessible for a wide audience," said Mark Michelin, Director at California (U.S.)-based CEA Consulting. "It is a huge undertaking and a helpful contribution to the field."

The solution that ranked No. 1 in Project Drawdown's 2017 list of climate-mitigation measures? It turned out to be refrigerant management, a strategy in the buildings and industry categories that was projected to eliminate 89.70Gt (billion metric tons) of CO_2e emissions under a "plausible scenario." Overnight, Project Drawdown elevated refrigeration's status in the fight against global warming. "Project Drawdown did a great job to put cooling and refrigeration No. 1 on the environmental agenda in 2017," said Toby Peters, professor, cold economy, University of Birmingham, U.K.

COOLING SOLUTIONS IN PROJECT DRAWDOWN

Ranking*	Solution	CO_2e (Gt) Reduction (2020-2050) Scenario 1**	CO_2e (Gt) Reduction (2020-2050) Scenario 2***
4.9	Refrigerant Management	57.7	57.8
7.10	Alternative Refrigerants	43.5	50.6
16.24	Insulation	16.9	19.1
27.31	High-Performance Glass	10.0	12.7
36.43	Smart Thermostats	6.9	7.5
37.34	Building Automation Systems	6.4	10.5
46.40	High-Efficiency Heat Pumps	4.1	9.3
73.69	Green & Cool Roofs	0.6	1.2
74.74	Dynamic Glass	0.3	0.5
TOTAL		146.4	169.2

*Ranking (out of 76 solutions) in Scenario 1 and Scenario 2, respectively.

**In Scenario 1, solutions would cause the level of GHG emissions to peak and then begin to decline (drawdown) in about 2065, with temperatures peaking at 2.0°C (3.6°F) by 2100.

*** In Scenario 2, solutions would cause the level of GHG emissions to peak and then begin to decline (drawdown) in about 2045, with peak warming of 1.52°C (2.74°F) through the 2050s.

Source: *The Drawdown Review 2020, Climate Solutions for a New Decade.*

That refrigerant management landed in the top spot – higher than onshore wind turbines (No. 2) and solar farms (No. 8) – delighted the natural refrigerants community and came as a surprise to many environmental experts, including Chad Frischmann, Vice President and Research Director for Project Drawdown.

"I was definitely surprised," said Frischmann, in an interview with *Accelerate Magazine*. "Fluorinated gases are a significant contributor to global warming, but are a small fraction of the pie. But taken as a whole, it represents the potential global leakage of HFCs, CFCs and HCFCs over a 30-year time period, and it's really important as a singular solution."

In early March, Project Drawdown released its first major update to its original book, in a document called *The Drawdown Review*. *The Review*, while applying the same research methodology as *Drawdown*, differs in some respects, such as ranking 76 technologies/practices rather than 80 (some were merged.) Some solutions changed their positions in the rankings, reflecting their level of implementation.

Also, *Drawdown* presented one main scenario (plausible) and two other scenarios (drawdown and optimum) for the top 15 technologies/practices. The Review presents two scenarios (one and two) for all 76 technologies/practices. (Project Drawdown plans to publish a separate paper updating the optimum scenario from the book.)

"We're always updating our methodology to better represent, to the best of our knowledge, the potential of different technologies and practices," said Frischmann.

In the refrigerants category, refrigerant management slipped to No. 4 under scenario one, with 57.7Gt of CO_2e reduced between 2020 and 2050, a decline from Drawdown's 89.70Gt. Under the more aggressive scenario two, refrigerant management fell to the No. 9 spot, with slightly more (57.8Gt) CO_2e emissions reduced.

However, *The Review* adds an entirely new category, alternative refrigerants, which ranks 7th (43.5Gt reduced) in scenario one, and 10th (50.6Gt reduced)

in scenario two. The alternative refrigerants category reflects the global HFC-reduction effort underway via the Kigali Amendment to the Montreal Protocol. So by creating a separate category for alternative refrigerants, Project Drawdown reduced the size of the refrigerant management GHG reduction to 57.7Gt (or 57.8Gt) from 89.70Gt, since the transition to new refrigerants results in less HFCs to manage, noted Frischmann.

But combining refrigerant management and alternative refrigerants in scenario one reduces 101.2Gt of GHG emissions, well above the No. 1 individual category, reduced food waste (87.4Gt). In scenario two, the combination removes 108.4Gt, which would rank fourth behind onshore wind turbines (147.8Gt), utility scale solar photovoltaics (119.2Gt) and reduced food waste (94.6Gt).

As an indication of what 101.2Gt and 108.4Gt represent, the latter is almost twice times what the entire planet generated in GHG emissions in 2018 (55.3Gt), according to UNEP (United Nations Envieonment Programme).

Chad Frischmann, Project Drawdown

FIVE WAYS TO CUT REFRIGERANT EMISSIONS

In *The Review*, refrigerant management and alternative refrigerants fall under the industry and buildings categories. The industry category accounts for 21% of all heat-trapping emissions, while buildings are responsible for 6%. "We can better manage and dispose of the fluorinated gases currently used as refrigerants, and, ultimately, replace them with benign alternatives," said *The Review's* section on industry.

Both the alternative refrigerants and refrigerant management sections posit five main ways to reduce refrigerant emissions:

- Lowering the demand/use of appliances and thereby production of refrigerants.
- Replacing refrigerants with low-warming HFCs/new cooling agents/non-HFC substances.
- Increasing the refrigeration efficiency in appliances, thereby lowering the use of refrigerants.
- Controlling leakages of refrigerants from existing appliances by good management practices.
- Ensuring recovery, reclaiming/recycling, and destruction of refrigerants at end of life.

Although the new analysis does not project an exact mix of alternative refrigerants (an average GWP of 10 is used) or model the cost of adoption, "current and emerging refrigerants and appliances (including ammonia, carbon dioxide, and propane) can replace between 67%-82% of HFC refrigerants by 2050," says *The Review* in an alternative refrigerants section.

Frischmann said he believes natural refrigerants "are the best alternatives to fluorinated gases." HFOs, he added, "are a foolhardy attempt to replace one problem with potentially other problems." Why do that, he argued, "when we have readily available [natural refrigerant] alternatives that are very implementable and will not cause much disruption. We should use those rather than other substances that seem to be very much [promoted by] an industry lobby."

At the same time, Frischmann pointed to the future potential of other refrigeration technologies, such as absorption cooling systems that link to solar energy.

For refrigerant management, the study projected a net lifetime operating cost (how much more it would cost compared to conventional practices between 2020 and 2050) of US$600 billion in scenario one and US$630 billion in scenario two.

The Project Drawdown analysis does not include a forecast for indirect emissions reduction through greater energy efficiency, though it cites estimates that this could be "half as much or as great as direct emissions reductions." Frischmann said that an energy analysis of alternative refrigeration technologies is being developed.

But another recent study conducted by academic and energy/industry experts, to which Peters and Dreyfus contributed, did incorporate energy efficiency of improved cooling systems and found even greater GHG emissions reductions than Project Drawdown.

The study – "Assessment of Climate and Development Benefits of Efficient and Climate-Friendly Cooling" – found that "if today's best available technologies—for both efficient equipment and climate-friendly refrigerants—were adopted for stationary air conditioning and refrigeration equipment in 2030, it would be possible to avoid the equivalent of up to 210–460 billion tons of CO_2e ($GtCO_2e$) over the next three decades compared to current technologies." The study was supported by UNEP, IEA and K-CEP.

"This is both the prize and what's at stake if we miss the opportunity to move aggressively on both the refrigerant and efficiency aspects of cooling in a coordinated and intentional manner," said Dreyfus.

Peters described this study as "an evidence-based anchor point that can help support Project Drawdown and governments in understanding the impact that energy-efficient cooling can have on our climate goals."

The refrigerant management section of *The Review*, which used an average GWP of 2,326 for HFCs, noted that effective end-of-life disposal of HFC refrigerants – whether through recycling or destruction – is essential, since 90% of emissions happen at that point. Refrigerant management also includes preventing leakages of refrigerant in existing equipment, particularly centralized commercial and industrial systems with elaborate piping.

Project Drawdown suggests that economic incentives for recovery, recycling and destruction of refrigerants, such as the issue of carbon credits under the Kyoto protocol, "would help increase the adoption in developing countries."

The Environmental Investigation Agency (EIA), an NGO with offices in Washington, D.C. (U.S.) and London, England, has been a strong advocate of measures to address F-gases in end-of-life equipment. In a report issued last year called "Search, Reuse and Destroy: Initiating Global Discussion to Act on a 100 Billion Ton Climate Problem," EIA said that preventing emissions of fluorinated greenhouse gases "is the single greatest near-term strategy to achieve faster and deeper emission reductions consistent with limiting global warming to within 1.5°C."

In March, a study published in *Nature* (https://go.nature.com/3awtlv9) reported that emissions from unrecovered sources, or "banks," of CFCs could delay the Antarctic ozone hole recovery by about six years and contribute 9Gt of CO_2e emissions between 2020 and 2100.

Since there is typically little or no business case for collecting and destroying HFCs, Frischmann would also like municipalities and communities to invest more in refrigerant waste management systems that can recycle or destroy fluorinated gases. "It's hard for individuals to know what to do," he said. "That's where municipalities can step up to provide waste management services."

Frischmann said he would like to see Project Drawdown's data serve as a "kick in the ass" to the refrigeration industry to start adopting natural refrigerant technology. "Natural refrigerants are available and it makes no sense to continue to harm the planet and humanity by producing HFCs, or even HFOs with their uncertainty and potentially negative externalities," he said.

"We should take the [Project Drawdown] data as motivation to really change the industry. I'd like to see this be a moment for producers of refrigeration equipment to really shift their operations as soon as possible in the direction of creating equipment that best uses natural refrigerants, and investing in innovative ways to make that happen."

OTHER COOLING SOLUTIONS

In addition to refrigerant management and alternative solutions, Project Drawdown analyzes the climate impact of a number of other cooling-related technologies, including insulation, high-performance glass, smart thermostats, building automation systems, high-efficiency heat pumps, green & cool roofs and dynamic glass. (See chart, page 28).

Most of these other solutions improve the efficiency of a cooling system or reduce the demand for cooling. In addition, high-efficiency heat pumps, which could use natural refrigerants, are seen as a substitute for heating equipment that relies on fossil fuels.

All told, refrigerant management, alternative refrigerants, high-efficiency heat pumps, and efficiency-enhancing secondary solutions eliminate 146.4Gt of CO_2e under scenario one, or nearly 15% of the total emissions reduced or sequestered by all 76 of Project Drawdown's climate-mitigation solutions. Under scenario two, cooling removes 169.2Gt of emissions, or about 11% of the total. While these numbers include non-cooling related emissions savings, they don't reflect the considerable amount of emissions that natural refrigerant cooling equipment reduces by virtue of its efficiency.

In Project Drawdown's analysis of high-efficiency heat pumps, end users would shell out an additional US$76 billion ($9,911 installed cost per unit), but

WHEN WILL DRAWDOWN TAKE PLACE?

Source: *The Drawdown Review*

Approximate Milestone	Approximate CO_2 Concentration
2045 (Scenario 2)	490ppm
2065 (Scenario 1)	550ppm

shecco Base

would save US$1 trillion in operating costs between 2020 and 2030 because of the elimination of fossil-fuel equipment. The cost rises to US$200 billion in scenario two but so does the operational savings (US$2.6 trillion).

"Heat pumps can serve as an efficient and sustainable solution to indoor space conditioning with high-efficiency," says *The Review*. "Retrofitting existing HVAC systems with state-of-the-art heat pump equipment is a viable option for consumers looking for ways to reduce building energy costs, without having to make major investments or structural changes to the building."

Another key cooling technology (also used for other applications) is building automation systems (BAS). Project Drawdown puts the net cost to implement BAS at US$200 billion and US$300 billion in scenarios one and two respectively, with a net operational savings of US$1.7 trillion and US$3.1 trillion, respectively. The study cites IEA data saying that BAS can cut energy consumption in commercial systems by up to 40%.

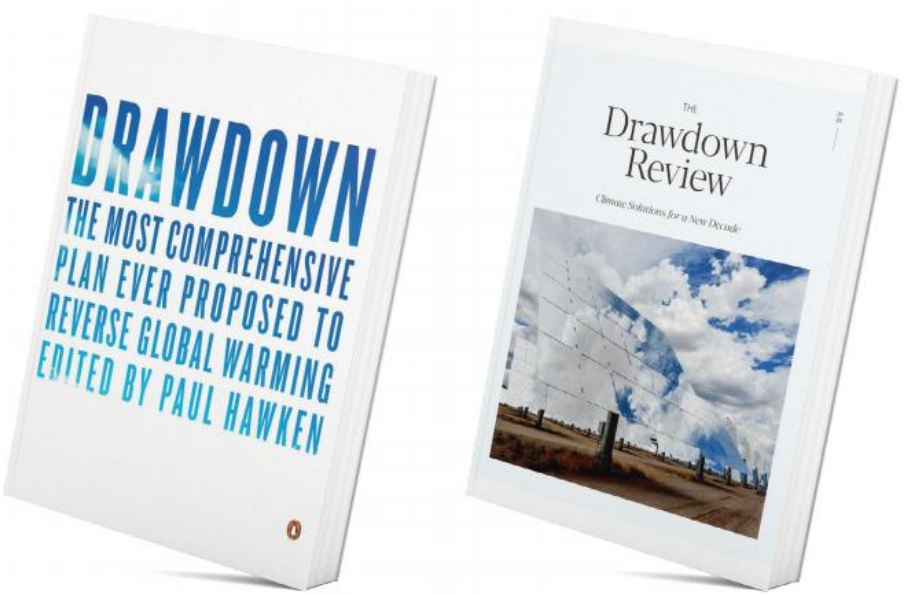
"Trends in automation and the growth of the Internet of Things, which connects many building devices, can accelerate the adoption of BAS across the global commercial building stock by making smaller systems more cost-effective," says *The Review*.

By presenting so many related solutions in one study, Project Drawdown encourages a more comprehensive and integrated approach to climate mitigation than any one solution. That aligns with the philosophy espoused by Peters of the University of Birmingham, U.K., with respect to cooling. "We should not be looking at the impact of cooling in siloes," he said. "The win is focusing on clean cooling in its entirety."

For Project Drawdown, Frischmann designed his models "so that we could develop an integrated global system that's harmonized," he said. "It's not dozens of models all doing different things; we have a consistent methodological approach to all sectors so we can compare apples to apples to apples to apples to apples."

Moreover, Project Drawdown envisions its scope as surpassing even climate change mitigation. Frischmann sees the healing of the climate setting off "a series of cascading benefits" similar to the United Nation's Sustainable Development Goals (SDGs).

"It will help humanity and planetary well-being for all, addressing social inequities, human rights, poverty alleviation, health, nutrition and biodiversity, as well as improving livelihoods." MG



Project Drawdown's two publications, the 2017 *Drawdown* book (left), and the new *Drawdown Review*

HOW DRAWDOWN WORKS

Project Drawdown offers in its latest analysis two scenarios for climate mitigation, one and two. Both scenarios enable humanity to achieve drawdown – "the future point in time when levels of greenhouse gases in the atmosphere stop climbing and start to steadily decline – but at different rates.

The study employs the FAIR climate model to determine the parts per million (ppm) of CO_2e that each scenario would deliver, compared to a baseline, which estimates ppm if technologies are fixed at 2014 levels.

Under scenario one – which the study calls "ambitious, at least compared to today's political commitments to climate action" – drawdown would occur in about 2065, when CO_2e concentrations would peak at about 540ppm (compared to nearly 460ppm today). The resulting global mean temperature would be 1.74˚C above pre-industrial levels in 2050 and rise to 1.85˚C in 2060, eventually peaking at 2˚C by 2100.

The Paris climate accord's goal is to keep temperature rise well below 2˚C. That goal can be achieved under scenario two, a faster and more aggressive adoption of climate solutions, which reaches drawdown in about 2045. CO_2e concentrations would peak at about 490ppm and then fall slightly by 2050 to about 485ppm. Temperatures would continue to rise after drawdown, with peak warming around 1.52˚C through the 2050s.

COOLING'S ROLE IN REDUCING FOOD WASTE

Reduced food waste is the No. 1 climate-mitigation solution in Project Drawdown's scenario one, cutting 87.4Gt of CO_2e between 2020 and 2050. In scenario two, it's No. 3, but it reduces even more CO_2e, 94.6Gt.

If food waste were a country, it would rank as the third largest emitter of greenhouse gas emissions behind only the U.S. and China.

Access to cooling plays a significant part in helping to reduce food waste, particularly in less developed countries early in the supply chain, where food rots on farms or spoils during storage or distribution.

"Improving infrastructure for storage, processing and transportation is essential," says *The Drawdown Review* in its reduced food waste analysis.

But how the cold chain infrastructure gets developed – whether efficient and climate friendly refrigeration systems are used –"will make a big difference for how much of the benefits of reduced food loss are realized or lost," said Gabrielle Dreyfus, Head of Policies, Standards & Programs for the Kigali Cooling Efficiency Program (K-CEP) and Senior Scientist, Institute for Governance & Sustainable Development (IGSD).

A new study by the World Resources Institute – "Reducing Food Loss and Waste: Setting a Global Action Agenda" – offers several cooling-related solutions for developing countries, including:

- Aggregation centers that provide adequate storage and preservation options, such as cooling chambers.

- Mobile packhouses and pre-cooling, which provide a way for farmers to get produce to markets without spoilage and without the need for large capital outlay.

- Evaporative cooling systems, which enable storage of crops at lower temperatures, without electricity, and at a lower-cost.

- On-farm solar preservation, which can provide energy to farmers that will allow them to adopt practices, such as on-farm cooling, that reduce post-harvest loss.

Americas

Technology
CO_2 Delivers Low Operating Costs in Ice Rink Chiller Study

Technology
Study Cites Faulty Line Opening as Cause of Lethal Ammonia Accidents

End User
Hillphoenix to Do Its First Low-Charge Ammonia Project in Latin America

Events

1. **April 28**
   2:00pm EDT
   EPA GreenChill Webinar
   608 Regulatory Update
   Register at https://bit.ly/3e9T3rp

2. **May 12**
   2:00pm EDT
   EPA GreenChill Webinar
   Supermarket Utility Incentives
   Register at https://bit.ly/2JU2JIU

3. **June 26**
   World Refrigeration Day
   https://worldrefrigerationday.org

Hillphoenix to Do Its First Low-Charge Ammonia Project in Latin America

The installation is expected to save poultry company 7% in energy usage and cost compared to a traditional ammonia system.

— By Franco D'Aprile

U.S. OEM Hillphoenix plans to install packaged low-charge ammonia units at a food distribution center operated by a multinational poultry company in Costa Rica, its first such installation in Latin America.

Following delivery from Hillphoenix's factory in Conyers, Georgia (U.S.), the units are expected to go live in June.

The poultry company's main motivation for choosing a low-charge ammonia system was concern for safety, according to Walter Castro, Latin-America Industrial Refrigeration Division Manager, Dover Food Retail (parent of Hillphoenix), adding that the lower amount of ammonia reduces the risk in the event of a leak.

Hillphoenix will install six low-charge ammonia units. Of these, one has a charge of 26.5lbs (12kg) with a capacity of 50TR (176kW); two others each have a charge of 19.8lbs (9kg) and a capacity of 40TR (141kW); and three others each have a charge of 15.4lbs (7kg) and a capacity of 30TR (105kW). This produces a total charge of 112.4lbs (51kg) and a capacity of 220TR (774kW), a ratio of 0.5lbs/TR (.07kg/kW).

The warehouse encompasses 1,700m² (18,299ft²) of frozen storage that is 14m (45.9ft) tall, as well as 3,200m² (34,445ft²) of storage for fresh poultry products at 13 meters (42.7ft) tall.

This poultry company has other distribution centers in Colombia, Nicaragua, and Honduras, which use traditional ammonia refrigeration systems. These not only require more resources devoted to safety, but also utilize 25.4lbs (11.5kg)/TR, or about 50 times more than the low-charge ammonia system.

Energy savings

A key advantage of the low-charge units is the lower energy consumption that results from not having to pump ammonia. In conjunction with this, the system uses self-adjusting suction pressure, which changes based on the temperature of each load during the cooling process. This saves energy when operational pressures are different from what the suction groups require, which are typically -20°F (-29°C) SST and 20°F (-7°C) SST.

Furthermore, there are energy savings because the ammonia does not have to travel through the long pipes of traditional systems.

This particular installation will save the end user 7% in energy usage and cost compared to a traditional ammonia system, said Castro.

Another plus is that, these systems do not require carbon steel or stainless-steel piping. Nor do they require oil purges, which also reduces the risk to personnel. Overall, Castro said, "these systems are easier to install and operate."

Though packaged units may have a larger upfront cost than traditional systems, their installation costs are much less, requiring only a crane to lift the unit into place and a duct system 9.8ft (3m) in length.

Concerning the installation of low-charge ammonia systems in other Latin American countries, Castro sees the biggest opportunities in larger installations, adding that bigger distribution centers offer more advantageous total cost of ownership (TCO) numbers. ■ FD

CO_2 Delivers Low Operating Costs in Ice Rink Chiller Study

The IIAR technical paper compares CO_2 and NH_3 chiller systems with two chillers using the HFO blend R448A.

— By Michael Garry

In a study of packaged chiller systems used for ice rinks, a transcritical CO_2 chiller was found to deliver a payback on its cost premium over a baseline system in "a few years," based on 13%-33% lower operating (electricity and water) costs.

The study – "Analysis of Package Chiller Systems – Comparison of Natural (NH_3 and CO_2) and HFC Refrigerants" – was conducted by John Collins, Industrial Sales Manager, Zero Zone, whose Refrigeration Division is based in Ramsey, Minnesota (U.S.). Collins was scheduled to present the study as a technical paper this week at the IIAR Natural Refrigeration Conference & Heavy Equipment Expo, but the event was cancelled due to the coronavirus pandemic.

The paper compares CO_2 and NH_3 chiller systems with two chillers using the HFO blend R448A; one of the R448A chillers employs evaporative condensing (the baseline system) and one is air-cooled. The chillers all use circulated glycol coolant. The nominal refrigeration capacity of the chillers is 160TR (562kW).

The energy analysis in the paper is based on "calculated performance" based on "readily available manufacturer data on component performance over the range of operating conditions," Collins wrote in the paper. In particular, performance data was derived from "Bitzer compression selection software and other published equipment data on the heat exchangers and condensers/gas coolers," he told *Accelerate Magazine*.

The analysis of water consumption is based on a nominal 0.30 gal/TR-hr (0.32ltr/kW-hr) for the evaporative condenser systems (in the baseline and ammonia systems), and one-quarter of this rate for the adiabatic gas cooler (in the CO_2 system).

"This is a comparative analysis to show relative performance of the considered options across a range of operating conditions," Collins said. "The performance data is not intended to serve as an annual or life cycle cost analysis."

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Cost comparison

While the costs of transcritical CO_2 chillers are declining, the installed cost of the CO_2 system in the study was 47% higher than that of the baseline unit, the paper noted. The installed cost of the ammonia chiller was 67% above that of the baseline system.

The overall performance of the CO_2 chiller, including energy and water usage, "allows for payback of the 47% premium in first cost over the baseline in just a few years," Collins noted in the paper. On the other hand, the 67% premium for the ammonia system "will take several years to make up."

In the study, the chillers were evaluated based on climates in four U.S. cities, Minneapolis, Minnesota (cold northern climate); Philadelphia, Pennsylvania (mixed humid northern); Atlanta, Georgia (mixed humid southern); and Los Angeles, California (dry warm). They were analyzed at 100% load, 55% load and for seasonal operation (September-April).

The CO_2 chiller employs parallel compression and adiabatic condensing, enabling it to "perform effectively at each of the locations considered over the entire range of annual weather conditions," Collins wrote.

Compared to the baseline system, the CO_2 chiller used less energy in the majority of the annual operating hours (62% of annual hours in Atlanta and 83% of annual hours in Minneapolis and Los Angeles). The added electric cost for the limited number of hours of peak hot weather operation "is more than offset by the savings during off-peak operation," Collins' paper said. Moreover, since the systems operate at reduced capacity much of the year, this "further improves the overall electric savings for CO_2 over the baseline system."

The electrical savings for the CO_2 system, combined with much lower water use for the adiabatic gas cooler/condenser, "results in the total operating costs between 13% and 33% below baseline across the range of locations and conditions," Collins wrote

The electric use/cost of the ammonia system is the least for all the options, but the added cost of water for evaporative condensing "more than offsets the electric savings," noted Collins in the paper. "This is more pronounced in cooler climates and where water costs are high. ■ MG

> *"This is a comparative analysis to show relative performance of the considered options across a range of operating conditions."*
>
> – John Collins, Zero Zone

Relative Operating Costs of CO_2, NH_3 and R448A Chillers

In Atlanta, at 100% Capacity

	Baseline R448A Evap Cooled	NH_3 Evap Cooled	R448A Air Cooled	CO_2 Adiabatic
Total Annual Op Cost	0.0%	-11.7%	+0.1%	-18.7%
Annual Water Cost	0.0%	-6.5%	-100.0%	-94.0%
Annual Powel Cost	0.0%	-13.1%	+26.2%	+1.1%

Source: IIAR technical paper "Analysis of Package Chiller Systems – Comparison of Natural (NH_3 and CO_2) and HFC Refrigerants" by John Collins, Industrial Sales Manager, Zero Zone.

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Study Cites Faulty Line Opening as Cause of Lethal Ammonia Accidents

Ammonia Incident Database, compiled over 14 years, points to sources of accidents.

— By Michael Garry

A study of accidents related to ammonia refrigeration has found that line-opening operations, along with liquid transfer and oil-draining activities, were responsible for the second largest number of incidents and the majority of 11 incidents that had catastrophic consequences.

The study – "Case History: A Study of Incidents in the Ammonia Refrigeration Industry" – was conducted by Peter R. Jordan, Senior Principal Engineer, MBD Risk Management Services, Langhorne, Pennsylvania (U.S.) Jordan was scheduled to present the study as a technical paper at the IIAR Natural Refrigeration Conference & Heavy Equipment Expo in mid-March, but the event was cancelled due to the coronavirus pandemic.

Jordan largely referenced an "Ammonia Incident Database" that he compiled between 2005 and 2019, based on publicly available sources. The database identified meat and poultry processing (159 incidents), cold storage (134) and ice rinks (103) as having the most ammonia-related incidents.

He also alluded to data provided in 2004 to the IIAR Ammonia Release Task Force by the U.S. Chemical Safety and Hazard Investigation Board (CSB), and to a 2008 survey that IIAR sent to its members.

His assessment of the data pointed to adverse incidents occurring in the ammonia refrigeration industry approximately once every three to six days. "These incidents often result in people being injured and sent to the hospital for treatment (more than 1,500 during a 14-year period)," he wrote in the paper.

To improve the safety of ammonia refrigeration systems, Jordan called for the industrial sector to adopt designs that "minimize the total ammonia charge" and "eliminate the use of ammonia equipment outside of machinery rooms."

Eleven fatalities

The Ammonia Incident Database included 11 incidents that resulted in catastrophic consequences – nine fatalities at facilities operating ammonia refrigeration systems and two at ammonia storage terminals.

Nine of these 11 incidents were related to line opening, liquid transfer, or oil-draining operations. "This supports the hypothesis that these operations are the most hazardous conducted in the ammonia refrigeration industry," wrote Jordan.

To prevent incidents stemming from line opening, liquid transfer, or oil-draining operations, Jordan suggested engineering controls (such as spring-loaded valves and pump-out systems) and training for system personnel. He also referenced IIAR administrative control standards, such as line opening procedures (IIAR 7), and written operating and maintenance procedures (IIAR 7 and IIAR 6, respectively).

In addition, during liquid transfer operations, he wrote, "facilities must ensure that the transfer line/hose is suitable for ammonia, has been properly maintained, and contains appropriate devices to limit the size of an ammonia leak if the line/hose were to rupture."

Three of the 11 fatal incidents involved persons trapped in limited access areas. "The location of ammonia equipment and possible escape routes must be considered during the design of the system and all subsequent hazard analyses," Jordan noted.

He suggested following options, preferably in this order:

- Relocate the ammonia refrigeration equipment.
- Provide a secondary (back-up) emergency exit.
- Provide personal protective equipment (PPE) that would enable personnel to escape the area in an emergency.

Human error vs. equipment failure

In an analysis of all incidents in the Ammonia Incident Database, Jordan found that 33% were the result of human error, including 27% attributed to line opening operations, and the rest to transferring liquid, oil draining and improper valve opening. He also found that 36% were due to equipment failure, including faulty equipment, leaks from seals/gaskets, corrosion and faulty pressure relief valves.

Jordan noted that IIAR has established procedural standards to address faulty and poorly maintained equipment, such as improvements to system design (IIAR 2 and IIAR 4) and mechanical integrity procedures (IIAR 6). In addition, facilities should "identify and replace older, obsolete equipment on a timely basis," Jordan advised.

The Ammonia Incident Database also revealed that 28% of incidents occurred in machinery rooms, while 22% took place in production areas and 50% happened outdoors. About 73% of the outdoor incidents were releases from pressure relief valves, most of which resulted in injuries and/or off-site consequences.

To address pressure relief valve releases, Jordan suggested that "additional emphasis must also be placed on the design, operation, and maintenance of overpressure relief protection systems." He also recommended that hazard analyses be conducted to identify the potential circumstances that cause pressure relief valves to open.

Jordan addressed other areas in the Ammonia Incident Database that were responsible for fewer incidents. For example, he proposed additional protections for refrigeration equipment from motorized equipment, especially forklifts (6% of incidents), and from structural or building failures (3%).

He recommended that IIAR standards 4, 5 and 8 should be followed to prevent incidents (6%) that occur during the commissioning and the decommissioning of ammonia refrigeration systems.

Fires, which were responsible for approximately 5% of the incidents in the database, can be prevented or minimized through "the implementation of hot-work permit procedures, the relocation of flammable materials, and improvements to fire suppression systems," he wrote.

Jordan urged a continuation of ammonia incident research, suggesting that the EPA and CSB could be queried about whether up-to-date data can be obtained from EPA's five-year accident history database. He also recommended that IIAR contact its members "to determine if they would be willing to share, on a confidential basis, reports conducted to investigate incidents that have occurred in their ammonia refrigeration systems." ■ MG

> *"The location of ammonia equipment and possible escape routes must be considered during the design of the system and all subsequent hazard analyses."*
>
> – Peter R. Jordan, MBD Risk Management Services

Causes of Ammonia Accidents

Cause	% in Database
Equipment Failure	
Faulty equipment	17%
Leak from seal/gasket	9%
Corrosion	6%
Relief valve fails to open	4%
Total	36%
Human Error	
Line opening	27%
Transferring liquid	3%
Oil draining	2%
Improper valve opening	1%
Total	33%

Source: Ammonia Incident Database as cited in "Case History: A Study of Incidents in the Ammonia Refrigeration industry" by Peter R. Jordan, Senior Principal Engineer, MBD Risk Management Services
Note: Other causes include loss of cooling (7%), impact from motorized equipment (6%), decommissioning (5%), external fire (5%), and others contributing 3% or under.

shecco Base

Europe, Middle East & Africa

Market
Estonia Builds Training Facility for NatRefs

End User
NH_3 Heat Pump Taps Warm Air from London Underground for District Heating

Events

1. **April 28, 5:45 AM - 7:00 AM EDT**
   Webinar: The cold-chain imperative - Food saved is as important as food produced.
   Institute of Refrigeration
   https://bit.ly/2UWhQrw

2. **June 5**
   EU Green Week
   World Green Building Council
   https://bit.ly/2yLq9gZ

3. **June 9**
   ATMOsphere Ibérica
   https://bit.ly/39YvLBt

3. **June 26**
   World Refrigeration Day
   https://worldrefrigerationday.org

Event
South African Retailers Share Advantages of Switching to CO_2

NH_3 Heat Pump Taps Warm Air from London Underground for District Heating

The pioneering system helps heat more than 1,350 homes, one school and two leisure centers, with lower heating bills.

— By Tine Stausholm

Anybody who's ever travelled on the London Underground will know just how hot it gets down there, with excess heat being generated by the trains' electric motors and friction from the brakes.

Until now, all that hot air has just been vented above ground. However, Islington, a borough of London, which intends to become carbon neutral by 2030, decided that the heat was a resource to be utilized in the pursuit of this goal.

In March 2020, Islington inaugurated a world's-first project, the Bunhill 2 Energy Centre, which sends the warm Underground air through an ammonia heat pump to assist in creating heating and hot water for more than 1,350 homes, one local primary school and two leisure centers, according to a press release from Islington's governing council. Bunhill 2, which cost £16.3 million ((US$20.3 million), thereby reduces the CO_2 emissions that would have been generated by oil- or gas-fired heating systems.

Bunhill 2 works with Bunhill 1 (opened in 2012), which employs a 2MW CHP (combined heat and power) engine. Together they comrpise the Bunhill Heat and Power Network, a district energy provider.

Interior of Bunhill 2 Energy Centre

The Bunhill 2 Energy Centre

How Does Bunhill 2 Work?

A huge 2m (6.6ft)-wide fan extracts 70m³ (2,472ft³) of warm air per second through a ventilation shaft from a tunnel on the Underground's Northern line. The warm air passes through a water-filled cooling coil, heating the water from 8°C to 13°C (46.4°F to 55.4°F), and at the same time cooling the air from 24°C to 14°C (75.2 to 57.2°F) before it's vented to the outside. The coil's total cooling capacity is 780kW (222TR).

The water is then sent through GEA's two-stage ammonia heat pump, which heats it to 75°C (167°F). The heat pump has a 1,000kW (284.3TR) capacity and a 350kg (772lbs) ammonia charge, and is powered (with the fan) by two gas-driven CHP engines. The hot water is then pumped through the new network of pipes to the homes and leisure centers. The return temperature of the water is 55°C (131°F).

In the summer, when the outside air is warmer than what's coming up from the Underground, the process can be configured to use the outside air. In that case, the direction of the fan is reversed so that cool air is rejected to the Underground tunnels instead of being released to the outside.

One of the technical challenges of the new system is the amount of iron dust in the air coming from the Underground. The iron dust is primarily created by the friction of the trains' brakes against the tracks. The amount of iron dust makes traditional air filtering useless, as the filters would clog up and need cleaning too often. Instead GEA chose a solution with wider fin spacing on the cooling coils, so the dirt goes straight through without sticking to the coils. Tests have shown that the cooling coils will only need cleaning once a year, Hoffmann said.

Another challenge has been the quality of the water in London, which uses surface water treated with chlorine. Chlorine is corrosive to the fin metal in the heat exchangers, meaning that GEA had to exchange its usual stainless steel for a special corrosion-resistant alloy called SMO254. ■ TS

Challenge of ammonia

Islington Council chose an ammonia heat pump for the project after conferring with engineers from German manufacturer GEA. One of the criteria was that very hot water – 75-80°C (167-176°F) – is needed for heating in the older housing units owned by the council, said Kenneth Hoffmann, GEA's Heat Pump Product Manager.

The hot-water requirement meant that an ammonia heat pump was the only viable option that would give Islington a sufficiently energy-efficient system, said Hoffmann. The solution chosen has an annual coefficient of performance (COP) of 3.5.

The energy-efficient ammonia heat pump has enabled the Islington Council to lower the heating bills for the residents in the 1,350 homes by 10% compared to other communal heating systems that use fossil fuels – which are in themselves around 50% cheaper than stand-alone systems for individual homes, according to Islington Council.

The reduced bills were a very important factor influencing Islington's decision, as "fuel poverty" is a serious problem for many people in London, especially people living in council housing, many of whom are in low-income households.

Choosing an ammonia heat pump for a system installed in a very densely populated area of London wasn't without its challenges and concerns. In order to eliminate the risk of any leaks reaching the general public, the system was fitted with active carbon-filter ammonia scrubbers (adsorbers), so that even if leaks occur, no smell would reach the public. This, of course, added extra cost to the project, but it was necessary, according to Hoffmann.

By using the waste heat from the Underground rather than a fossil-fuel system, the Bunhill 2 project not only saves around 500 metric tons of CO_2e per year but it also prevents considerable amounts of nitrogen oxides (NOx) from entering the atmosphere, Hoffmann said. This is an important benefit in a heavily polluted city like London, where poor air quality killed almost 3,800 people in 2017 alone, according to a study by Centre for Cities.

The technology used in Bunhill 2 has lots of potential elsewhere, both in London and in other big cities. The Greater London Authority estimates that there is enough heat wasted in London to meet 38% of the city's heating demands, according to an article in *The Telegraph* (https://bit.ly/2UROfOt).

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ESTONIA BUILDS TRAINING FACILITY FOR NATREFS

The country's Environmental Research Centre is leading a transition to climate-friendly refrigerants in spite of cheap HFC imports from Russia.

— By Tine Stausholm

The old town of Estonia's capital city, Tallinn.
Credit: © Susan Peterson/ 123RF.com

Despite facing some significant challenges, Estonia, led by the Ministry of Environment and the Estonian Environmental Research Centre, has embarked on a major effort to transition to natural refrigerants and low-GWP gases, including a new training facility.

The journey started in 2014 after the EU adopted the F-Gas Regulation. The Estonian government originally put its faith in the market to adopt phase-down measures, said Stanislav Stokov, Specialist in the Environmental Research Centre's Climate Department.

But Estonia is one of the poorer countries in the European Union with a per capita GDP just over half of the EU average (in 2019). This lack of financial resources meant that the HVAC&R industry in Estonia needed a bit of a nudge to get moving towards natural refrigerants. The country is also dealing with an influx of legal and illegal imports of HFCs from neighboring Russia. (See sidebar, page 47.)

In 2018, to jump-start Estonia's transition to climate-friendly refrigerants, the Environmental Investment Centre allocated €0.6 million (US$0.65 million) to a project that includes training and certification.

Estonia is still only at the very beginning of its transition. Currently the country has around 20 CO_2 installations; a mix of subcritical and transcritical systems; two or three companies with industrial ammonia installations; and a small number of retailers using hydrocarbon units, according to Stokov.

Still, there are signs of progress. Since 2016, Estonia's f-gas emissions have decreased by 2.4%.

NEW TRAINING FACILITY

In preparing for the transition project, members of the Estonian Environmental Research Centre (including Stokov), the Ministry of Environment and the national refrigeration association went on a trip to Denmark to acquire knowledge and inspiration from the Danish

Technological Institute on potential legislation, characteristics of each natural refrigerant, and how to best disseminate what they learned.

One of the project's major initiatives is a new training facility for refrigeration technicians. The facility is meant to address the lack of qualified natural refrigerant technicians, and thus make it easier for the companies to switch from HFCs.

The training facility should be fully up and running in April. It contains CO_2 transcritical, CO_2 subcritical, hydrocarbon and HFO systems. That ammonia isn't included in this list is entirely due to cost. "We wanted an ammonia unit, but it's so expensive, it would have been much more than the project itself," Stokov said.

"Currently, we are looking into cooperation with some companies who have experience [with ammonia] and have sites, where they [student technicians] can come and do some practical stuff."

The project has also focused on textbooks and other literature for trainees. Most technicians and trainees in Estonia don't speak English, and currently only one book about refrigerants exists in Estonian, and that doesn't include natural refrigerants.

So the project is in the process of translating a Norwegian book about flammable refrigerants, and a U.S. manual about refrigerants in mobile air conditioning (MAC).

The project is also in the process of rewriting the country's certification requirements, as it hasn't been possible to certify in natural refrigerants until now. Stokov expects the new certification to be ready in April or May.

Because it wasn't previously possible to get certified to work with natural refrigerants in Estonia, some of the early adopters of sustainable technologies sent their staff to Germany for training.

Some of these early adopters include retailers owned by foreign companies, such as a Swedish company that has implemented the same environmental policies in its Estonian operations as the ones used at home in Sweden, Stokov said.

The final aspect of the transition project is to ensure efficient recycling of used refrigerants. The project has invested in a couple of HFC recycling machines, and offers these to companies so they can clean up used refrigerants like R404A and R134a. ■ TS

Stanislav Stokov,
Estonian Environmental Research Centre

CHEAP HFC IMPORTS FROM RUSSIA

One of the biggest obstacles to Estonia's effort to transition to natural refrigerants is the influx of HFCs from its neighbor to the east, Russia, according to Stanislav Stokov, Specialist in the Environmental Research Centre's Climate Department.

Russia has no quota system for HFCs, and has yet to ratify the Kigali Amendment to the Montreal Protocol, meaning that HFCs can still be imported very cheaply into Estonia. For some refrigerants the price difference between buying within the EU, and importing from Russia, can be tenfold, Stokov explained.

"It's a very huge gap," he said. "And if there's cheap, cheap refrigerants [from Russia] on the market, the companies are not that motivated to change."

Another problem in a small market like Estonia is the exemption in the EU F-Gas Regulation that allows companies to import up to 100 metric tons of CO_2e in HFCs per year.

The Environmental Research Centre is therefore urging the Estonian government to lobby the European Commission to scrap the exemption in article 15(2) when the F-Gas Regulation is to be renegotiated within the next year.

Estonia is also dealing with a large amount of illegal HFC imports. "Currently we have credible intel that about one third of the refrigerants sold in our market are illegal, or haven't been accounted for in the system or anywhere," Stokov said.

Ilana Koegelenberg (left) of shecco introducing the end user panel, from left: Richard Taylor (PnP); Alex Kuzma (Woolworths); Wayne Derdekind (SPAR); Andre Snyman (Lynca Meats); and Neshen Moodley (RCL Foods).

South African Retailers Share Advantages of Switching to CO_2

During the first-ever ATMOsphere Cape Town event, three major chains discussed their progress with transcritical CO_2

— By Ilana Koegelenberg

The end user panel at the first-ever ATMOsphere Cape Town conference, held on March 10 in South Africa, featured representatives of three retailers and two food processors, all of whom have had positive experiences with natural refrigerants.

The panel was one of more than 20 presentations on local and global market trends as well as new technology and policy, with 150+ attendees from around the world on hand. (ATMOsphere conferences are organized by shecco, publisher of *Accelerate Magazine*.)

This wasn't the first time an ATMOsphere conference took place in South Africa. In 2018, an ATMOsphere networking event was held in Johannesburg during the FRIGAIR trade exhibition. Alex Kuzma, Head of Engineering Services at Woolworths – the first retailer in South Africa to adopt CO_2 – presented the benefits of this move. Kuzma returned to ATMOsphere Cape Town as a speaker, but this time his company was no longer the only retailer using natural refrigerants.

Pick n Pay accelerates CO_2 use

Richard Taylor, General Manager of Store Design and Implementation of Cape Town-based food retailer Pick n Pay (PnP), was first to the podium to talk about his company's journey with CO_2. PnP, he said, started looking at CO_2 after hearing Kuzma's presentation at FRIGAIR in 2018. At that time, PnP didn't have a single CO_2 store, but by the end of the week after FRIGAIR, Taylor had the go-ahead for the first CO_2 installation. Today, PnP boasts 17 stores running on transcritical CO_2, a number that should almost double by year's end, according to Taylor.

Richard Taylor of PnP.

PnP operates over 1,600 stores of various formats – more than 600 of them franchised – across seven countries in southern Africa. Of its 20 hypermarkets (15,000m²/161,459ft²), two are served by a cascade R134a/CO_2 system and one by transcritical CO_2. On the supermarket side (3,000m²/32,292ft²), there is only one transcritical CO_2 system and 22 cascade systems running among the 304 franchise stores; the 240 company stores feature more natural refrigerant solutions: 89 CO_2 cascade systems (two with ammonia), and 15 transcritical CO_2 stores (with a further five in progress). The smaller stores are still running on fluorinated refrigerants only: 39 local stores (1,000m²/10,764ft²); 151 express stores (300m²/ 3,229ft²); and 467 liquor stores (of which 241 are corporate and 225 franchised).

"Our transcritical CO_2 score at the end of 2020 will be 32 [stores]," said Taylor. "Considering that score was 0 in mid-2018, you really just have to get one store on the board, and you will make a dent quickly."

Taylor talked everyone through the initial barriers to getting started on transcritical CO_2. The biggest was the premium paid on CO_2 systems over fluorinated alternatives, as well as the fact that these systems weren't initially energy efficient in higher ambient temperatures. There was also an initial concern about not having enough expertise locally to install and maintain these installations – especially in the smaller, more rural towns. But this changed as the technology became more popular locally.

Taylor explained that it's easier to motivate an investment in transcritical CO_2 for a large store or hypermarket, but it becomes much more difficult for a smaller store, especially for the franchisees and stores in the more rural areas.

PnP has been tracking the energy used by transcritical CO_2 stores vs. cascade CO_2 stores and those using only fluorinated refrigerants. Taylor pointed out that often a 2020 transcritical system is compared to a 1999 synthetic refrigerant system, which will obviously make the CO_2 system look more efficient. "You have to be careful what you are comparing – when you are comparing with a state-of-the-art freon system, the race is actually quite close," he said.

Taylor said he believes grocers should reduce the energy consumption of their stores first and "then motivate for new equipment." He recommends things like putting doors on display fridges and having smaller fridges as well as using analytics to reduce the need for refrigeration.

Woolworths: more than 100 TC CO_2 stores

Kuzma was up next and spoke about Woolworths' decade-long transition to CO_2, which now includes smaller stores. Cape Town-based Woolworths – not associated with the Woolworths chain in Australia – operates over 200 full-line stores with food offerings and more than 400 stand-alone food stores, with about 60 more in other African nations.

"For us it's a no-brainer; CO_2 is business as usual now," Kuzma said, starting off his presentation. "We generally go for CO_2 wherever we can – because it works, and it works well."

Woolworths installed its first subcritical CO_2 system in October 2009 and currently has nine stores running on this technology. In November 2010, it moved to transcritical CO_2 and today uses it at more than 100 stores.

"We found it reliable and simple – and of course, sustainable," Kuzma said about transcritical CO_2. He said he had a lot of support from Woolworths' board as the company's strategy aligned with going "green." Transcritical CO_2 is also future proof, a major plus, he said. "This is Africa, I have enough to worry about already – I want to just put a system in and not worry about it again. Transcritical CO_2 allows for that."

Woolworths was also initially worried about energy savings, but Kuzma said that with parallel compression, the company has managed to save energy for more than a year. Parallel compression enables the crossover point where the system is working harder to move from 27°C (80.6°F) to 38°C (100.4°F), and the temperature rarely reaches the latter. He also mentioned the "excellent heat reclaim opportunity" that comes with transcritical CO_2 as well as the fact that HFC costs are spiralling upward.

According to Kuzma, in larger stores, transcritical CO_2 becomes almost cost neutral – but the challenge lies in smaller stores. "I want to make CO_2 the default for all formats but we are battling a bit with the smaller stores," he said.

Despite this, Woolworths is currently busy fitting out three convenience stores (300-400m²/3,229-4,306ft²) with transcritical CO_2. The installed refrigeration capacity is 26-40kW (7.4-11.4TR) for medium temperature and 7kW (2TR) for low temperature.

According to Kuzma, the price premium for transcritical CO_2 above an HFC refrigeration system is about 16% at smaller stores. Transcritical equipment that cost more than HFC counterparts include compressors and components capable of withstanding higher pressures, while the piping itself is cheaper (less copper) as is the price of the gas (with less needed).

So, what are the solutions to higher cost? First, economies of scale, Kuzma said. He was encouraged by seeing the other retailers on stage talking about CO_2. "CO_2 and other natural refrigerants need to become more mainstream," he said. "We see it as a commodity."

Kuzma ended by looking at what end users consider when selecting a refrigeration system. At the top of his list was performance, as retailers regularly inspect core product temperatures. Then, reliability and low maintenance are key – boxes CO_2 easily checks, he explained. Other priorities include energy efficiency and compatibility with African conditions – i.e. being robust and simple so any technician can work on it. He also listed being future proof and meeting emissions standards. Of course, the list also includes being cost effective and having a compact footprint. Don't just think about CAPEX though, Kuzma urged, reiterating the importance of lifecycle costing.

Alex Kuzma of Woolworths.

Wyane Derdekind of SPAR.

SPAR joins the CO_2 race

The third panelist was Wayne Derdekind, Group Development Manager of SPAR, which only recently started using transcritical CO_2 in retail stores in South Africa. SPAR, based in the Netherlands, operates more than 13,000 mostly franchised stores in 48 countries. In South Africa, there are more than 800 stores, with a relatively small footprint (1,164m²/12,529ft²).

Although transcritical CO_2 is nothing new for SPAR's European retail stores, South Africa has been slow to catch up, so far with only three transcritical installations, said Derdekind. This is because in South Africa, SPAR is a voluntary trading organization (similar to a franchise), he explained. Retailers pay a fee to belong to the brand, but SPAR doesn't dictate things such as what refrigeration system should be put in. Its retailers have a lot of freedom regarding what they use – and usually cost is a primary consideration.

Derdekind echoed the other retailers in saying that, traditionally, transcritical CO_2 didn't have potential for a great return on investment for retailers. This was predominantly because of South Africa's warm climate. As such, the only angle is the environmental benefit. "Our challenge comes with convincing these retailers to invest in something for a 'noble cause,'" said Derdekind.

That has been SPAR's biggest difficulty – until now. Fortunately, as technology and the industry evolved, the costs came down and efficiencies went up. Available expertise was a problem, as were availability and cost of components. But as South African retailers' demand for transcritical CO_2 grows, so does the local industry and expertise. "Transcritical CO_2 systems are getting more efficient and we're now seeing them match or even exceed efficiencies on R404A plants," he added. "It is becoming a great motivator for our retailers."

It's not a no-brainer yet, because the savings don't yet justify the premium. "It still involves a bit of sacrifice, but retailers are starting to see the long-term benefits," said Derdekind.

When you go to international trade fairs such as EuroShop and Chillventa, it's clear that the world is moving away from HFCs, which Derdekind sees as a positive sign, and he thanked Woolworths and PnP for "setting the path" locally for CO_2 in South Africa. "It has given our retailers a little bit more confidence to start looking at investing in it."

However, Derdekind still believes there should be incentives from government entities for retailers to go natural in order to soften the financial blow. He said incentives would lead to far better buy-in from independent retailers.

Trading on the successes of the other retailers, SPAR has completed three transcritical CO_2 stores. The hope is to be able to show a significant improvement in energy savings, which will incentivize other stores to follow suit. "We hope there will be a knock-on effect," Derdekind said, mentioning that there are already another eight transcritical CO_2 stores in the pipeline for 2020. "Hopefully at the next ATMO we'll be in the double digits, too."

The next issue of *Accelerate Magazine* (June) will feature coverage of the two food processing companies in the ATMOsphere Cape Town end users panel.

Download the presentations

To download end user presentations and any others from ATMOsphere Cape Town, visit atmo.org. ■ IK

Australia & New Zealand

Event
Green Building Council of Australia Takes Conference Online

Technology
Sales Engineer Working With CO_2 Makes Her Mark in New Zealand

End User
Produce Warehouse Drops in Low-Charge Ammonia Packagefor Expansion

Events

1. **June 1-2, online event**
   International Conference on Global Warming and Natural Disasters.
   Global Warming Congress, Sydney, Australia
   https://bit.ly/2XsCEbE

2. **June 26**
   World Refrigeration Day
   https://worldrefrigerationday.org

Produce Warehouse Drops in Low-Charge Ammonia Package for Expansion

Bitzer's Green Point commissioning underway.

LRT/VCT chooses first Bitzer Ammonia Compressor Pack to be installed in Australia

— By Ilana Koegelenberg and Caroline Rham

One of the advantages offered by packaged low-charge ammonia systems is that they can be dropped into a facility undergoing an expansion.

That is just what LRT/VCT (Leslie Refrigerated Transport/Vince Cordoma Transport) did last year at one of its two fresh produce cold-storage facilities in North-West Victoria, Australia.

The refrigerated transport business, established in 1977, opted for compressor manufacturer Bitzer's Ammonia Compressor Pack (ACP) solution – the first to be installed in Australia.

LRT/VCT uses its cold-storage facilities for the preparation of predominantly oranges and grapes to be transported locally within the state as well as exported internationally. Today, their fleet includes 35 tractors and 75 trailers.

As the operation grew, there was a clear need for extending the cold storage space. LRT/VCT sought a refrigeration system that offered reliable operation, efficiencies and a refrigerant with a long-term future, according to a Bitzer case study.

Contractor Sutton Refrigeration installed the Bitzer ACP ammonia compressor unit with two compressors; it is connected to a Bitzer Thermowave plate heat exchange package that chills glycol for circulation through the cold storage area. The system's capacity is 450kW (128RT) at -8°C sst/35°C sct, and it uses only 80kg (176.4lbs) of ammonia. Commissioning was handled by Green Point, a Bitzer after-sales support company.

Logistics challenges and subsequent coordination "proved to be a key focus, as all product installation and technical demands went very smoothly," said the Bitzer case study.

Efficiency gains

New ammonia systems "are more efficient than conventional HFC systems," said Raj Gulati, Bitzer Customer Solutions Industrial. "Part-load operation of the ACP unit offers further efficiencies." (Energy data was not available.)

"Ammonia is an excellent refrigerant and when combined with Bitzer products, energy efficiency and future proofing are guaranteed," said Simon Wood, Managing Director, Bitzer Australia.

The system was very competitive cost wise, added Gulati "It's also very simple to install and operate and offers the added benefit of Green Point doing the maintenance," he said.

Contractor Sutton supports the use of a natural refrigerant like ammonia. "The biggest challenge facing the industry over the next decade is the move from HFC refrigerants to HFOs and naturals," Robert Sutton, Sutton Refrigeration Director, told Climate Control News CNN in 2018, when the publication named Sutton Contractor of the Year. ■ IK & CR

This year's Transform event took place online.

Green Building Council of Australia Takes Conference Online

Because of the global pandemic, the two-day Transform event was quickly reimagined as a virtual gathering, keeping original March dates.

— By Caroline Rham and Ilana Koegelenberg

Acting swiftly in response to the COVID-19 pandemic, the Green Building Council Australia (GBCA) changed their scheduled two-day Transform conference from a physical to a virtual event, maintaining its original March 24-25 dates.

The conference, covering the sustainable built environment, attracted more than 360 previously registered attendees. Due to the ongoing pandemic, major industry events around the world that were scheduled to take place in March and later, including ARBS in Australia, were forced to cancel or postpone. (ARBS has been rescheduled to February 15-17, 2021; see page 24).

"With the health and well-being of our attendees as our first priority, we are now moving Transform 2020 online as a virtual conference, and will no longer proceed with a physical event," said the conference website (https://bit.ly/3amMZtu).

The online version of Transform delivered the complete conference as programmed via live streaming, with all content uploaded for viewing post-event. GBCA filmed all sessions and video-conferenced remote speakers where feasible. Attendees were able to participate in sessions by submitting questions and comments live. The price of the event was unchanged.

During the online conference, GBCA stressed the importance of resilience in these difficult times and finding solutions and opportunities.

The case for Green Star

GBCA runs a "Green Star" building rating program, describing it as "Australia's mark of quality for the design, construction and operations for sustainable buildings, fit outs and communities." Building operators can earn credits for eliminating high-GWP refrigerants. (See sidebar, page 56.)

On the first day of the online conference, Jorge Chapa, Head of Market Transformation at GBCA, presented on "The business case for Green Star." "All Green Star buildings will need to be fossil fuel free, highly efficient, powered by renewables and built with low-carbon materials," he said.

In another presentation, Martijn Wilder, Chair of the industry association Australian Renewable Energy Agency (ARENA), emphasized that COVID-19 was a short-term hit but that climate impacts on assets won't go away.

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> *Even if we focus on the pandemic, as we must do, our planet is going to keep warming.*
>
> – Bob Carr, University of Technology Sydney.

ARENA provides grants and funding for innovative ideas to accelerate the shift to affordable and reliable renewable energy. For instance, last year, ARENA provided AUS$2 million (US$1.2 million) to Glaciem Cooling Technologies to trial its CO_2 refrigerant technologies (https://bit.ly/2xsz4DD). However, the future of ARENA is currently under discussion, with its funding expected to be exhausted by the end of 2020.

The Transform event included panel discussions, including one on "Our industry as an agent of change." "Sustainability is central as we recover from the [coronavirus] situation," said panelist Pamela Hanrahan, Non-Executive Director of Landcom, the New South Wales (NSW) Government's land and property development organization. "As a global community we must continue to engage, celebrate and connect with each other."

"We will learn how to be more efficient in the management and construction of buildings," she added, advocating for a more holistic approach to sustainability – going beyond just "green."

The conversation on how to drive businesses to a sustainable future continued on day two. "Even if we focus on the pandemic, as we must do, our planet is going to keep warming and the symptoms of that are going to keep building," said Bob Carr, Professor of Climate and Business at the University of Technology Sydney, former Australian Foreign Minister and former Premier of NSW. "Our challenge is to deal with more than one problem at once." CR & IK

Earning Green Star Credits via Refrigerants

In the Green Building Council (GBCA)'s "Green Star" building rating tool, building operators can gain credits by transitioning from high-GWP to low-GWP refrigerants.

Green Star's "Design & As Built" category, which assesses sustainability outcomes from the design and construction of new buildings or major refurbishments, offers credits for the use of low-GWP refrigerants. This approach incentivizes new technologies and has been used to trial systems that "are slowly becoming mainstream," says GBCA.

In February, GBCA solicited feedback for a new certification standard, "Green Star for New Buildings," which "reimagines the existing rating tool for new buildings and major refurbishments." Under the "Positive" category – which "drives the building to address energy use, carbon emissions, water consumption and the impact of materials and resources" – credits would be available for eliminating high-GWP refrigerants. (See https://bit.ly/2QQ9yip). The new standard is expected to be released in April.

The proposed criteria called for a building owner to completely eliminate or offset emissions from refrigerants, based on charge and GWP.

Purchased offsets must be from afforestation and reforestation activities, or domestic renewable energy generation. Stapled biodiversity and carbon offsets are preferred.

The credit is applicable to all building sectors and to all refrigerants in building systems or domestic appliances provided by the building.

In a residential setting, where fridges or freezers are provided as part of a fit-out package, the emissions from the refrigerants in those systems must also be offset.

Specialty medical equipment or manufacturing equipment is excluded from this credit.

"Rather than a prescriptive approach to selecting refrigerants, [this approach] focuses on the issue: addressing the emissions from refrigerants," said GBCA in a document on the Positive category. "In effect, it places a price on using high-GWP refrigerants and encourages using lower-GWP refrigerants."

World Guide to Transcritical CO_2 Refrigeration

- Market analysis • Technology trends
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Sales Engineer Working With CO_2 Makes Her Mark in New Zealand

Patton Refrigeration's Megan Dinsdale-Jones is one of just seven women with CO_2 refrigeration qualifications in the country.

— By Michael Garry

Megan Dinsdale-Jones, who joined Auckland, New Zealand-based wholesale supplier Patton Refrigeration in January, is the latest woman to be recognized for taking on natural refrigerant systems.

A 12-year HVAC&R industry veteran, she began working in supermarket refrigeration early in her career, according to an article published at www.pattonnz.com. She furthered her experience with another large supermarket supplier, working with transcritical CO_2 refrigeration, commissioning supermarket racks and gaining hands-on experience with controls and systems. This included carrying out usual service-tech duties, as well as fully commissioning transcritical CO_2 plants, cabinets and controllers, including RDM, Emerson and Carel.

At the beginning of this year, Dinsdale-Jones became a sales engineer with Patton, acquired by Beijer Ref in 2015.

"Megan brings to us an ideal combination of both general and specialist CO_2 knowledge as well as a great work ethic," said Alddon Mackay, Patton Auckland Branch Manager. "She has fit in seamlessly and we are all very pleased to have the opportunity to welcome her to the Patton team."

Dinsdale-Jones is one of only seven New Zealand women with this type of qualification, and is part of a small group of women worldwide who have made an impact on the natural refrigeration industry. (See "Women in Natural Refrigerants," *Accelerate Magazine*, January 2020.)

Dinsdale-Jones believes that refrigeration has a promising future, with the potential for improvement. "We are already moving into more sustainable and eco-friendly options, and technology is waiting for no one. We will be licenced in the near future, which is a huge step in the right direction to getting the recognition the industry deserves. The possibilities of what our industry could do, moving forward, are endless and all I can really say is I am looking forward to being a part of some of those upcoming changes."

She appreciates the variety and opportunity her work offers. "There are so many opportunities to advance within this industry, whether it be on the tools or in an office-type role. You can never know everything about this trade, which makes it all the more exciting."

Since transitioning from a service engineer to a sales engineer, she spends time in the office part time, building customer relationships and doing quotes for clients. But "I also get the chance to go out on the road and visit clients to ensure we are keeping up with their needs," she said.

> *"We are already moving into more sustainable and eco-friendly options, and technology is waiting for no one."*
>
> Megan Dinsdale-Jones

Proving yourself

As one of a handful of women in this role, she has experienced some push back. "You often feel you have to prove yourself to every single person you work with," she said. "Sexism is still very much prevalent, which is disappointing, but on the flip side of that I have met some incredibly supportive people who I will forever be thankful to, and who I will always refer to as my friends."

In order to keep progressing, she has found it is important to be fairly thick-skinned. "It makes it all the more satisfying when you do succeed."

In her previous role as a service tech, the mother of twin four-year-old boys found the work/life balance a challenge. "Being part of an on-call roster and doing supermarket refrigeration takes a lot of your spare time (and energy)," she said. But in her current job, "I am able to go home, put my phone down, spend time with my family and actually wind down. The work life balance is pretty much perfect right now."

Megan began as an apprentice in her uncle's refrigeration business, where she worked with a wide range of refrigeration equipment, from ammonia to refrigerated trucks and large cool stores to domestic appliances.

Initially, she was unsure if this was the trajectory that she wanted her life to take, but it wasn't long before she began to enjoy the work, and make use of her natural mechanical aptitude.

"Even on the slower days, you're still learning more about the industry," she said. "It is a huge learning curve and there are lots of intelligent people in the business who specialize in certain areas. We are all always learning."

Dinsdale-Jones recently decided to take her learning to the next level by studying for a Bachelor of Business, extramurally, via Massey University. "I don't like to stay stagnant and always believe in upskilling," she said. MG

Asia Pacific

End User
Tokyo Department Store Puts CO_2 Water-Loop System in High Rise

Policy
Tokyo Aims for Zero F-Gas Emissions by 2050

Market
More Cold Storage Facilities Needed in Philippines to Curb Food Waste

Events

1. **April 28, 5:45 AM - 7:00 AM EDT**
   Webinar: The cold-chain imperative - Food saved is as important as food produced.
   Institute of Refrigeration
   https://bit.ly/2UWhQrw

2. **June 26**
   World Refrigeration Day
   https://worldrefrigerationday.org

Tokyo Department Store Puts CO_2 Water-Loop System in High Rise

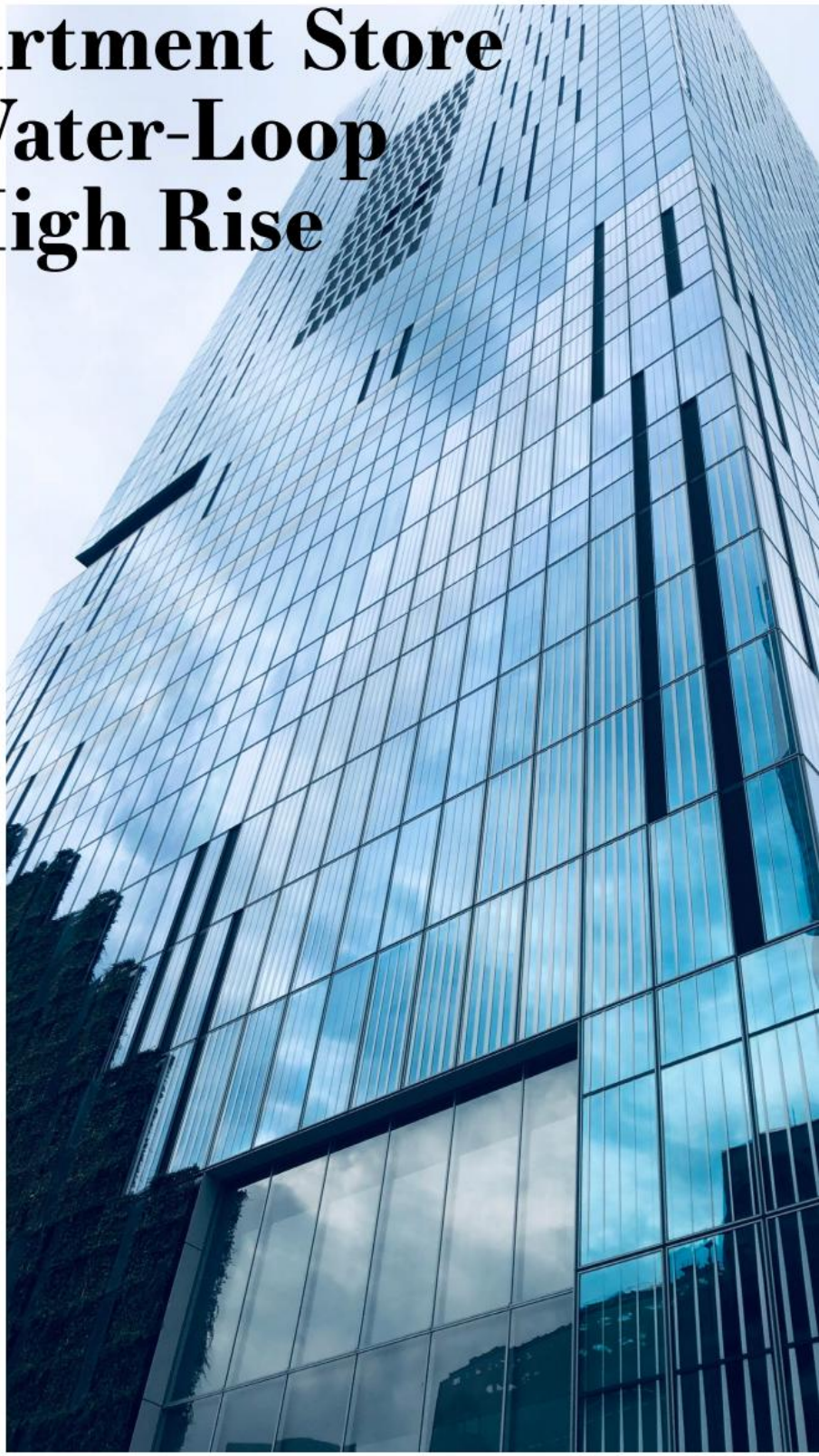
Tokyu finds alternative to CO_2 condensing units for basement food store where space is limited.

— By Devin Yoshimoto

In November 2019, Tokyu Department Store, a major Japanese chain, opened a new 47-story high-rise commercial complex called Shibuya Scramble Square, just a few blocks from Tokyo's well-known "Shibuya Scramble Crossing" intersection.

The company installed several CO_2 plug-in display cases combined with a water loop system in the complex's basement food-shopping area. The combination of CO_2 plug-in equipment with a water loop system in a retail department store setting is relatively new in Japan, where CO_2 outdoor condensing units in convenience stores are dominant.

The innovation represents a new opportunity for end users such as department store retailers to employ natural refrigerant systems, especially those located in densely populated Tokyo neighborhoods, where space is always limited.



Shibuya Scramble Square, a 230 meter (754 foot) tower overlooking the Shibuya Scramble Crossing, opened on November 1, 2019.

Water Loops Solve Space Restrictions

In the 2nd-floor basement of the Shibuya Scramble Square high-rise tower, two food suppliers, Head Line (a rotating showcase of various food makers) and Sanwein (a vendor specializing in Taiwanese delicacies), use seven pieces of specially designed CO_2 water-cooled plug-in showcases.

While Tokyu Department Store aimed to use natural refrigerant equipment, the space restrictions and the underground location of the food sales area meant that the conventional CO_2 air-cooled condensing unit type system was not seen as a viable option.

So Tokyu Department Store worked with Japanese OEM Panasonic and Japanese refrigeration installer Hama Refrigeration Industries to design and install CO_2 plug-in showcases that would be cooled by a water loop. The cooling tower is located outside on the 13th floor. Tokyu Department Store chose to forego using subsidies for this project due to a tight construction and delivery schedule.

Tokuo Sato, Director of Hama Refrigeration Industries, said that in addition to preventing waste heat from being released on the sales floor, water-cooled systems are a good option for commercial facilities with limited space, and help businesses transition away from synthetic refrigerants.

"Several major department stores have called for water-cooled CO_2 showcases," said Sato. "Looking ahead, it is better to transition away from fluorocarbons now rather than half-way through with low-GWP refrigerants such as mixed fluorocarbons." ■ DY

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1 / Shibuya Scramble Crossing. Photo by Timo Volz on Unsplash

2 / Head Line food vendor using CO_2 plug-in showcases

TOKYO AIMS FOR ZERO F-GAS EMISSIONS BY 2050

Chihiro Kaneko, Tokyo Metropolitan Government

The city's Zero Emission Tokyo Strategy includes a phase out of fluorocarbons, with subsidies for non-HFC commercial refrigeration.

— By Devin Yoshimoto

> *As the world faces a climate crisis, Tokyo will pursue efforts to limit the temperature increase to 1.5°C.*
>
> – Zero Emission Tokyo Strategy

While Tokyo grapples with the implications of its postponement of the summer Olympics due to the coronavirus pandemic, the city is continuing to push forward with environmental initiatives where natural refrigerants are playing a key role.

Last December, the Tokyo Metropolitan Government released its "Zero Emission Tokyo Strategy," which aims to achieve zero emissions in Tokyo by 2050. "As the world faces a climate crisis, Tokyo will pursue efforts to limit the temperature increase to 1.5°C," the strategy document states.

"By achieving a Zero Emission Tokyo by 2050, Tokyo will assume responsibility as a global megacity having a major impact on the use of energy and resources and contribute to the realization of net-zero CO_2 emissions in the world," adds the document.

The initiative calls for several measures including an expansion of renewable energy sources, a reduction of building emissions and plastic use, the promotion of electric vehicle adoption, and others.

Among the measures is also a "zero fluorocarbon emissions" goal, which calls for a 35% reduction in hydrofluorocarbon (HFC) emissions by 2030 (as compared to 2014) and the eventual elimination of all HFC emissions by 2050.

The actions listed under this zero fluorocarbons goal include the "support of the introduction of non-fluorocarbon equipment," combined with strengthened supervision around its use and disposal, especially for commercial refrigeration equipment.

The city provided ¥50 million (US$448,300) in subsidies in 2019 for the installation of non-HFC commercial refrigeration equipment to cover one-third of the installation costs for the end user.

At ATMOsphere Japan 2020, which took place in February in Tokyo, Chihiro Kaneko, Deputy Director, Stationary Hydrofluorocarbon Reduction Team, Bureau of Environment, Tokyo Metropolitan Government, said that these subsidies would continue with the same amount in 2020. ■ DY

More Cold Storage Facilities Needed in Philippines **to Curb Food Waste**

The country's Department of Agriculture has called for additional cooling to stem post-harvest losses of fruits and vegetables.

— By Devin Yoshimoto

Food waste is a global issue but it varies by whether a country is developed or developing. In the developed world, it's more associated with consumption, while in developing regions it tends to happen early in the supply chain, where food rots on farms or spoils during storage or distribution.

In addition to being a social issue, food waste has a pronounced impact on global warming. In fact, Project Drawdown, a major research study, named reduced food waste the No. 1 climate-mitigation solution in its latest analysis under a moderately ambitious scenario, and No. 3 in a more ambitious scenario (see page 33.)

In the Philippines, post-harvest losses for fruits and vegetables are a major issue for farmers. The Philippines Department of Science and Technology, in a joint project carried out with the Japan International Cooperation Agency in 2017, estimated that post-harvest loss in the country for fruits ranges from 5% to 48%, and 16% to 40% for vegetables.

Global Approach to Cutting Food Waste

A new study by the World Resources Institute – "Reducing Food Loss and Waste: Setting a Global Action Agenda – offers a comprehensive look at the issue (see https://go.aws/3bJQKt8). Here are the highlights of the study:

- Numerous studies find that the world experiences significant levels of food loss and waste, with losses "near the farm" predominant in lower-income regions and waste "near the plate" predominant in higher-income regions.

- Halving the rate of food loss and waste is an important "no regrets" strategy that would contribute to achieving the UN Sustainable Development Goals, meeting the goals of the Paris Agreement on climate change, and sustainably feeding the planet.

- This report, based on extensive desk-based research and input from partner organizations, proposes a Global Action Agenda to reduce food loss and waste. It involves three main components.

- Governments and companies should follow the "Target- Measure-Act" approach: adopt a target to halve food loss and waste by 2030, measure how much and where food is being lost and wasted, and take action on the hotspots.

- All actors in the food supply chain should kick-start their actions by pursuing a "to-do" list tailored to their specific roles.

- Governments and business leaders should pursue 10 "scaling interventions" that have the potential to rapidly scale, accelerate, and broaden deployment of the Target-Measure-Act approach and the actor-specific interventions.

Access to cooling plays a significant part in helping to reduce post-harvest food waste. To that end, the Philippines Department of Agriculture has called for establishing more cold storage facilities in the country, according to a recent article in the *Philippine Star* (https://bit.ly/3bFLQgG).

The Philippines has a relatively low rate of refrigeration capacity per capita compared to other Asian countries. According to the Global Cold Chain Alliance's 2018 report on Global Cold Storage Capacity, the Philippines has an estimated 0.037m³ (1.3ft³) of available cold storage capacity per urban resident, while Vietnam has 0.116m³ (4.1ft³), South Korea 0.281m³ (9.9ft³) and India 0.343m³ (12.1ft³).

Less produce handling

While the article attributed food losses mainly to "physical factors such as impact, vibration, compression, abrasion and mechanical damage," several studies emphasize that the appropriate addition of cold chain infrastructure contributes to reducing the number of times produce is handled, which, in turn, can reduce losses.

Philippines Agriculture Secretary William Dar is urging the Cold Chain Association of the Philippines to partner with the Department of Agriculture, local government units and farmers' groups to build more cold storage facilities that can maintain the freshness and quality of farm and fishery products, the article states. In the Philippines, 95% of cold storage facilties use ammonia-based refrigeration systems, according to some experts.

"With more cold storage facilities located near major farm production areas, trading centers, livestock slaughterhouses and poultry dressing facilities, fishing grounds and municipal fish ports, we will be able to reduce post-harvest losses by at most 35%," Dar said. "That could be added [to] the national food supply, thus bringing down prices for the benefit of millions of Filipinos."

In addition to more cold storage, improvements in processing and transportation are also "essential" to reducing post-harvest food waste, says Project Drawdown in its reduced food waste analysis. ■ DY

Cold Chain Innovation Hub Launches Website

This year, a "Cold Chain Innovation (CCI) Hub" was unveiled in the Philippines to help develop environmentally friendly, energy-efficient refrigeration throughout the country's cold chain.

CCI Hub is part of the "Global Partnership for improving the Food Cold Chain in the Philippines," a project launched last October by the United Nations Industrial Development Organization (UNIDO) with the Department of Environment and Natural Resources of the Philippines (DENR). (See "Reinventing the Food Cold Chain in the Philippines," *Accelerate Magazine*, November-December 2019.)

The CCI Hub is designed to be an "ecosystem of technical resources, research, knowledge sharing and stakeholder collaboration" supporting technology exhibitions and training, for which UNIDO is seeking industry contributions, said Franziska Menten, Project Coordinator, Department of the Environment, UNIDO, last year.

On March 30, CCI Hub's official website (CCI-Hub.org) was launched. The website serves as the project's main online resource and includes details on its background and goals, as well as news updates and a list of official partners and details on how to get involved. Future sections of the website will include an events page and a knowledge section, which will include official resources on technical data, case studies and best practices.

On March 10, the Food Cold Chain project announced that the Philippines' Technical Education and Skills Development Authority (TESDA) was selected as an official partner and national entity to host the CCI-Hub at its central office located in Metro Manila.

Over the coming months, the CCI Hub platform will release information about upcoming events, opportunities and developments through a newsletter. To sign up for the newsletter, go to https://bit.ly/2w8Cc7c.

Smart Buildings Can Help Europe Meet Energy Reduction Targets

In HVAC&R, the new technology can be used to collect and analyze equipment performance data from many installations,

— By Tine Stausholm

Many countries in the European Union (EU) are struggling to meet the bloc's ambitious energy-reduction targets, a problem that can be partly alleviated by adopting more extensive Building Automation and Control Systems (BACS), according to U.K.-based research and consultancy company BSRIA.

BSRIA, owned by the Building Services Research and Information Association, has found that several EU countries, including Belgium, Ireland and Austria, are set to miss their energy reduction targets by more than 20%.

However, with buildings accounting for up to 40% of all energy consumed, BACS is an area with lots of potential for improvement, according to BSRIA. The European BACS market is forecasted to see a 3.3% compound annual growth rate (CAGR) from 2019 to 2024, resulting in a €2.67 billion (US$2.9 billion) market in 2024.

In HVAC&R, the new technology can be used to collect and analyze equipment performance data from many installations, and use the gathered information to predict trends, and prevent future problems with preventative maintenance, thus saving money.

Uncertain times

Like many things at the moment, these figures are subject to some uncertainty. "The COVID-19 virus is almost certain to have a negative economic impact in the short term," said Henry Lawson, Senior Research Analyst at BSRIA, during a webinar on March 18. "Nonetheless, there are some underlying reasons why we believe that the medium- to long-term effects for building automation are more positive."

One of the reasons is the ambitious EU climate targets; the other is what Lawson calls the "well-being" agenda. Research has proven that good air quality and ventilation resulting from BACS can measurably improve people's work performance.

BACS supervisory software is becoming more sophisticated, and there is a trend towards "genuine" artificial intelligence (AI), he added.

Some of the companies driving this development are huge players like Amazon, Apple and Alphabet, Google's parent company. Over the last decade they have been digging deep and buying a number of AI companies to widen their offerings.

Cloud-based software is, however, slow to take off, according to BSRIA data, with a current market share in Europe from 5% to 15%. Most of the systems still run on locally based servers, as end users, especially in Germany, are cautious about how much data to share with the cloud.

The situation is changing though, and a genuine Internet of Things (IoT) is emerging, with 60%-70% of all new AC units sold in Europe capable of easy Internet connection. Controllers are also becoming more flexible, with 74% of units sold in 2019 being freely programmable, and only 4% having fixed function.

However, the move towards IoT does not come without challenges as increasing digitalization can create a new skills shortage, with more IT people but fewer engineers needed, Lawson said. ■ TS

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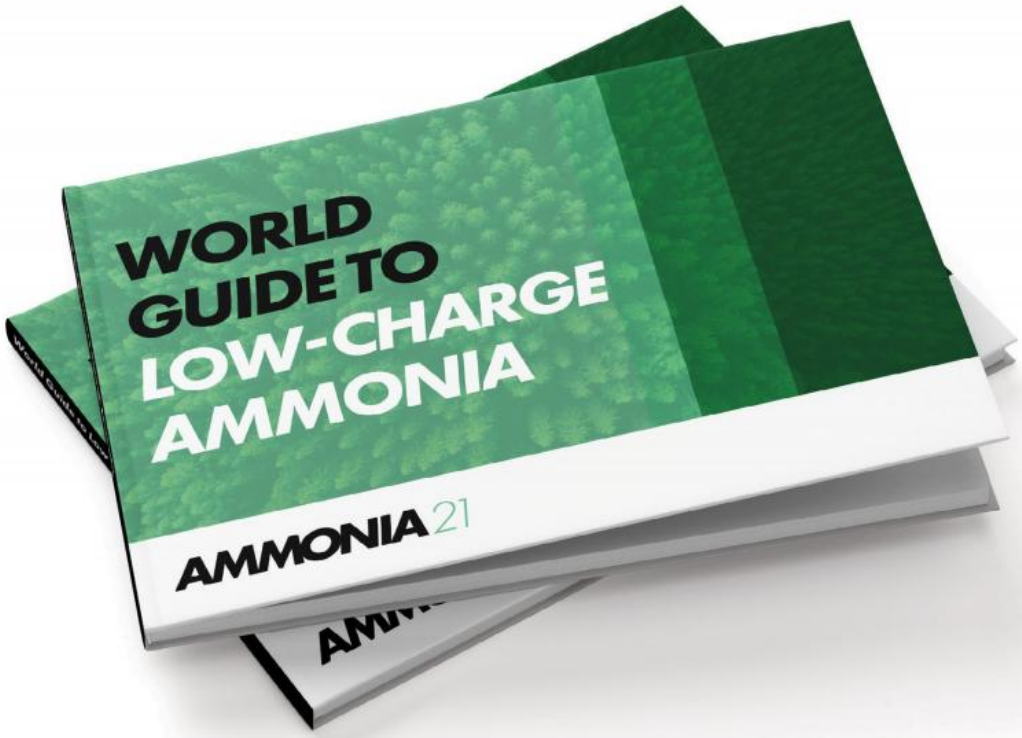

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The panel, from left: Marius La Grange (SAIRAC), Marcel Steinberg (Sphere Solutions), and Johnathan First (DBSA).

WORKSHOP IN SOUTH AFRICA STIRS INTEREST IN COOLING-AS-A-SERVICE MODEL

The first-ever CaaS workshop in Cape Town drew stakeholders from all over the country to discuss the pay-as-you-go option.

— By Ilana Koegelenberg

The first-ever Cooling-as-a-Service (CaaS) Initiative workshop in Cape Town, South Africa on March 9 attracted many local providers, end users and funders of HVAC&R technology interested in learning about this pay-as-you-go business model.

The workshop – which took place the day before the first-ever ATMOsphere Cape Town conference, organized by shecco, publisher of Accelerate Magazine (see page 48) – also served as a "matchmaking" opportunity, putting equipment providers in contact with end users to discuss leveraging the CaaS model.

The CaaS Initiative is led by Switzerland-based Basel Agency for Sustainable Energy (BASE) along with the Kigali Cooling Efficiency Program (K-CEP), and endorsed by the Global Innovation Lab for Climate Finance. CaaS is designed to provide a pay-as-you-go, servitization alternative to upfront payment models, thereby overcoming key market and financial barriers and accelerating the adoption of energy-efficient cooling technologies and the use of climate-friendly refrigerant gases.

The workshop was so well attended that extra chairs had to be brought in to accommodate all the parties interested in learning more about the CaaS model.

"We are highly satisfied with this first CaaS matchmaking event, which attracted more than 75 participants and resulted in insightful discussions," said Thomas Motmans, Sustainable Energy Finance Specialist at BASE. "South Africa has a strong cooling sector, and the inputs received during the workshop will enable us to better support companies in adopting the [CaaS] business model."

HOW IT WORKS

Motmans kicked off the event with a presentation on how CaaS works, speaking about servitization as a global trend. He discussed the benefits of such a model in HVAC&R, not only for funders and technology providers, but also for end users.

A panel of experts then discussed opportunities and challenges related to the implementation of the model. The panel comprised Marcel Steinberg, CEO of Sphere Solutions; Johnathan First, Lead Specialist Innovation Group, Development Bank of South Africa (DBSA); and Marius la Grange, President of the South African Institute of Refrigeration and Air Conditioning (SAIRAC).

Sphere Solutions is a local provider of transcritical CO_2 equipment that is already implementing CaaS in South Africa, and Steinberg shared some experiences on how this works. La Grange looked at the potential of the model for the industry while First considered the finance side, discussing the potential of the CaaS model for South African investors. He highlighted that there is global funding available for sustainable solutions, noting that funders will no longer support climate "un-friendly" technology.

POTENTIAL FOR THE SOUTH AFRICAN MARKET

The workshop part of the event engaged the audience in a discussion about the key opportunities and challenges related to CaaS, as well as whether they perceive South Africa to be ready for the model.

Attendees broke into smaller groups to discuss the questions posed by the BASE team, giving feedback that was then collated and summarized. Stakeholders openly shared concerns and suggestions to help better adopt the model specifically in the South African market.

The attendees stated that CaaS offers important opportunities for providers, end users and investors alike. They concluded that for providers, CaaS unlocks the deployment of technology for which the upfront cost could otherwise be prohibitive, locks in revenue streams from maintenance, and enables digital connections (the Internet of Things). For investors, CaaS offers the opportunity to deploy green funding. And for end users, the model enables the implementation of an expensive and well-performing system and simplifies compliance by meeting indoor air-quality-related requirements.

Some key challenges were also raised by the discussion groups. Building trust between providers and end users was pointed out as the backbone of the model. For end users to enter into such long-term commitments in South Africa, the reliability of contractors will be key. Sometimes end users might be reluctant to give away control of their cooling systems, especially when the value of potential food loss in case of cooling disruption is large. More generally, this requires a shift in mindset.

The need to reach consensus on a unit of refrigerant charge was raised by end users, as well as the need to make the service highly customer-centric.

"Overall the attendees were positive in trusting that South Africa is ready for cooling as a service," said Motmans. "Indeed, the country has a world-leading refrigeration sector, and high electricity prices make the CaaS model more attractive to cooling users."

This was the first global BASE CaaS matchmaking event scheduled this year. BASE offers a CaaS newsletter with updates on upcoming events. ■ IK

Attendees at the cooling-as-a-service workshop in Cape Town.

MAGNETOCALORIC REFRIGERATION FORGES AHEAD UNDER NEW LICENSING PROGRAM

French IP company launches program for Cooltech's patents, with Ubiblue as the first licensee.

— By Tine Stausholm

Among potential alternatives to vapor compression refrigeration systems, magnetocaloric systems – which use magnets to induce cooling in suitable materials – have emerged over the past several years as one of the major contenders in commercial and medical refrigeration.

One of the companies that had been leading the development of magnetocaloric technology was Cooltech Applications, based in Strasbourg, France. But the company ended its operationsin 2018.

In 2019, Nicolas Brochard (who was not part of Cooltech) founded Ubiblue, which took over some of Cooltech's assets – including prototypes, equipment, models and test data – and hired some former Cooltech employees.

Complicating this scenario, another company, French intellectual property (IP) specialist France Brevets, bought Cooltech's patent portfolio in April 2019. In January, France Brevets, partly owned by the French government, launched a licensing program for its magnetic refrigeration patents, and its first licensee is Ubiblue.

The new licensing program, called Kione, consists of 49 patent families, and is accessible to researchers, manufacturers, traders and distributors. The goal of the program is to bring magnetocaloric technology to a stage where it is market-ready.

"France Brevets now wishes to offer a second chance to this portfolio, creating an ecosystem of companies that will keep on developing [it] to finally industrialize it," said France Brevets on its website (https://bit.ly/343SMBL).

SEVERAL PROTOTYPES

Ubiblue does not yet have a product on the market, it but has developed several prototypes including a magnetocaloric fridge, that have been tested under "real" conditions, according to Rémi Dubois, Ubiblue's Head of Sales. While the technology is similar to Cooltech's, Ubiblue is working to improve efficiency, and to reduce both the size and price of the systems, he said.

The company is planning to market modules of 2kW (0.6TR), 20kW (5.7TR) and 100kW (28.4TR), and "our ambition" is to be ready for small-scale serial production in 2022-2023, said Dubois.

Magnetic refrigeration leverages a phenomenon called the magnetocaloric effect, in which a suitable material heats up when subjected to a magnetic field, and cools down when removed from it, chilling a secondary glycol fluid.

One of Cooltech's systems used a proprietary blend of solids, including a gadolinium alloy, as the material that is influenced by the magnetic field. Cooltech claimed its system achieved energy savings of 30% to 40% compared to R404A systems.

Magnetocaloric technology is also being pioneered by other organizations, including the Fraunhofer Institute for Physical Measurement Techniques in Freiburg, Germany. (See German Researchers Developing a New Type of Magnetocaloric Heat Pump," *Accelerate Magazine*, October 2019.)

Other entities that have worked on the commercialization of magnetocaloric cooling include Ames Laboratory at Iowa State, Ames, Iowa (U.S.), U.S.-based General Electric, Astronautics Corp. of America., two German companies (BASF and Vacuumschmelze) and the Chinese firm Haier. ■ TS

BOOSTING THE EFFICIENCY OF TC CO_2 SYSTEMS WITH ECONOMIZERS

Economizers and extra compression make transcritical suitable in almost all European climates, saving up to 8.5% in energy consumption, according to a new study.

— By Tine Stausholm

It is well known that CO_2 refrigeration systems typically operate in transcritical mode at high ambient temperatures, causing lower energy efficiencies in refrigerated facilities.

This has led scientists and HVAC&R manufacturers to research and develop several ways to improve the efficiency of such systems. A new study looks at the use of economizers to reduce refrigerant temperature after the gas cooler, finding that they save up to 8.5% in energy usage in warmer climates.

The study, "Improvements in CO_2 Booster Architectures with Different Economizer Arrangements," was published in the journal *Energies* in March 2020. It was carried out by researchers from the Department of Mechanical Engineering and Construction at Jaume I University in Valencia, Spain.

The economizers, also called economizer heat exchangers in the article, are subcoolers located at the exit of the gas cooler. They are intended to reduce the temperature of the refrigerant before it enters the expansion device, thereby increasing the cooling capacity.

The model system in the analysis was designed for a medium-sized European supermarket, having capacities of 41kW (11.7TR) for low-temperature and 140kW (39.8TR) for medium-temperature.

Three systems compared

The analysis compared a basic booster system to two improved booster systems. The basic booster system included compressors with a desuperheater on the low-temperature side, and compressors with a flash-gas valve and an internal heat exchanger on the medium-temperature side.

For the improved systems, the researchers used a basic booster with an economizer, and a basic booster with economizer plus an additional compression stage, which acts on the stream of refrigerant "expanded from the high-pressure level."

Comparing the three setups, the researchers found that the system with economizer and an additional compression stage had the best COP at all ambient temperatures above 2.6°C (36.7°F) with the advantage increasing with higher the ambient temperatures, reaching a maximum improvement of 22% at 40°C (104°F). "This [result] makes this configuration very interesting in almost all European climates," the authors noted.

The system with an economizer, but no additional compression stage, also had a better COP than a basic booster system at all temperatures from 2.6°C to 21°C (36.7°F to 69.8°F), with its best improvement of 5.5% seen at 5°C (41°F). Only at ambient temperatures below 2.6°C did the basic booster system have the best COP of the three systems.

Both improved systems reduce the energy consumption at all the ambient temperatures analyzed. The economizer system reduced the annual energy consumption by 1.95% to 4%, with the best results found in cooler climates like Belgium and the U.K.

The economizer plus an additional compression stage gave even better results, with energy reductions of 3.5% to 8.5%, and the best results achieved in warmer climates like Spain, France and Greece. ■ TS

Kamal Nandi, Godrej Appliances

In the Running

Kamal Nandi of Godrej, a finalist for the Global Cooling Prize, talks about the company's entry, a propane-based AC system.

— By Ilana Koegelenberg

The Global Cooling Prize was launched in November 2018 with the aim of spurring the development of a radically more efficient, climate-friendly residential cooling solution, with the potential for five-times less climate impact than a baseline unit.

Last November 15, the prize administrators – a global coalition led by the Government of India and Rocky Mountain Institute (RMI) – announced, the eight finalists in New Delhi, India. (See "Finalists in Global Prize Incorporate NatRefs," *Accelerate Magazine*, January 2020.) The finalists have been awarded US$200,000 each to develop and ship their prototypes to India for testing in the summer of 2020. The winner of the Global Cooling Prize will be announced in December of 2020 and awarded more than US$1 million.

One of the eight finalists is Godrej and Boyce Mfg. Co. Ltd., one of India's largest AC producers (with A.T.E. Enterprises Private Limited). In the following interview, Kamal Nandi, Business Head and Executive Vice President – Godrej Appliances, talks about the air conditioning technology Godrej has developed for the prize competition.

Accelerate Magazine: What can you tell us about your prize entry and why it is revolutionary?

Kamal Nandi: With green at its heart, Godrej Appliances has put forth the concept of leveraging evaporative cooling along with a natural low-GWP refrigerant (propane/R290) to deliver powerful cooling, but with 5 times less climate impact. The design employs a highly optimized vapor compression cooling system integrated with advanced evaporative cooling technology to reduce energy consumption. Small solar PV incorporated in the design will be instrumental in reducing power consumption from the grid, with intelligent integration accomplished through smart control systems. This revolutionary technology will go a long way in making air conditioners affordable to the masses without putting high stress on the environment.

Accelerate Magazine: Why is it important for Godrej to look into sustainable solutions such as this?

Kamal Nandi: A key driver for electricity demand globally is the ever-increasing use of air conditioners in homes and offices. India is not untouched by this phenomenon. According to the Indo-German Energy Forum 2018 report, by 2027 India's cooling energy demand is expected to increase by 2.2 times. With growing disposable income, a rising middle class and urbanization, the number of room air conditioners in use in India is projected to be a whopping 1 billion by 2050. The growing use of air conditioners is amplifying the "urban heat island" effect, making cities warmer. It is also known that air conditioners are power guzzlers and an increase in demand for air conditioners will, in turn, put upward pressure on energy generation, leading to higher emissions.

The emissions report by UNEP (the United Nations Environment Program) confirms that global GHG emissions for the year 2018 stood at 55.3gt of CO_2e. And if the emissions continue at this rate, the average temperature in India will shoot up from about 24°C (75°F) to about 28°C (82°F) by 2100, as said in research by the Climate Impact Lab. This will further stress the urgency for a more efficient cooling efficiency for all, without warming the planet.

"The environment" has been a cherished brand value at Godrej always. Continuous innovation on the green technology front, therefore, has been a business imperative for us. Despite being on this journey, we recognize that a lot more is needed if we are to make a significant dent and curb the climate threat faced around the world. To meet this end, we have been constantly increasing our spend in R&D, and, with new product offerings every year, we still hold the baton of bringing to our consumers India's most energy-efficient products.

Accelerate Magazine: How do you feel about being a finalist for the Cooling Prize?

Kamal Nandi: We are delighted that Godrej Appliances is one of the eight finalists across the globe and among 139 applicants for the Global Cooling Prize. "Environmental friendliness" for us is a value that has been ingrained in our corporate DNA since our inception. Godrej Appliances are not the greenest only in terms of usage of an environmentally friendly refrigerant, but also because of the high levels of energy efficiency in our products. Being selected as a finalist is a matter of pride for us, as it helps us place Indian technology prowess on the world map.

Accelerate Magazine: What is the potential of this technology?

Kamal Nandi: Developed by our in-house R&D team, this innovative evaporative cooling based, energy-efficient and sustainable technology employing low- GWP refrigerant – our latest design concept – explores the possibility of an 80% decrease in energy consumption for air conditioners. Potentially, this breakthrough technology can make comfort cooling available to the masses since it would be affordable in terms of operating costs.

Accelerate Magazine: What is the long-term vision of the company with regards to climate-friendly HVAC solutions?

Kamal Nandi: We have been treading the green path for our cooling products for a long time, much before it became fashionable to talk sustainability. And we continue to ensure all our manufactured refrigerators are 100% green. Living up to our commitment to green, we have worked towards building energy-efficient benchmarks in our appliances.

The latest series of Godrej air conditioners use only R290 or R32 refrigerant. Both refrigerants have zero ozone depletion potential (ODP), causing no harm to the Earth's ozone layer, thereby protecting the Earth and its atmosphere from harmful ultraviolet radiations from the sun.

The brand's vision is to be at the forefront of developing and deploying environmentally friendly technologies relevant to consumers while preserving the planet – one appliance at a time. ■ IK

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