Refindustry
REFRIGERATION INDUSTRY MAGAZINE
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CO_2 & Heat Recovery Special Edition

Introducing the magazine “Refrigeration Industry”

Welcome to the 10th issue of our magazine!

This CO_2 Refrigeration & Heat Recovery Special Edition looks at what happens after the refrigerant decision is made. Across food retail, CO_2 transcritical systems are moving toward default inclusion in new builds, and the conversation has shifted from refrigerant choice to how well these systems perform once installed — and how much of their potential as an energy hub, heating buildings and producing hot water alongside cooling, holds up in real operation.

This issue also brings three conversations from across the industry. At MCE 2026 in Milan, we spoke with Jens von Ebbe of Johnson Controls on how Europe's HVAC market has shifted over three years, from the acceleration of natural refrigerants to the explosive growth of data centre cooling. Also at MCE, François Audo, CEO of Enex Technologies, explains why his company never pushes a single refrigerant and how eight acquisitions came together under one mission. And Trevor Matthews, founder of Refrigeration Mentor, talks about closing the refrigeration skills gap — the problem the industry has never managed to solve, and the one a successful transition depends on.

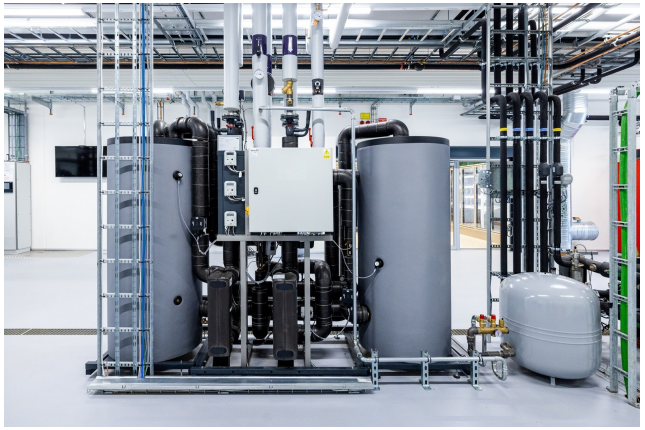
If you'd like to learn more, share feedback, or contribute your insights, please don’t hesitate to reach out to us by email, or contact me directly on LinkedIn.

Warm regards, Editor-in-chief

Sergei Mukminov.

The concept of the new magazine:

1. In today’s fast-paced world, staying updated with the latest developments in the refrigeration industry can be challenging. Our mission is to simplify this by providing the most critical news and insights in a single quarterly issue.
2. The magazine is published exclusively in digital format, with pages designed in a landscape orientation for optimal readability on screens.
3. Our magazine is interactive, allowing you to follow internal content links, as well as external links to detailed articles on our website and advertisements.
4. All news featured in the magazine can also be easily found on our website by title.



CO_2 Refrigeration & Heat Recovery Special Edition

How Europe's HVAC Market Is Shifting: A Conversation with Johnson Controls' Jens von Ebbe

The case studies: SWEP, Eliwell, Eurovent Certification, Enex Technologies, Refra

Trevor Matthews: Closing the Refrigeration Skills Gap, One Contractor at a Time

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We recommend reading in a PDF viewer's full-screen mode.
Links may not work in a browser.

New Products

Copeland introduces CO_2 scroll compressor with dynamic vapor injection

Copeland has launched a transcritical CO_2 scroll compressor with dynamic vapor injection (DVI) technology in North America.

The new solution is designed for distributed CO_2 refrigeration systems and supports both new installations and remodels in food retail.

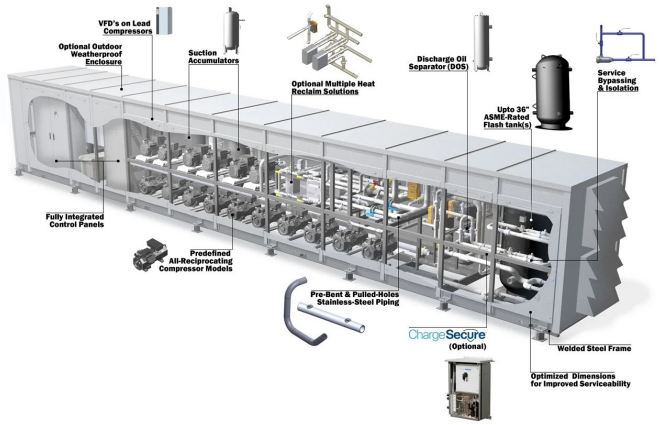
DVI injects high-pressure vapor within the compression cycle, reducing the need for parallel compression and helping simplify system design.

Arneg launches PRISMA CO_2 refrigeration units for small stores

Arneg has introduced PRISMA, a range of transcritical CO_2 refrigeration units for mini-markets and small retail stores. The outdoor-installable units are available in both normal- and low-temperature versions and combine a compact footprint with an integrated system architecture that includes the gas cooler inside the unit structure.

The range targets retailers seeking natural refrigerant solutions without the space requirements of traditional machine rooms.

Hillphoenix introduces AdvansorUltra CO_2 booster system for industrial use



Hillphoenix has launched AdvansorUltra, an industrial CO_2 booster refrigeration system designed for high efficiency, serviceability, and environmental performance in industrial applications.

The system features stainless steel piping, an optional 90-bar standstill rating, and a welded steel frame for improved robustness and corrosion resistance.

It is positioned for food processing, distribution, and cold storage facilities seeking a scalable CO_2 platform.

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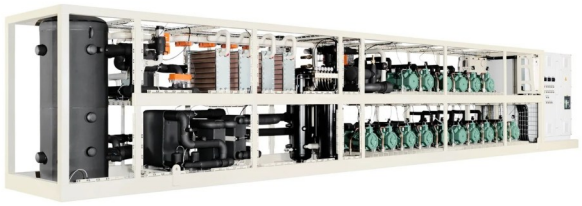
Danfoss launches new ETS 5T valve and upgrades ETS 5M for CO_2 systems

Danfoss has introduced the ETS 5T electric expansion valve alongside an upgraded ETS 5M, both designed for CO_2-based refrigeration systems.

The ETS 5T is based on the compact ETS 5M platform and suits CO_2 applications ranging from 4 to 19 kW. The additions give HVAC&R engineers greater component flexibility when working with natural refrigerants across commercial and industrial installations.

Advansor launches SteelXL CO_2 heat pumps for up to 50 MW heating

Advansor has launched SteelXL Heat



Pumps, a range of large-scale CO_2 heat pumps delivering up to 5 MW of heating and 3 MW of cooling per unit.

Multiple units can be installed in parallel to reach up to 50 MW of heating capacity, with water outlet temperatures of up to 95°C.

The range positions CO_2 as a viable refrigerant for district energy, industrial process, and large commercial heat pump projects.

Castel introduces 3032 changeover valves with ORS connection

Castel Srl has expanded its portfolio with the 3032 changeover valves for safety valves, now available with ORS connections suited for CO_2 (R744) and R290 systems.

The solution is designed to ensure safe maintenance and uninterrupted operation, meeting ISO 24664 requirements for correct safety valve sizing and piping in natural refrigerant installations.

The ORS connection option reduces installation time and supports leak-tight assembly in high-pressure CO_2 systems.

Hillphoenix launches Next Generation Flex Mini CO_2 system in the US

Hillphoenix has launched the Next Generation Flex Mini, a CO_2 transcritical refrigeration system designed for food retail and industrial applications in the United States.

The platform features a compact design aimed at maximizing operational uptime and reducing total cost of ownership across a range of store sizes.

It is positioned as a versatile CO_2 system for operators transitioning from HFC-based refrigeration.

Sanhua Introduces SD2 VSD Extension for Commercial and Industrial HVAC&R Systems

Sanhua has unveiled the SD2 Variable Speed Drive (VSD) Extension, expanding its drive portfolio to support systems up to 60 kW for heating and 45 kW for cooling in commercial and industrial HVAC&R applications.

The SD2 Extension is compatible with CO_2 and other natural refrigerant systems, bringing variable speed control to larger-scale installations beyond the existing SD2 range.

The product targets system integrators and OEMs seeking scalable drive solutions for natural refrigerant platforms.

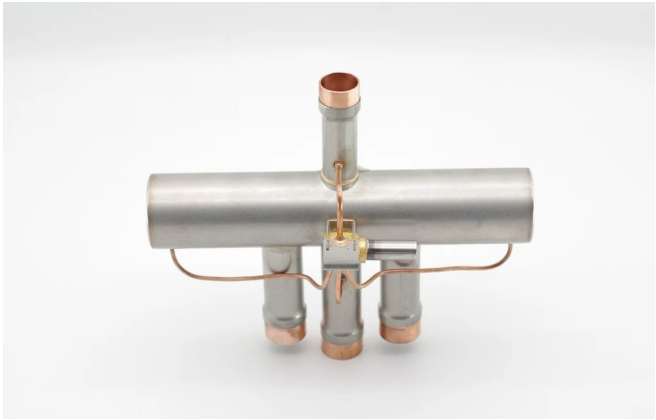
SWEP launches stainless steel heat exchanger for CO_2 and deionized water applications

SWEP has introduced the All-Stainless B4TS brazed plate heat exchanger, designed to operate with R744 (CO_2) in high-pressure cooling systems for the electronics and semiconductor industries.

The compact, frameless unit addresses demand for sustainable refrigeration solutions in applications using deionized water, where standard copper-brazed exchangers are not suitable.

The B4TS targets data center and industrial process cooling segments requiring both CO_2 compatibility and resistance to corrosive media.

Sanhua introduces SHF-G series stainless steel reversing valves for HVAC systems



Sanhua has launched the SHF-G series, a new line of four-way reversing valves for heat pump systems supporting cooling capacities from 4.2 to 77.3 kW.

The series is compatible with a wide range of refrigerants including R32, R290, R1270, R600a, and R744 (CO_2), and is engineered for both fixed and variable speed systems.

Stainless steel body construction targets demanding HVAC and refrigeration applications where durability and refrigerant compatibility are key.

Market News

Daikin faces HVAC pricing lawsuits in the United States

Daikin Industries and several U.S. subsidiaries have been named as defendants in four separate lawsuits filed in the Eastern District of Michigan between April 20 and April 30, 2026, all alleging conspiracy to artificially increase prices for HVAC equipment.

The complaints were filed as provisional class actions by plaintiffs in Florida, North Dakota, and New York, seeking damages and other relief.

Daikin said it is currently unable to estimate the potential financial impact and will take appropriate action after analyzing the claims.

Mitsubishi Electric launches air conditioner production in India

Mitsubishi Electric has started full-scale operations at its first residential air conditioner manufacturing plant in India, located in Tamil Nadu, built with an investment of 21 billion rupees (approx. USD 232 million).

The facility positions the company for growth in one of the world's fastest-growing cooling markets. Production targets rising domestic demand for energy-efficient air conditioning systems.

Panasonic establishes HVAC & CC company

Panasonic HVAC & CC Co., Ltd. was established on April 1, 2026, consolidating the group's heating, cooling, and commercial cooling divisions under a new corporate structure.

The company will operate Panasonic's HVAC and commercial cooling businesses including air conditioning and refrigeration systems for commercial and residential markets. Eiichi Katayama was appointed Representative Director and President.

DOJ Settlement Requires Kroger to Cut Refrigerant Leaks in U.S.

The U.S. Department of Justice announced a proposed settlement with The Kroger Company requiring the retailer to spend an estimated $100 million over three years to reduce refrigerant leaks from equipment across its grocery stores nationwide.

The action resolves alleged Clean Air Act violations related to refrigerant management and leak compliance. Under the consent decree, Kroger will implement enhanced leak detection, monitoring, and reporting systems.

Danfoss begins brazed plate heat exchanger production in Mexico

Danfoss has launched production of brazed plate heat exchangers at an expanded facility in Monterrey, Mexico, tar-

COMPACTNESS IS KEY.

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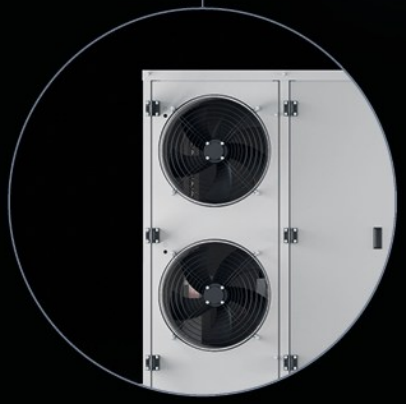
PRISMA is a compact, high-performance transcritical CO_2 refrigeration system: it features an integrated gas cooler, simplified installation and maximum design flexibility in complex environments.



Available in various configurations with 1, 2, or 4 fans, it always follows the same principle: optimizing space without compromising on power and efficiency.

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geting shorter delivery times and stronger supply chains for North American HVAC and refrigeration customers.

The move supports growing demand for sustainable cooling components including heat pumps and industrial refrigeration. The company plans to install two brazing ovens at the Monterrey plant by end of 2026, with additional production capacity to follow.

Carrier Opens €12m Montluel HVAC and Data Centre Test Lab

Carrier announced a 12 million euro testing facility at its European Centre of Excellence in Montluel, France, expanding R&D capacity for cooling and heating technologies used in data centers, industrial, and large commercial buildings.

The new laboratory is designed to test air-cooled chillers up to 1,500 kW and equipment using alternative refrigerants, supporting performance validation aligned with Europe's efficiency and electrification requirements.

The facility is part of Carrier's investment in sustainable cooling technology development across Europe.

Australia extends incentives for clean energy and HVAC apprenticeships to 2026

The Australian government extended financial support for employers and apprentices in priority and clean energy occupations, including refrigeration and air conditioning, through the Key Apprenticeship Program.

Updated measures continue incentive payments through December 2026, aiming to strengthen the HVAC&R workforce in response to growing demand from natural refrigerant transitions.

The program includes New Energy Apprenticeships and financial payments to boost participation in key trades.

Trane Technologies to acquire US-based LiquidStack to expand data center cooling solutions

Trane Technologies signed a definitive agreement to acquire LiquidStack, a US provider of advanced liquid cooling technologies for data centers, including direct-to-chip and immersion cooling systems.

The acquisition expands Trane's position in data center thermal management, addressing demand from high-density and AI-driven computing environments.

LiquidStack is headquartered in Carrollton, Texas, and serves hyperscale and enterprise data center operators globally.

EU Safety Rules Trump F-Gas Certification for Natural Refrigerant Work

The European Commission confirmed that EU occupational health and safety directives apply in full to technicians working with natural refrigerants and are not replaced by F-gas certification under the updated EU fluorinated gas regulation.

The ruling followed a petition filed by Italian consultancy CSIM SRL, with the European Parliament's PETI Committee publishing the Commission's response in March 2026.

The clarification has practical implications for contractors and training providers working with NH3, CO2, and hydrocarbon refrigerants across the EU.

Trane Technologies partners with Garrett Motion on oil-free centrifugal compressors

Trane Technologies and Garrett Motion announced a strategic collaboration to develop high-efficiency, oil-free centrifugal compressor technology for commercial HVAC systems.

The agreement focuses on next-generation compressor solutions designed to improve

energy efficiency and support the use of ultra-low GWP refrigerants, drawing on Garrett's turbocharger expertise adapted for HVAC applications.

The partnership targets large commercial cooling systems where oil-free operation and efficiency are key requirements.

Daikin Europe reports record EMEA turnover

Daikin Europe N.V. reported annual turnover of 5.25 billion euro (approx. USD 5.68 billion) for fiscal year 2025, a record result for the EMEA region.

Growth was supported by demand across heat pumps, air conditioning, and commercial refrigeration, with natural refrigerant systems contributing to performance in Europe.

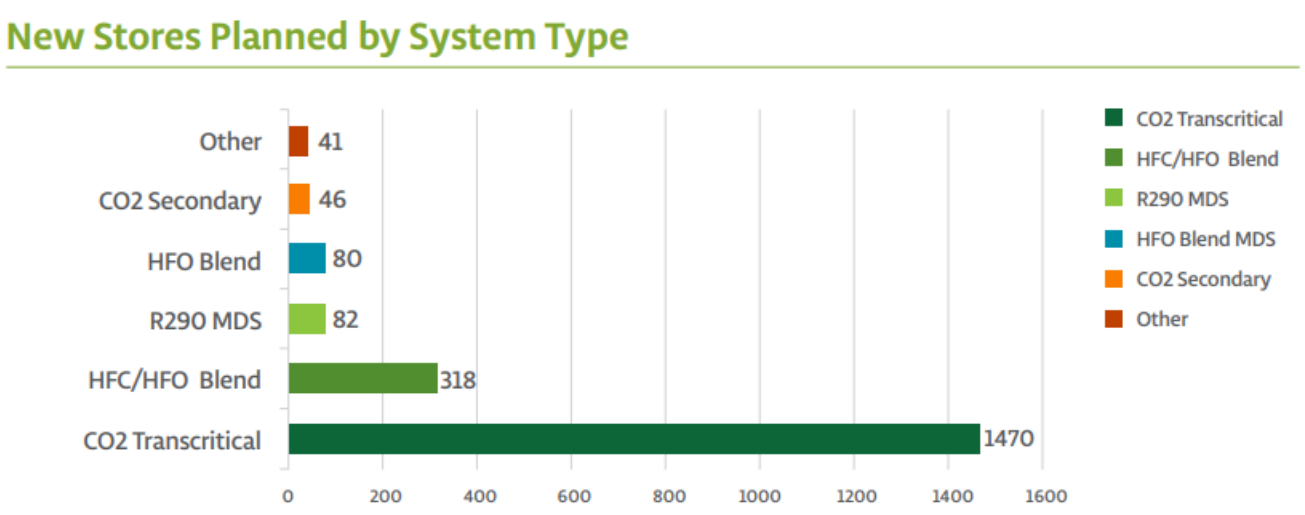
The result reflects continued market expansion in the region despite broader macroeconomic headwinds.

New York Court Halts Refrigerant Ban Enforcement

The Appellate Division of the New York State Supreme Court granted an injunction preventing the New York State Department of Environmental Conservation from enforcing a ban on two refrigerants used in commercial refrigeration systems across the state.

The injunction will remain in place while the court considers whether the broader regulation should be overturned, following concern over the operational and financial impact of the ban.

The case reflects ongoing legal tensions around refrigerant phase-out timelines in the United States.



Market Research

NASRC projects CO_2 growth in U.S. food retail refrigeration

The North American Sustainable Refrigeration Council said its late-2025 survey of 18 food retailers, representing more than 29,000 U.S. grocery, supermarket, convenience and pharmacy locations, points to a continued shift away from HFCs toward lower-GWP refrigerants through 2029. In NASRC's projection, HFC/HCFC direct-expansion stores fall to about 48% of the fleet from roughly 80% in the base, while HFO blend stores reach around 21% and CO_2 transcritical stores 19%.

The report says existing fleets are still dominated by legacy systems, with 78% of current stores using HCFC/HFC systems, 10% using HFO blends, 5% using CO_2 transcritical systems and 3% using glycol systems. Retailers also reported portfolio refrigerant use that included HFCs at 100% of respondents, HFO blends above 300 GWP at 94%, CO2 at 89% and HCFCs such as R22 at 67%.

Participants collectively reported plans for more than 2,000 new stores between 2025 and 2029, with CO_2 transcritical identified as the dominant architecture for those sites. Retailers also said they plan to replace about 13,400 systems by 2029, with the largest replacement category shifting to pumped medium-temperature glycol and CO_2 secondary systems, while CO_2 remote condensing units were described mainly as add-ons to existing stores and are projected to exceed 8,200 cumulative new installations by 2029.

Regionally, NASRC projects the Southeast to account for 6,315 CO_2 transcritical systems by 2029, or 47% of the total shown in the report's regional breakdown. Respondents ranked regulatory requirements, refrigerant cost and availability, and future regulation risk as the main drivers for considering CO_2 systems, while the lack of trained technicians was identified as the leading barrier to transition.

Market review

2025 in Refrigeration — What Changed, What Mattered, What's Next

Refindustry has released its 2025 year-in-review, compiled from the most-read and most impactful updates published on https://refindustry.com/. The review captures how the industry moved from "refrigerant choice" discussions to real-world transition execution—where compliance pathways, safety engineering, component readiness, service capacity, and digital monitoring determine outcomes on projects and in day-to-day operations.

What shaped 2025 in practice:

- Regulation and standards became less linear, with reviews, petitions, and evolving timelines pushing companies to plan for multiple scenarios.
- Safety readiness moved to the core of system design and service, driven by wider deployment of A2L refrigerants and hydrocarbons and rising attention to leak detection and verification.
- Environmental scrutiny widened beyond GWP, with more focus on lifecycle impacts and chemical-policy pressure that can influence long-term refrigerant strategies.
- Digital operations accelerated, with continuous monitoring and analytics increasingly seen as practical tools for leak reduction, reporting, and performance stability.
- Component and platform innovation remained central, as compressors, validated testing, and equipment design translated transition goals into real installations.
- Cold chain investment continued to grow, with decarbonisation framed more often as project-level engineering and measurable performance.

Get the full report

Interviews

How Europe's HVAC Market Is Shifting: A Conversation with Johnson Controls' Jens von Ebbe

At MCE 2026 in Milan, **Sergei Mukminov**, Editor-in-Chief of Refindustry.com, spoke with **Jens von Ebbe**, General Manager HVAC Equipment EMEA at Johnson Controls. The conversation covers three years of market shifts under his leadership — from the accelerating move to natural refrigerants and the explosive growth of data centre cooling, to the 41-city Innovation Studio tour across Europe. Von Ebbe also discusses the new YVAM magnetic bearing chiller, readiness gaps in the F-gas transition, and what the outside world underestimates about HVAC's role in decarbonisation.

You have been leading HVAC Equipment for EMEA since 2022. How has the market changed in these three years, and what has surprised you most?

The market has significantly developed just over the last three years. Some of the changes that surprised us most are the speed of evolution in key segments — particularly critical infrastructure: data centres, information technology facilities, but also the pharmaceutical space.

The move towards natural refrigerants and ultra-low GWP refrigerants is accelerating exponentially — and that has been a surprise compared to other regions globally. At the same time, the explosion in energy costs has sharpened customer focus on efficiency. In sectors like data centres, where a large portion of total energy consumption goes toward cooling the chips and technologies inside, thermal management has become a primary engineering concern — not a secondary one.

The key requirements we are hearing consistently: increased demand for energy efficiency, decarbonisation, and support in meeting our customers' ESG commitments across the region.

Yesterday I had a personal tour of the Innovation Studio, and today Refindustry published a story about the launch of the 41-city tour across Europe. What is the idea behind it, and what do you want customers to take away from that experience?

This tour is about bringing our innovation to where customers are — rather than expecting them to come to us. Over the last three years, Johnson Controls has invested significantly in technologies that help customers improve energy efficiency, meet decarbonisation goals, and manage the full thermal chain. The Innovation Studio is how we make those investments tangible.

The focus is on mission critical environments: hospitals, pharmaceutical and biochemical plants, and data centres — what many customers are now calling AI factories. These are segments where HVAC and controls technology can have a direct, measurable impact on operational performance and energy spend.

Johnson Controls covers a broad portfolio — chillers, controls, building management systems. Where is the real growth in EMEA right now, and where are you putting the most focus?

We are focusing on three areas.

The first area is advancing energy efficiency to achieve decarbonization. Representing around 40% of global CO2 emissions, buildings represent one of the largest and most complex decarbonization opportunities.

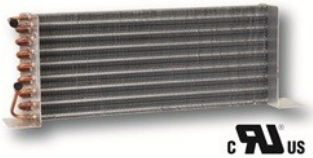
The second is data centres and information technology. This segment has been growing rapidly in other parts of the world and is now accelerating in Europe, the Middle East, and Africa. Thermal management — the full chain from cooling the chips to heat recovery — is the central technology challenge here.

The third is mission critical environments: healthcare, life sciences, pharmaceuticals, for example. This is where HVAC and controls work together to manage the environment where people work — and where equipment failure may have consequences.

Read the full interview

Optimized Design For CO2 Applications at Your Fingertips

Static
Evaporator Coil



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François Audo, CEO of Enex Technologies: “We Never Push One Refrigerant — We Have Them All”

At MCE 2026 in Milan, Sergei Mukminov, Editor-in-Chief of Refindustry.com, spoke with François Audo, CEO of Enex Technologies.

Over four years, Enex has assembled one of the broadest natural refrigerant portfolios in the HVACR industry — CO2, ammonia, propane, and water — through eight acquisitions spanning Spain, Italy, France and beyond. The interview covers how the group selects the right natural refrigerant for each customer, what holds a 400-year combined technology base together under one mission, and why Enex Technologies is targeting two to three times its current revenue within five years.

Enex Technologies brought together companies with very different histories — Samifi, Roen Est, Emicon, Kobol, Morgana, and others. What did consolidation actually change for customers?

What is fundamental about Enex Technologies is that we are the only company in the world offering solutions across all natural refrigerants. Customers come to us with a challenge — refrigeration, heating, whatever it may be — and we put every option on the table. Not just one option because that is what we manufacture, but any of them.

That is what makes us different. I am not trying to force you into CO2 or ammonia or propane. I have them all. So I sit down with you and genuinely think through the best solution together. That is really the core of our company.

You cover CO2, ammonia, propane, and water. How does the customer selection process work in practice — is it centralised, or does each brand team make its own recommendation?

We have people dedicated to installer customers, and they each have a specialty. Behind them is a back-office team that supports the sales force and can indicate one solution over another.

Very often, when you approach a customer, they already have a preference. They might say they want CO2. And then I will say: yes, but given the specific environment and application, propane might actually be the better fit. That opens a dialogue. It is about finding the best solution for them — and ultimately for the end user.

Eight brands, four years. What was the biggest challenge in keeping the expertise and key people together under one roof?

Our mission — across all these brands — is to move the HVAC and refrigeration industries toward natural refrigerants. That is important on two levels. First, the regulatory pressure on synthetic gases is real and accelerating. But we do not talk enough in Europe about PFAS. That is actually even more serious, because PFAS causes disease. Our mission was to find solutions that address both global warming potential and PFAS — that is what drives us.

So what we did was go across Europe and find the right companies for each technology. We found companies in Spain with very strong ammonia expertise. We found companies with deep CO2 and propane capabilities, and we brought them together. Enex Technologies today represents 400 years of combined technological experience. Emicon, for example — the company behind the propane units on display at our booth — has been working with propane for 18 years. That kind of experience is very hard to find.

What holds all of it together is one mission: solving the GWP and PFAS problem in HVAC and refrigeration. That is our leitmotif.

Read the full interview

Sustainability

CO_2 Refrigeration & Heat Recovery Special Edition

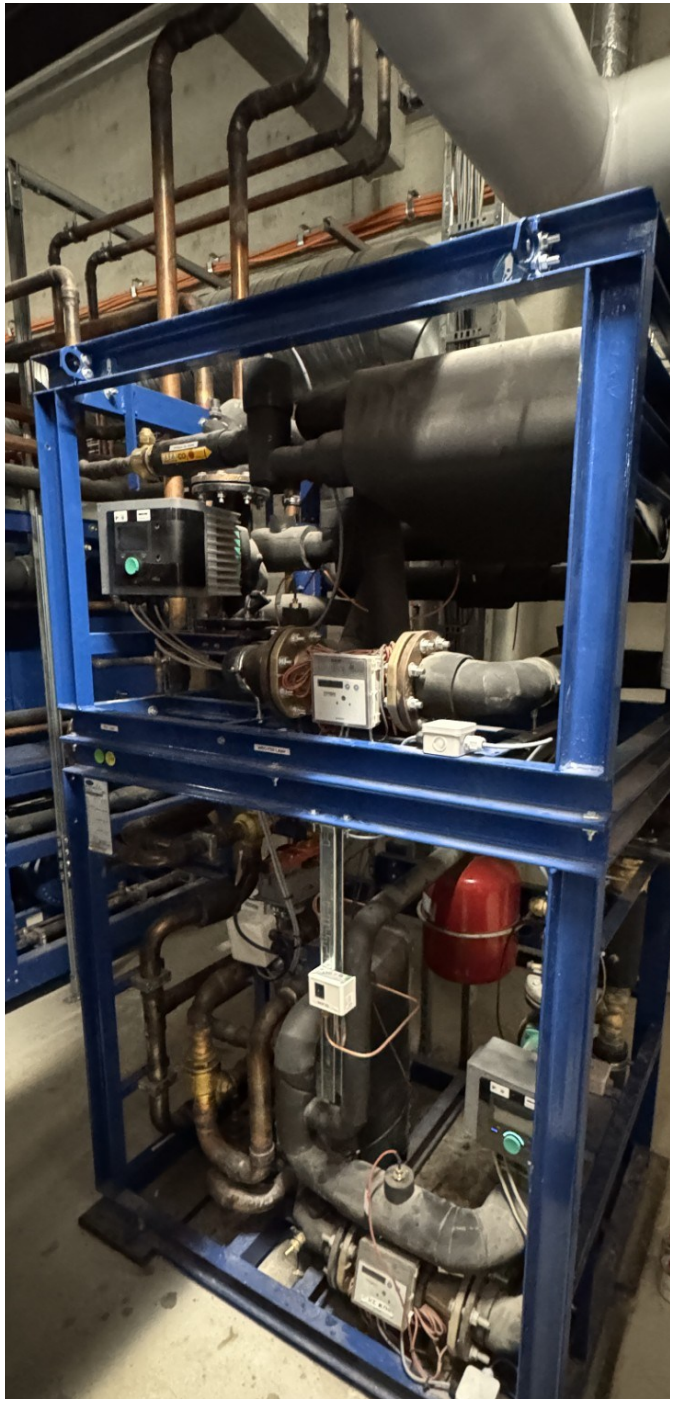
A Danish convenience store covered its entire heating demand from refrigeration waste heat through the coldest winter in over a decade — and exported the surplus to a district network. That result, documented over two years of monitoring, frames the question this special edition examines: as CO_2 transcritical systems move into mainstream commercial refrigeration, how much of the integrated energy-hub model holds up outside showcase installations, and what does it cost?

The transition away from high-GWP refrigerants is no longer a question of refrigerant choice. With CO_2 systems approaching default inclusion in new food retail builds across Europe, the focus has shifted to execution: return water temperatures, controls commissioning, the gap between refrigeration and HVAC trades, and the workforce capacity to keep these systems performing as designed.

This edition pairs that market analysis with case studies that put real numbers behind it — from a Romanian supermarket using liquid-ejector technology to recover 127 kW of heat, to a Migros store in Bellinzona that eliminated its boiler and cut energy consumption by 20 percent, to a transcritical CO_2 system holding temperature in 48°C Sydney heat. A separate Eurovent Certification study examines what happens when manufacturer data and measured gas cooler performance diverge under real climate conditions.

Included in this special edition:

- A market analysis on how CO_2 systems are becoming the energy hub of modern food retail, with input from manufacturers, operators, an independent consultant, and a training specialist across Europe and North America
- Real-world case studies from Eurovent Certification, Enex Technologies, SWEP, Refra and Eliwell, covering heat recovery, performance verification, and integrated control
- An interview with Trevor Matthews of Refrigeration Mentor on the training and commissioning skills the industry needs as CO_2 heat recovery becomes routine practice



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Beyond Refrigeration: How CO_2 Systems Are Becoming the Energy Hub of Modern Food Retail

A Danish convenience store covered 100 percent of its heating demand from refrigeration waste heat through the coldest winter in more than a decade. Over two years of operation, the same site exported 36 MWh of surplus heat to its city's district network and saved close to €8,800 on heat it would otherwise have purchased from the same grid. The electricity penalty for delivering that heat was, in the operator's words, marginal.

The site is the Danfoss Smart Store ADC in Nordborg, instrumented and monitored since May 2023.

The question this raises is no longer whether CO_2 refrigeration can heat a building; it can. The real questions are how transferable the model is, what it costs, and where it fails. When a transcritical CO_2 system simultaneously cools, heats a building, produces hot water, and exports surplus heat to a district network, how much of that holds up outside a showcase installation, and does it change the investment case? This market analysis puts those questions to operators, manufacturers, an independent consultant, and an independent training specialist across Europe and North America. Their answers are not identical. Together they describe a technology that is approaching default-inclusion in new builds in Europe while still moving from pilot projects to strategic adoption in North America.

Why CO_2 delivers different heat

CO_2's appeal as a heat source is not theoretical. In a transcritical cycle, the gas cooler rejects heat over a temperature glide rather than at a single condensing point, which means the working fluid leaves the cooler hotter than an HFC condenser would. What that translates to in real installations is documented across four manufacturers in this market analysis.

Jeffrey Gingras, Chief Growth Officer at Evapco Systems LMP in Laval, Quebec, gives the most explicit gradient: "in commercial operation, CO_2 systems can reliably deliver water temperatures in the range of 35 –45°C under most conditions, 50–60°C with proper design and controls, and up to 60–70°C when heat reclaim is prioritized." For comparison, Gingras notes, HFC systems are "largely limited to low-grade heat reco-

Jeffrey Gingras, Chief Growth Officer at Evapco Systems LMP

Umberto Di Barbora, Global Refrigeration Coolers Product & Marketing Director at Modine

Andre Patenaude, Director, Business Development and Solutions Strategy at Copeland

very" with typical outputs of 30–40°C without an efficiency penalty. Gingras also notes that heat recovery works in both directions: an optimised reclaim strategy delivers a measurable subcooling benefit, improving gas cooler efficiency and reducing compressor workload.

Modine's experience aligns with the upper part of that range. "In real-world CO_2 transcritical installations, not laboratory settings, recovered water temperatures of 60–70°C are reliably achievable, with higher short-term temperatures possible depending on system configuration," **Umberto Di Barbora**, Global Refrigeration Coolers Product and Marketing Director at Modine, says. The implication, in his words, is that the recovered heat enables "direct DHW production without booster heat pumps" and "direct replacement of gas boilers in many retail and industrial settings."

Andre Patenaude, Director, Business Development and Solutions Strategy at Copeland, places rack systems higher: 60–88°C from CO_2 booster racks, 35–60°C from CO_2 scroll condensing units. Patenaude frames the technical difference plainly: "Unlike HFC systems, CO_2 refrigeration enables true heat recovery utilization, making it a potential primary energy source."

Massimiliano Sfragara, Product Management Director at Enex Technologies, pushes the envelope further. Recovered water at 80–90°C, he says, is achievable depending on the unit type. That temperature opens up applications outside food retail. Sfragara cites wineries, where recovered hot water at 80°C is used to clean wine tanks, replacing fossil-fuel boilers in a process step that is otherwise hard to electrify cleanly.

The cumulative point is that CO_2 shifts heat recovery out of the preheat category, where HFCs operate, and into direct burner-replacement territory. That qualitative shift is what makes the integrated energy-hub model viable.

From one function to many

What the recovered heat is actually used for has expanded steadily. **Sergio Girotto**, Founder and Honorary President of Enex Technologies and one of the early developers of CO_2 refrigeration, describes the hierarchy across Enex's installed base: "First comes domestic hot water. Second is space heating, around 50 percent. Summer cooling is less frequently used. This is a pity, because thanks to the ejector it can be implemented in a way that makes it very cost-effective." Exporting heat to district networks remains rare in Southern Europe;

Massimiliano Sfragara, Product Management Director at Enex Technologies

Sergio Girotto, Founder and Honorary President of Enex Technologies

Piotr Jabłoński, Senior Product Manager Refrigeration Europe at Panasonic Europe

Girotto notes Enex has done it for projects in Finland, where district heating infrastructure is dense.

The smallest end of the use-case spectrum may be the most revealing. In Irún, Spain, a 100-square-metre convenience store runs its entire cooling and heating load on a single Panasonic iCO2RE OCU-CRC150A08-D condensing unit (15 kW MT). According to **Piotr Jabłoński**, Senior Product Manager Refrigeration Europe at Panasonic Heating & Cooling Solutions Europe, recovered heat from the R744 circuit feeds a heating DX cassette directly, eliminating the need for a separate heating system in the store. "Heat recovery from the refrigeration unit is a primary heating source, allowing the store to operate without an additional heating system," Jabłoński says.

At a larger scale, the same principle works through aggregation. The Cuisine Centrale de Puellemontier in France, a central kitchen producing 5,000 plates per day, uses two Panasonic iCO2RE OCU-CR1000 condensing units operating in parallel, with a third unit (OCU-CR400) for a freezer cold room. Recovered heat from the medium-temperature units preheats roughly 524 litres per hour of domestic hot water to 55° C, supplying the kitchen with an annual average of 2,871 litres per day. Jabłoński characterises the result as "substantial and stable heat recovery" in a decentralised CO_2 architecture.

The German food wholesale operator METRO has pushed integration further. At its new Hamburg-Rahlstedt store, opened on 11 November 2025, recovered heat is the sole source of floor heating, with no heat pump and no fossil-fuel backup. "In new store openings like Hamburg, the heat recovery is the only source for floor heating, no heat pump, no fossil sources," says **Olaf Schulze**, Vice President Energy Management at METRO Properties Holding GmbH in Düsseldorf. The same architecture is planned for the new METRO store in Düsseldorf-Ulmenstraße opening in 2027. At MAKRO Opole in Poland, recovered heat is used year-round to preheat water for industrial dishwashers, addressing the seasonal question of what heat recovery does when space heating is not needed.

Olaf Schulze, Vice President Energy Management at METRO Properties Holding GmbH

Hans Ole Matthiesen, Senior Director, Global ADC at Danfoss A/S

In North America the picture sharpens around Canada, where colder annual climates result in a longer heating season. Andre Patenaude reports that Copeland's North American field services teams see "an overwhelming majority of Canadian retailers that use CO_2 as a refrigerant are also leveraging it for space heating," with adoption running close to 95 percent of CO_2 retailers. Three integration architectures are common: direct heat reclaim of discharge gas to a rooftop unit, a glycol loop linking the CO_2 rack to one or several rooftop units, and hot-water preheating via heat exchangers on the rack feeding storage tanks.

The Smart Store sits at the upper end of the integration spectrum. Across two years of operation, **Hans Ole Matthiesen**, Senior Director, Global ADC at Danfoss A/S, reports, recovered heat has covered 100 percent of the heating demand of the store and an adjacent laboratory building, with two-thirds going to the store and one-third to the lab. The 36 MWh exported to the local district network represents only the surplus during warmer months. "In 2025, we only sold heat in the warmer periods, but are preparing to export heat based on price signals in the future," Matthiesen says.

When the investment case actually works

Heat recovery adds incremental cost to a CO_2 booster system. Three independent manufacturer estimates put that increment at roughly 5–10 percent. What follows from there depends on local heating costs, climate, operating hours, and how the recovered heat is used.

The fastest paybacks come from the European market, where current gas prices and a regulatory push toward decarbonisation tilt the case. Andre Patenaude reports that Copeland's CO_2 scroll condensing units with the heat recovery module sold in Europe generally achieve payback within 0.8 to 2.5 years, depending on system size and heating capacity. Larger systems pay back faster because their recoverable heat capacity is higher.

Massimiliano Sfragara gives a similar order of magnitude: incremental cost of 5–10 percent, payback under two years when the recovered heat replaces a fossil-fuel boiler. The exact figure depends on local fuel prices.

Modine's range is wider and explicitly regional. "Given current energy prices and carbon pressures, payback periods of 2–5 years are realistic when heat replaces fossil -fuel boilers" in Europe, Di Barbora says. In

Jonas Schoenenberger, Head of Research and Development at Frigo-Consulting Ltd.

Trevor Matthews, founder of the Refrigeration Mentor

North America paybacks are longer, typically 4–7 years, "reflecting lower gas prices and uneven incentive frameworks, though state programs such as CARB FRIP in California are shortening returns in select markets."

A documented commercial case sits inside that range. The Cuisine Centrale de Puellemontier installation, with 30 kW of heat recovery capacity from two medium-temperature CO_2 units, reached payback in two years and two months without subsidies, calculated over 310 operating days per year at eight hours per day.

The Smart Store provides a more complex financial picture, because part of the heat is sold rather than self-consumed. Hans Ole Matthiesen describes a structural asymmetry in the Danish district heating market: "in our local grid there is a big difference between the price of a MWh heat sold (~€32) and a MWh heat purchased (~€100)." Over two years, the Smart Store exported 36 MWh to the local district network while saving close to €8,800 on heat it did not have to buy. The pack electricity consumption increase to deliver that heat was marginal. Matthiesen is direct about the business model: "selling heat makes sense if the connection to the grid is existing and if the heat recovered comes at little or no cost."

The independent view tempers headline payback figures. **Jonas Schoenenberger**, Head of Research and Development at Frigo-Consulting Ltd. in Bern, Switzerland, frames the variables that decide outcomes: "the key decision factors are annual operating hours, simultaneity of heating and cooling demand, achievable return temperatures, and the proportion of the recovered heat that can be used on site." Schoenenberger argues against general assumptions in either direction. "A project-specific simulation model that evaluates refrigeration load, heating demand, and local climate data provides a far more reliable basis for decision-making than subjective estimations."

Where it actually breaks

The technology is mature; the failures cluster elsewhere. Four barriers recur across the interviews behind this article.

The first is a technical correction to a common marketing emphasis. Manufacturers tend to advertise the high supply temperatures CO_2 systems can deliver. Schoenenberger insists the binding constraint is on the other side of the loop. "The single most critical factor is return water temperature from the heating circuit. If return temperatures are higher than assumed during design, available heat recovery capacity and

efficiency decline immediately." Sfragara confirms the same effect from the heat-pump side of Enex's product range: "one challenge we are facing in CO_2 heat pumps is the high hot water return temperature, which reduces the efficiency of the CO_2 cycle." Two independent voices, one consultant and one manufacturer, name the same physical bottleneck. Evapco's commissioning experience points the same way: the most common reason a heat recovery installation underperforms, Gingras says, is not a shortage of heat but controls that fail to prioritise reclaim against the building's heating, hot water and dehumidification demands.

The second barrier is organisational. Refrigeration contractors and HVAC designers come from different disciplines and rarely share a system view. Girotto puts the gap precisely: "the 'refrigeration' team assumes the 'HVAC' team understands how CO_2 systems work, for example, the temperature glide in transcritical operation and its impact on the circuit, or they may not be aware of the variability in thermal load and recoverable heat." Di Barbora reaches a similar conclusion from Modine's commissioning experience: "from a technology standpoint, the bottleneck is rarely CO_2; it is the lack of a shared energy-system mindset."

That gap is not only a matter of design; it resurfaces in the field. **Trevor Matthews**, founder of the independent training firm Refrigeration Mentor, has trained CO_2 technicians since 2015. Heat recovery, he says, raises the skill demand sharply, because "the refrigeration system becomes part of the building's overall energy strategy," and the technician must now hold refrigeration, HVAC interaction, hydronics, reclaim logic and controls together. Most heat recovery underperformance, in his experience, is human rather than mechanical: "many problems come back to commissioning, controls setup, sensor placement, sequences of operation, lack of coordination between trades, or simply lack of training and experience." A store short of reclaimed heat in winter rarely has failed hardware; the cause is usually wrong control settings, reclaim that was never prioritised, glycol flow problems, or poor startup coordination. He also points to a structural fragmentation, with installation, commissioning, controls and service split across separate contractors and no single party owning end-to-end performance.

The learning curve is slowed further on two fronts. Manufacturers, Matthews notes, do not always document their control strategies in full, leaving technicians to "read between the lines, learn through experience,

or attend very specific manufacturer training programs" to understand how a system is meant to operate. And the competence cannot be acquired quickly: a technician with solid fundamentals needs one to two years to be confident on a standard CO_2 booster, and longer again for full heat recovery integration. The curve is also regional. Technicians in Canada have practised heat reclaim on HFC systems for decades and begin with an advantage that markets without that history lack.

The third barrier surfaces specifically in retrofits. New stores can be designed around recovered heat from the start; existing stores carry HVAC infrastructure sized for a different thermal source. "In existing stores we see a conflict with the dimension of the conventional existing heating system," Olaf Schulze reports. The fix is sometimes operational rather than mechanical. After the

Smart Store opened, Matthiesen's team discovered that rail heat had been set to 100 percent on by the commissioning engineer, and that this was standard practice. Switching to adaptive humidity-controlled rail heat reduced low-temperature compressor and case energy consumption by 32 percent overnight. The lesson, in Matthiesen's words, was about commissioning competence, not equipment.

The fourth barrier is contractual. Schoenenberger highlights a structural reluctance among retailers to commit to long-term heat supply agreements with third parties, even where the technical case is favourable. Schemes involving multiple parties, complex legal structures, or external offtakers face additional friction. "In practice, simpler ownership and stakeholder structures tend to support broader implementation," Schoenenberger says.

Outlook

Two manufacturers and one consultant agree the European trajectory bends toward standardisation in three to five years. "Within 3–5 years, heat recovery is likely to become a 'de facto standard' in new CO_2 food retail installations," Di Barbora says, citing the EU F-Gas phase-down, potential PFAS restrictions affecting HFOs, and CSRD reporting as accelerators. Schoenenberger adds that in Switzerland regulation already obliges operators to utilise waste heat where economically feasible, and that Eastern European markets show high openness to the technology even without comparable regulatory frameworks.

There is, however, a useful disagreement on whether "standard" will become "mandatory." Sfragara is sceptical: "we don't believe it will become mandatory, but it can be promoted with incentive schemes." That distinction matters. A market can reach effectively universal adoption through economics and procurement standards without legal compulsion.

North America's path is shaped differently. Andre Patenaude points to California's Title 24 building energy efficiency standards, which already mandates heat reclaim for refrigeration systems regardless of refrigerant, and expects other states with comparable climate goals to follow. Modine highlights CARB FRIP as a programme that already shortens paybacks in select markets. Federal direction is harder to predict.

Regulation sets the pace; the workforce sets the ceiling. Matthews names systems integration and controls as the skills gap the industry most needs to close as heat recovery becomes routine practice. Closing it, in his view, is a shared responsibility of manufacturers, contractors and training organisations alike.

For retailers weighing the question now, the consultant in this article gives a direct answer. "In most food retail applications, our honest answer would be yes," Schoenenberger says, on whether the additional cost of heat recovery is worth paying.

The wider point comes from Modine. "As CO_2 adoption scales, the real value is no longer just refrigerant choice; it's how efficiently recovered heat is integrated into the wider building energy system."

The full article, including the monthly heat balance chart from the Danfoss Smart Store ADC, is available at Refindustry.com

Case study: exposing the performance gap

Eurovent Certification

Product performance is critical to achieving system reliability and energy efficiency. However, correct product selection and good system design hinges on accurate manufacturer data. Without it, refrigeration systems may underperform. To gain insight into the correlation between data and product performance, Eurovent Certification put two uncertified CO_2 gas coolers through a comprehensive evaluation process including laboratory tests, data analysis and evaluation via a professional design tool. This case study explores the research, its aims, methodology and results.

Aims and methodology

The aim was to ascertain:

- If there were any discrepancies between manufacturer declared data and measured performance.
- The accuracy of Eurovent Certification's correction factors: calculations applied to tests at standard conditions to simulate the efficiency of CO_2 units across different climate zones.

It was critical for the research to follow an authentic customer journey. A project specification was created and submitted to independent distributors for an offer. Eurovent Certification received five (5) offers from the distributors based on the specification.

The offers included heat rejection capacity of the units under standard and different market conditions as follows:

- Condition 1: Standard transcritical condition (known as SC20)
- Condition 2: Market transcritical condition at High ambient T with 2K approach used in warm weather areas
- Condition 3: Market transcritical condition with 3K approach used in the Central and Northern European market

Table 1: Operating conditions in transcritical mode

Condition in transcritical mode	Gas Cooler inlet pressure	Gas Cooler inlet temperature	Air Inlet temperature	Gas Cooler outlet temperature	DT (temperature approach)
Condition 1 (standard condition SC20)	90 bar	110 °C	30 °C	35 °C	5 K
Condition 2	92 bar	110 °C	35 °C	37 °C	2K
Condition 3	80 bar	100 °C	29 °C	32 °C	3 K
Condition 4	80 bar	100 °C	30 °C	32 °C	2 K

Table 2: Operating conditions in subcritical mode (operating as a Condenser)

Condition in subcritical mode	Air inlet temperature	Condensing temperature	Refrigerant inlet temperature	Subcooling
Standard condition SC25	5°C	15°C	60°C	<3 K

- Condition 4: Market transcritical condition with 2K approach used in the Central and Northern European market
- Condition 5: Standard subcritical condition (Condenser) known as SC25.

A design tool was used to calculate the predicted heat rejection capacity of the units under these standard and market conditions.

Design simulation results

The results from the design software simulations suggested that, while units behaved reliably at Standard Condition (SC20), performance may deviate from declared values when operating under non-standard conditions. Conditions 3 and 4 saw significant underperformances:

- At condition 4, the average underperformance was 32% and maximum underperformance 41%
- At condition 3, the average underperformance was 26% and maximum underperformance 28%.

The two CO_2 gas coolers displaying the most significant performance gap were selected for laboratory testing.

Independent laboratory tests

The gas coolers undertook an identical evaluation process based on the Eurovent Certified Performance for Heat Exchangers programme, using the test standard EN327 to measure:

- Heat rejection capacity: testing under both subcritical / transcritical conditions
- Fan power consumption
- Air flow rate
- For the sound measurement, the test standard EN 13487:2019-11 and EN ISO 9614-1:2009-11 was used.

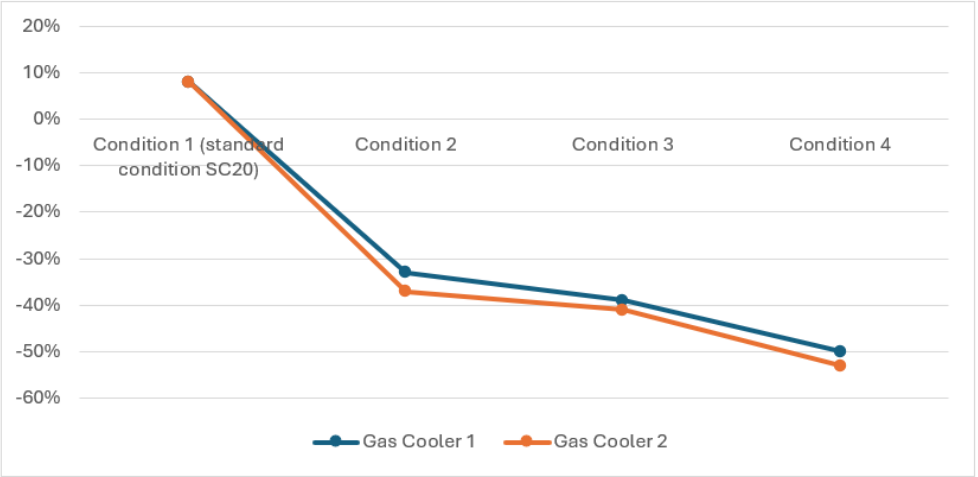
To ensure impartial testing, Eurovent Certification had no direct contact with the tested units, or the laboratory testing process, which was handled by an independent Legal Officer (French Bailiff).

The laboratory results

The units displayed material deviations from declared performance under non-standard conditions:

- At condition 4 the average underperformance was 51.5% for both units and the maximum underperformance 53%.

Figure 1: Deviations between declared and measured heat rejection capacity under transcritical conditions



- At condition 3 the average underperformance was 40% across both units and the maximum underperformance 41%.
- At condition 2 the average underperformance across both units was 35% and the maximum underperformance 37%.
- When operating as a condenser (subcritical) the average underperformance of both units was 27.5% with a maximum underperformance of 32%.

Notably, the independent laboratory tests showed that actual measured performance under the tested operating conditions exceed the shortfalls predicted by the design tool simulations.

Correction factors

One aim of the laboratory tests was to evaluate the correction factors used by Eurovent Certification to calculate gas cooler performance at different market conditions (climates). To comply, tested results had to be within a 15% tolerance of the values available within the Heat Exchanger Technical Certification Rules (TCR).

The tested results fell into the 15% tolerance. Correction factors therefore provide a reliable method for calculating CO_2 performance across different climates.

Table 3: Gas Coolers correction factors comparison

		Calculated from the test results	Calculated from the design tool	Available in TCR
Correction factor for Condition 3	Unit 1	**0,56**	**0,58**	**0,62**
	Unit 2	**0,54**	**0,58**	
	Mean value	**0,55**	**0,58**	
Correction factor for Condition 4	Unit 1	**0,46**	**0,47**	**0,52**
	Unit 2	**0,43**	**0,48**	
	Mean value	**0,45**	**0,48**	

Conclusion

The study found a correlation between accurate data and product performance. The uncertified CO_2 gas coolers were found to have significant deviations between declared and measured performance across non-standard conditions, especially those related to Central and Northern European climates. In contrast, Eurovent Certification's CO_2 testing protocol and correction factors were validated - showing that third-party verification can help provide transparent, accurate performance data across multiple climates.

Want to know more? A new white paper from Eurovent Certification explores the impact of heat rejection equipment underperformance.

Download Beyond the brochure: Exposing the reality of refrigeration product underperformance for free at

www.eurovent-certification.com

SWEP

Breaking new ground in transcritical CO_2 systems

The customer: BITZER Australia, an industry leader in compressors, engineered refrigeration packages, pressure vessels, and air conditioning solutions.

The challenge: Maintain critical temperature parameters for multiple loads, even when ambient temperatures reach 48°C.

The solution: Create a new transcritical CO_2 system for a grocery store in Sydney, Australia.

The heat exchangers: The new system depends on SWEP B12, B200T and B18 brazed plate heat exchangers.

The results: The system delivered exceptional temperature control to all connected loads – including a 34-kW frozen produce load, a 205-kW chilled produce load, 325 kW of space cooling and 12 kW of heating, even when peak temperatures reached 48 °C.

BITZER Australia, a global leader in compressor technology, approached SWEP with a proposal to collaborate on the creation of a new transcritical CO_2 system for a grocery store in Sydney, Australia. Over the last decade, SWEP has been the global leader in the development of ultra-pressure BPHEs for transcritical supermarket refrigeration. They were ready and willing to address the myriad challenges that the hot Australian climate poses for transcritical systems.

SWEP's ability to deliver a technical solution for this project enabled BITZER to design a system that could meet the customer's requirements. The design of the chilled water thermosyphon unit, with its low refrigerant-side pressure drop, was essential to the system's operation.

SWEP B12, B200T and B18 were key to this project. Chilled water (+8/+12) was generated via CO_2 thermosyphon. Suction superheat control for low temperature compressors via liquid. Condensate subcooling via flash gas. Vapor condensing via R134a mechanical resilience unit. Heat reclaim to water via discharge gas, for store heating.

The role of SWEP BPHEs

SWEP B12, B200T and B18 brazed plate heat exchangers were key to the success of this project. The system uses a CO_2 thermosyphon to generate chilled water, which is then used for store air conditioning. SWEP BPHEs are also used to control the suction superheat for low-temperature compressors; condensate is subcooled via flash gas. The system utilizes vapor condensing via an R134a mechanical resilience unit; reclaimed heat from discharge gas is used to warm water, which is then used for store heating.

Brazed plate heat exchangers for refrigeration - SWEP

Eliwell

Smart cooling, sustainable heating – Migros turns to Eliwell to boost its refrigeration efficiency

The Swiss retailer adopts integrated CO_2 refrigeration for its store in Bellinzona, cutting energy consumption by 20% thanks to Eliwell control technology.

In the European landscape of large retailers, sustainability is no longer optional but a strategic driver, as demonstrated by the Swiss retail group, Migros. With a turnover of 31 billion Swiss francs and over 97,000 employees, the retailer continues to invest in advanced technological solutions to reduce the environmental impact of its operations.

A highlight among the group's most recent initiatives is the new Bellinzona store, opened in June 2024, where refrigeration is at the heart of an integrated and efficient energy model.

A system-driven climate control strategy

Founded in 1925 and organised as a cooperative with over 2.3 million members, Migros has placed sustainability at the heart of its corporate strategy, translating it into concrete actions, from the installation of photovoltaic systems to railway based logistics to the electrification of its road vehicle fleet.

In this context, improving the efficiency of refrigeration systems becomes a key lever not only for reducing energy consumption but also for rethinking the very role of refrigeration as part of a building.

Refrigeration and heating in a single intelligent central unit

A decisive step in this direction was already taken in 2016 by Migros Ticino, with the introduction of systems capable of simultaneously addressing industrial refrigeration and heating.

The solution, developed by E. Biaggini SA in collaboration with Eliwell by Schneider Electric, is based on an integrated CO_2 solution that combines refrigeration and heat recovery in a single central unit.

The heart of the system is Eliwell's control technology, designed to optimally manage CO_2 systems and coordinate the subsystems (refrigeration and heating) as a result maximising overall energy efficiency.

The Bellinzona case study: measurable performance from the very first months

This integrated architecture was implemented at the new Migros store in Bellinzona, with tangible results right from the start.

Eliminating the traditional boiler, made possible by recovering the heat generated by the refrigeration cycle, has led to a 25% reduction in overall system costs, including installation and operational costs.

On the environmental side, the benefit is equally significant: the store has recorded annual savings of approximately 3,300 cubic meters of natural gas, making a tangible contribution to curbing CO_2 emissions.

Refrigeration performance has also improved, with a 20% reduction in energy consumption compared to the average of stores equipped with conventional systems.

CO_2 technology as the standard for the future

The adoption of natural refrigerants such as CO_2 is a cornerstone of energy transition in the food retail sector. However, the real leap forward only occurs when technology is integrated into a system vision.

In the Bellinzona project, Eliwell's advanced control technology plays a key role, enabling dynamic and coordinated management of energy resources. The result is a system capable not only of refrigerating, but also of actively contributing to the building's heating.

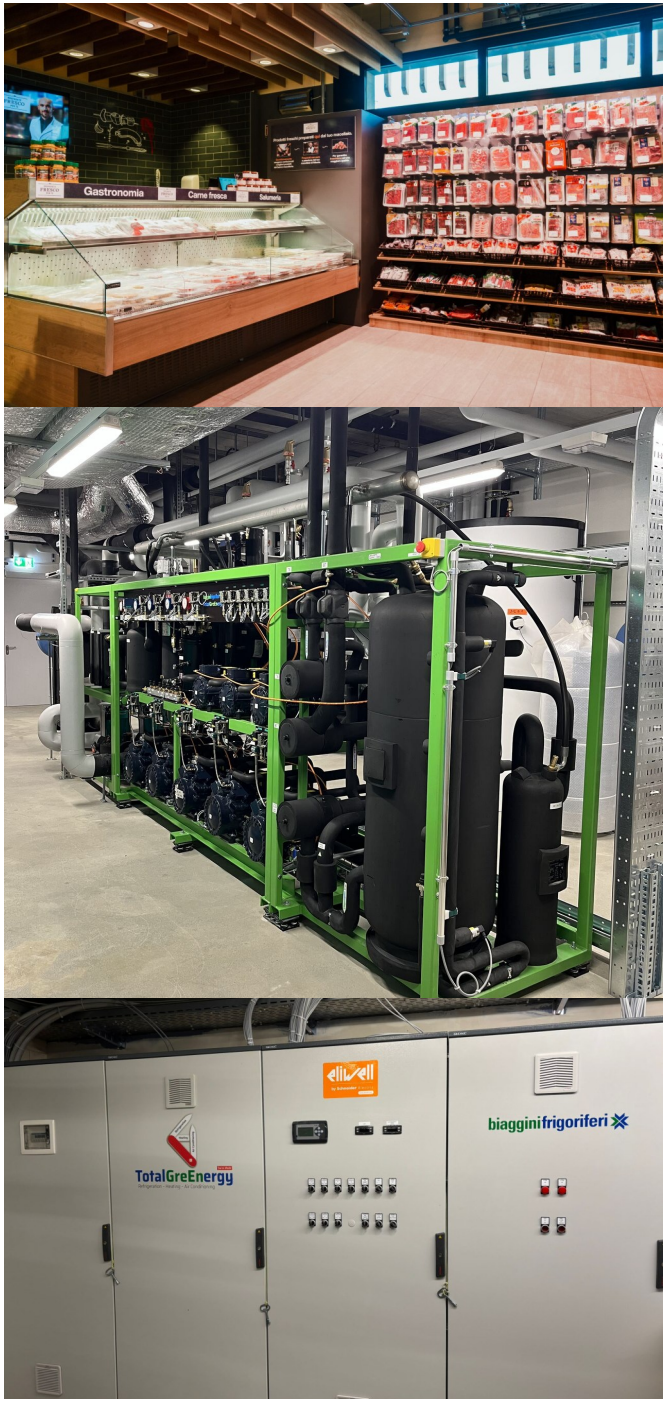
Continuous innovation for a more sustainable retail sector

The Migros case confirms how technological innovation applied to refrigeration can generate concrete and measurable benefits, both economically and environmentally.

In a sector increasingly oriented towards sustainability, integrated solutions like the one developed with Eliwell and Biaggini represent a replicable model, destined to become a benchmark for next-generation stores.

The direction is clear: transforming refrigeration systems from simple technical solutions to true energy hubs at the heart of the decarbonisation strategies of large retailers.

Read more on the Eliwell website



Refra

Refra Delivers Advanced CO2 Refrigeration Systems for Major London Depot

Refra is contributing to a major new development in the European foodservice sector — the construction of a 44,129 m² depot in London. The facility is designed to become a showcase of efficiency, capacity and service in the UK. To meet its demanding refrigeration requirements, the project incorporates Refra's advanced CO_2 refrigeration systems, supporting sustainable and energy-efficient operation.

Now fully operational, the depot has expanded capacity in the South East and provides storage for a wider selection of fresh, frozen and shelf-stable products. This scale and versatility strengthen service responsiveness and support the evolution of the UK's wholesale foodservice industry.

Meeting the Cooling Demands of a 44,129 m² Facility

The project is being delivered in close cooperation with Absolutely Chilled - an official Refra distributor in the UK. To address the significant cooling demands of the depot, the solution includes four Refra CO_2 Container systems with transcritical booster technology. Each container provides 445 kW of capacity in the medium temperature (MT) stage and 150 kW in the low temperature (LT) stage, giving a combined total capacity of 1,800 kW MT and 600 kW LT across the four units. This high-capacity setup guarantees precise temperature control for both chilled and frozen storage areas.

Ready-to-Install Systems That Save Time and Space

Refra walk-in CO_2 Container systems offer a complete refrigeration solution that arrives ready-to-install outdoors. This system offers both installation efficiency, reduced construction costs and significant savings of valuable indoor space.

All piping is pre-assembled and brought to a single side point, so installers can make connections quickly and with minimal disruption. This approach simplifies the insta-

llation process and can shorten project timelines by 2-3 weeks. The container also serves as a protective housing, shielding the system from outdoor conditions such as rain, dust and dirt, which helps extend equipment life.

The containers are engineered with careful attention to detail in order to ensure safety, reliability, and ease of maintenance. Standard features include integrated lighting, sound insulation, electrical sockets, an emergency unlocking mechanism and CO_2 leak detection together with safety ventilation options. Additional heating and air conditioning systems can be incorporated to provide even greater comfort during service work. All these features create a secure and technician-friendly working environment.

Customers seeking a full-package solution can choose Refra CO_2 Containers with Refra Gas Cooler mounted on top. The gas cooler is delivered together with a custom-built platform and ladder, making installation and servicing safe and easy. This design maximises space efficiency, simplifies planning and provides customers with a complete, ready-to-operate system that combines durability, practicality and long-term reliability.

Delivering Capacity While Lowering Environmental Impact

One of the defining aspects of this project is the use of R744 refrigerant. Unlike synthetic gases, CO_2 has an extremely low global warming potential and is widely recognised as a safe and future-proof alternative. This approach allows the facility to reduce its environmental impact while still delivering the cooling performance required for a site of this scale.

Another important factor is regulatory compliance. With European legislation gradually restricting the use of high-GWP refrigerants, the decision to invest in CO_2 ensures that the system will remain in line with current and future requirements. With more than ten years of experience in natural refrigerant technologies, Refra combines proven expertise with high-quality engineering to deliver reliable and future-ready refrigeration solutions.

Visit Refra website and browse 80+ product catalogue

Enex Technologies

Case study: ELBA CO_2 Unit for retail application

Enex Technologies in partnership with Frigotehnica have installed a refrigeration and heating recovery system with natural refrigerant CO_2 in a supermarket in Romania.

A top leader retail company, with several stores across Romania, including mainly hypermarkets and in general large-scale retail trade, has recently opened a new store using not only CO_2 as refrigerant fluid but also cutting-edge solution of flooded evaporation with liquid ejector to increase the efficiency.

The problem:

Refrigeration is using more and more natural refrigerants, Carbon dioxide, Propane and Ammonia. Introduced again in commercial refrigeration in the first years of the 2000s, after decades during which it was completely forgotten, CO_2 systems are now a standard choice.

In commercial buildings there are also other users with synthetic refrigerants, like, chillers for air conditioning and heat pumps for space heating. Due to electrification, within the wide energy transition process, systems powered with natural refrigerants are being used increasingly. In supermarkets and hypermarkets, however, it is not practical to use flammable or toxic refrigerants. For this reason, only CO_2 is the most common option.

Intrinsically a CO_2 transcritical system is more complex of a “simple” refrigeration system with synthetic refrigerants. All that has blocked for years the extension of the use of this refrigerant to other applications. Moreover, the idea of combining the use of “warm side” and “cold side” of a refrigeration system is very attractive, because energy wise such system can be in very efficient.

For this supermarket chain in Romania, it was paramount to find a solution that allow energy efficiency while delivering outstanding performance without compromising the environment and warranting low emissions. The system was required to give refrigeration for a significant number of cabinets (40 in MT and 18 in LT) plus several cold rooms for dedicated warehousing at

medium and low temperatures. All disposed over a surface of 5000 sqm. Moreover, the selected solution needed to be able to provide sanitary water and heating for the cold months.

Frigotehnica was entrusted with this important project thanks to their experience as a leading Romanian company specialized in commercial and industrial refrigeration solutions, with a wide experience providing end-to-end services, including design, installation, and maintenance for sectors like retail and logistics. At the same time, they decided to partner with Enex Technologies, trusting on their wide expertise with natural refrigerants to create the best solutions to fulfill the client's specific needs.

The solution:

To fulfill the request of maximizing energy efficiency in the overall system, the ELBA CO_2 booster from Enex Technologies was considered the best option. With Liquid ejector for semi-overfed evaporation & parallel compression to increase efficiency.

The Liquid ejector allows evaporation at higher temperatures because of the removal of superheating (the concept of semi -overfed evaporation), avoiding possible suction of liquid to compressors that its pumped from the MT line. To simplify the concept, evaporate higher means the reduction of electrical consumption.

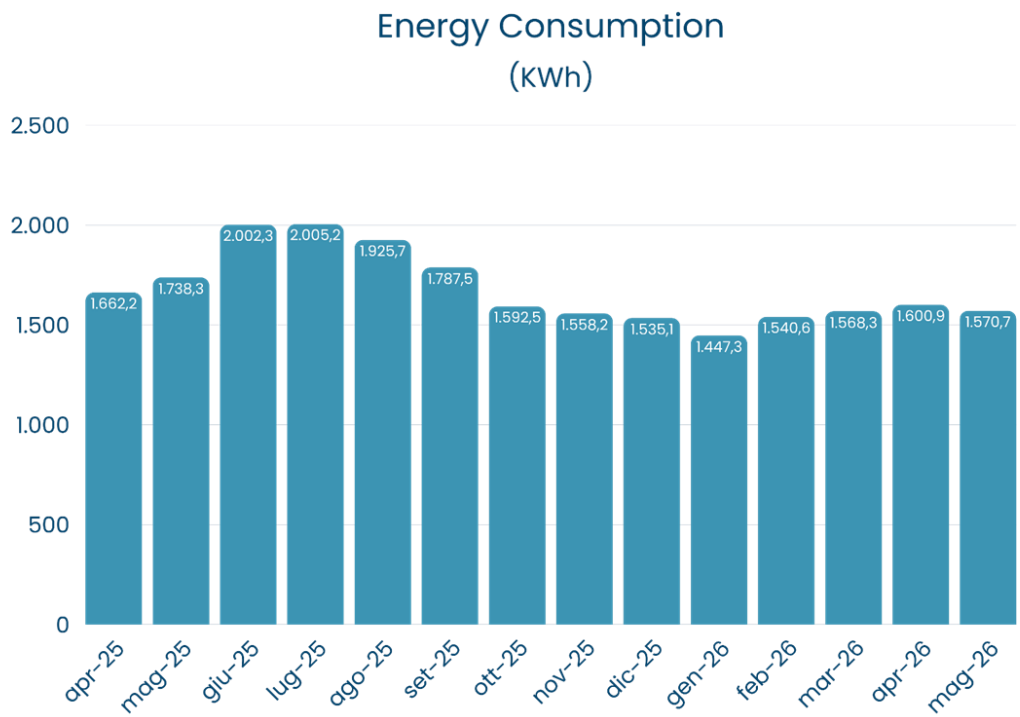
Parallel compressors, on the other hand, draw vapor from the liquid receiver, which operates at a higher evaporation temperature than the MT line. This avoids unnecessary vapor expansion and reduces compression with a higher-pressure difference (ΔP).

It is worth to remind that "liquid ejector" overfeeding is an invention of Enex Technologies, which filed numerous patents and is installed over several hundreds of systems. The original Enex solution has no rivals in terms of efficiency, simplicity and reliability.

Main features of this ELBA CO_2 Rack:

Features	kW	Conditions
MT load	91	-7°C evap temp
LT Load	61	-34°C evap temp
Heating recovered	127	Water 30-45°C

Another valuable feature about this project regards safety. This unit has redundancy of expansion valves, like we can see in the image below (fig.1). In traditional systems, the electronic valves represent the core of the machine and in case of their fault, the unit would not be able to run with considerable problems of downtime. The use of the mechanical valves installed in parallel to the main ones in this project, allow to solve the issue, guaranteeing continuity and reliability.



Comments:

"Our collaboration with Enex Technologies on this project enabled us to implement a highly advanced CO_2 solution, combining liquid ejector technology and heat recovery to maximize overall system efficiency. This approach ensured outstanding performance, operational reliability, and a sustainable footprint, fully meeting the demanding requirements of large-scale retail applications". **Alexandru Munteanu**, Project Manager of Frigotehnica.

"Partnering with Frigotehnica on this supermarket project demonstrates how advanced CO_2 technologies can unlock new levels of efficiency in retail applications. By integrating our ELBA system with liquid ejector technology, enabling semi-overfed evaporation at higher temperatures and reducing compressor load, we have delivered a solution that maximizes energy performance while ensuring sustainability and reliability." **Luis Crespo Barber**, CCO Enex Technologies.

Results:

In terms of environmental impact and energy efficiency the first year of monitoring shows outstanding results:

The average daily energy consumption after 398 days of monitoring is 1.689,2 KWh

Energy efficiency is achieved due to several factors:

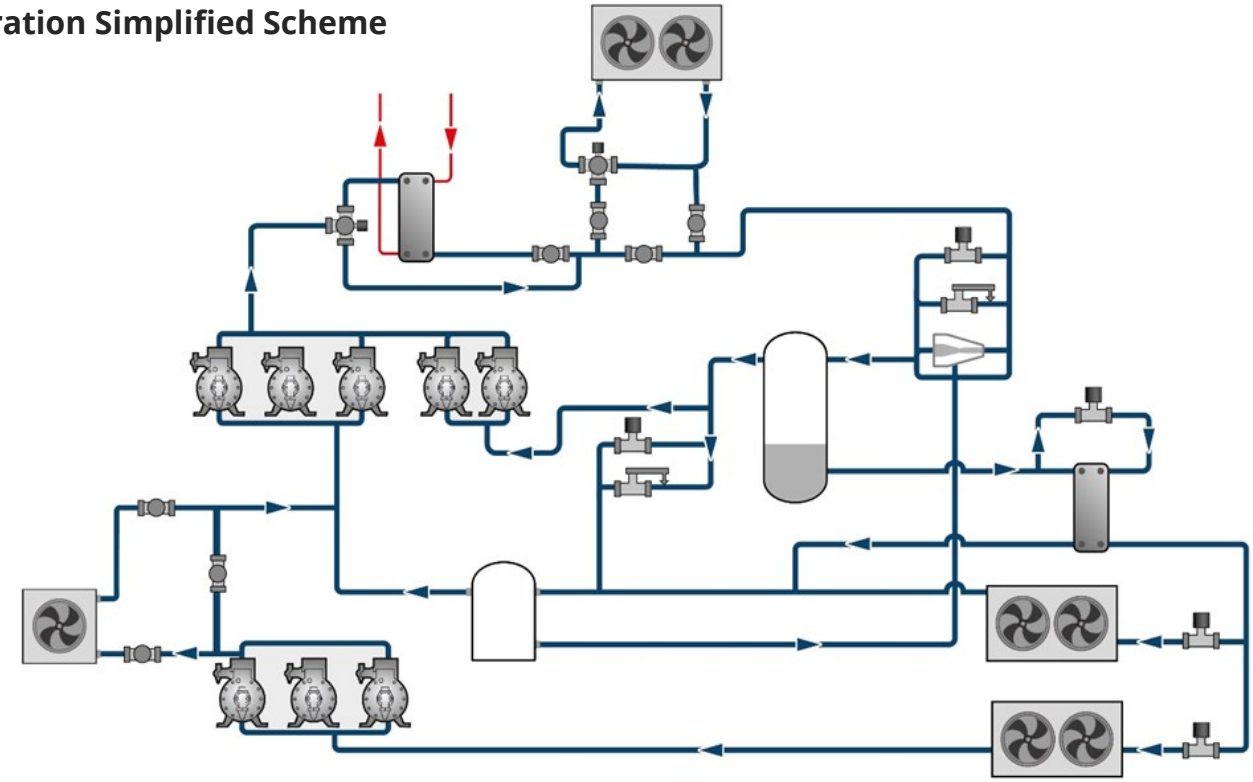
- Thermal recovery of free heat (plate heat exchanger after compressor)
- Recompression of flash vapor from liquid receiver (thanks to parallel compression)
- Liquid ejector (that allows to work at higher evaporation temperature & being installed In parallel to the high-pressure valve, recovering also the expansion energy)

- Modulating 3-way ball valve for the gas cooler
- LSPM compressors (higher efficiency)
- Liquid /Liquid subcooler exchanger (liquid to evaporators with 3K subcooling)
- Air intercooler after LT compressor (improving medium compressor suction temperature and consequently compressor long life)

Other particular features installed include:

- Energy meter to monitor consumption
- LT suction /Liquid plate exchanger (as superheating of LT line, this avoiding liquid to LT compressors)

Operation Simplified Scheme



Operation Simplified Scheme

- Commercial Refrigeration: Medium & Low Temperature
- Heating recovery

Interview

Trevor Matthews: Closing the Refrigeration Skills Gap, One Contractor at a Time

Trevor Matthews did not plan a career in refrigeration, but after two decades working his way from installation crews to national trainer at Copeland, he founded Refrigeration Mentor to tackle the industry's most persistent problem: the skills gap that nobody has managed to close.

Ilana Koegelenberg spoke with Matthews for Refindustry about his journey into the industry, why he walked away from a corporate promotion to build something of his own, and what it will actually take to bring more people, and better training, into refrigeration.

An Accidental Entry Into a Lifelong Career

Matthews went to university in Canada to study business, but it was a chance conversation at an open house that set his career in motion. While exploring a bartending program, he got talking to someone whose father was a refrigeration technician earning $50 an hour. It was a career path he had never considered, but the earning potential was appealing. He signed up for an HVAC program shortly after, in 2004.

After completing a full-year HVAC and gas fitting program and earning his gas and oil burner licenses, Matthews cold-called a leading refrigeration contractor in Western Canada, packed up, and moved across the country to break into supermarket refrigeration. It was the first of many moves driven by a willingness to go wherever the work was and to keep learning once he got there. Over the years, he worked internationally, took jobs when he needed income, and traveled when he had freedom, gradually building real depth in commercial refrigeration.

The defining chapter came in 2014 when he joined Emerson, the parent company of Copeland, starting in technical support before eventually becoming their national trainer for Canada. It was there that he built his foundational knowledge in compressors, CO2, and supermarket refrigeration – and found his love for training.

Working under Andre Patenaude, a globally recognized CO2 expert, Matthews began training contractors and technicians across Canada and into the US. The business development role gradually gave way to a training role.

Read the full interview and watch the video

Events

MCE 2026 Closed in Milan with Focus on Natural Refrigerants and Data Center Cooling

The 44th edition of MCE – Mostra Convegno Expocomfort brought together more than 1,600 exhibiting companies from 48 countries at Fiera Milano Rho, drawing over 120,000 professionals across five days under the theme "Energy is Evolving." The show confirmed two converging priorities for the HVACR industry: natural refrigerant adoption and data center thermal management.

On the refrigerant transition side, BITZER presented a full R290 compressor line-up across four technologies — scroll, screw, reciprocating, and rotary — plus CO2 and ammonia components, and high-temperature screw compressors reaching fluid outlet temperatures up to 120°C for industrial heat pump applications. Danfoss showed the BOCK HGX68 CO2 transcritical compressor supporting systems up to 3 MW in a single rack, alongside CO2 ejectors, control valves for transcritical installations, and the VPN175 R290 inverter scroll compressor for commercial heat pumps.

Air-to-water heat pumps were well represented. LG presented three new indoor unit models for its THERMA V Monobloc R290 platform with heating capability down to -28°C. SPRSUN introduced a new R290 multi-function series with full inverter technology and stable operation down to -25°C, while PHNIX showcased its airMono R290 indoor monoblock targeting space-constrained urban retrofits.

Data center cooling drew significant floor space. Danfoss introduced the XB67 brazed plate heat exchanger enabling CDU development up to 1.3 MW alongside the oil-free Turbocor TGS380 ecosystem. BITZER's CSW105 screw compressors reached 4 MW in tandem configuration, qualified for R1234ze(E). Panasonic debuted CDU models at 400 kW and 800 kW for AI data centers, expanding into liquid cooling following its acquisition of Italian CCU manufacturer Tecnair.

Controls also advanced: CAREL launched STone, a new HVAC/R programming platform with an integrated AI coding assistant, updated energy optimisation logic, and cybersecurity-by-design architecture.

Read the full MCE 2026 review and see photos from the show

EuroShop 2026 in Germany highlights energy-efficient refrigeration tech

EuroShop 2026 has closed after five trade-fair days in Germany, bringing together retailers and suppliers around investment priorities such as efficiency and the customer journey. Organisers reported more than 81,000 trade visitors from 141 countries and 1,840 exhibitors from 61 nations at the 23rd edition of the event.

Two thirds of visitors came from abroad, including one in five travelling from countries outside Europe. Exhibitors reported a very good overall mood and pointed to the high decision-making competence of visitors. Trade visitors said they were highly satisfied with the presence of market leaders and the completeness of ranges shown across 14 exhibition halls.

According to the organisers, budgets were spent selectively where increasing efficiency intersects with customer benefits. Areas of interest included AI-based applications and check-out solutions, energy-efficient refrigeration technology, modern LED lighting, and flexible store fitting concepts.

Among EuroShop's seven Dimensions, the Refrigeration & Energy Management area highlighted the relevance of energy-efficient technologies in food service equipment and pointed to trends such as food service in retail and automation. The EuroCIS area, spanning four halls, focused on AI-based applications, automated processes and connected platforms designed to optimise workflows along the customer journey, from merchandise management to checkout.

The programme of side events drew strong interest, with discussions held on seven stages and in special areas, alongside Guided Tours and a Store Tour to selected store concepts. The next EuroShop is scheduled for 18–22 February 2029, while EuroCIS is set to run from 16–18 February 2027.

"EuroShop 2026 has demonstrated impressively that retail invests in its future – strategically, technology-driven and with a clear focus on efficiency and the customer journey at the same time," said Marius Berlemann, Chief Operating Officer at Messe Düsseldorf.

View EuroShop 2026 photos:

Opening day | *Show highlights*

Chillventa 2026, 13 - 15 October

Exhibitors have booked more display space for Chillventa 2026 than the trade fair filled in 2024, when 1,010 companies from 49 countries drew 33,076 trade visitors to Nuremberg. To hold the demand, organiser NürnbergMesse has added Hall 1 to the footprint, giving room for larger stands and easier navigation. The refrigeration, air conditioning, ventilation and heat pump fair runs 13 to 15 October 2026 at Exhibition Centre Nuremberg, with the Chillventa CONGRESS the day before, on 12 October.

The programme tracks where the industry is putting its engineering effort. Low-GWP refrigerants stay central, with R290 and CO2 systems expected across commercial and industrial stands, set against F-gas and PFAS regulatory sessions. Heat pumps for commercial and industrial use, energy efficiency, waste heat recovery and the circular economy anchor the technical agenda. Digitalisation, controls and IT security round out the topics, a reflection of how connected systems now sit at the centre of refrigeration design.

The Chillventa CONGRESS and four specialist forums give researchers and practitioners deep technical sessions on refrigeration technology, heat pumps, low-GWP refrigerants, F-gas regulation, PFAS, digitalisation and the circular economy. A new area, the ZUKUNFTSRAUM, makes its premiere with hands-on insight into emerging trends, new markets and digital tools, alongside exhibitor forums, live demonstrations and guided tours.

International participation defines the event: in 2024, 74 percent of exhibitors and 57 percent of visitors came from outside Germany. For refrigeration professionals, two questions are worth testing on the floor. How far have R290 and transcritical CO2 moved into mainstream product ranges, and how are manufacturers answering the rising cooling loads of AI data centres, a theme that dominated MCE 2026 in Milan earlier this year. Both will show where the next two years of refrigeration technology are heading.

Chillventa 2026 runs 13 to 15 October at Exhibition Centre Nuremberg, with the CONGRESS on 12 October.

Full details and registration: chillventa.de

Introducing the magazine in PDF Format to the partners

We are thrilled to introduce our new PDF magazine, designed to be a valuable resource for our readers. In a world brimming with information, our mission is to streamline the process of staying informed by delivering the most crucial updates and insights from the past quarter.

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We are committed to ensuring that our readers receive our magazine promptly. We distribute it through our newsletter to over 4,000 subscribers, registered users on our website, and webinar attendees.

Additionally, we will actively promote the magazine across our social media platforms. With more than 50,000 followers on our news feeds and over 150,000 members in our LinkedIn and Facebook groups, we guarantee extensive and far-reaching exposure.

We are excited to share our initial outlook on this new magazine and have plans for its ongoing development. Join us on this exciting journey, and please share your feedback and ideas.

Discover more about the magazine's features and pricing on the following pages.

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- **The Most Popular News from Refindustry.com:** Stay updated with the most crucial developments.
- **Sustainability:** Discussing green refrigeration practices and their impact on the environment.
- **Technical Insights:** Explaining complex concepts and providing technical insights into refrigeration equipment.
- **Case Studies:** Real-world examples of successful industrial refrigeration projects, installations, and problem-solving.
- **Maintenance and Troubleshooting:** Tips and guides for maintaining and troubleshooting refrigeration equipment.
- **Interviews:** Insights from industry experts, engineers, and leaders in the field.
- **Opinions:** Expert perspectives, commentary, and analysis on relevant industry issues and trends.

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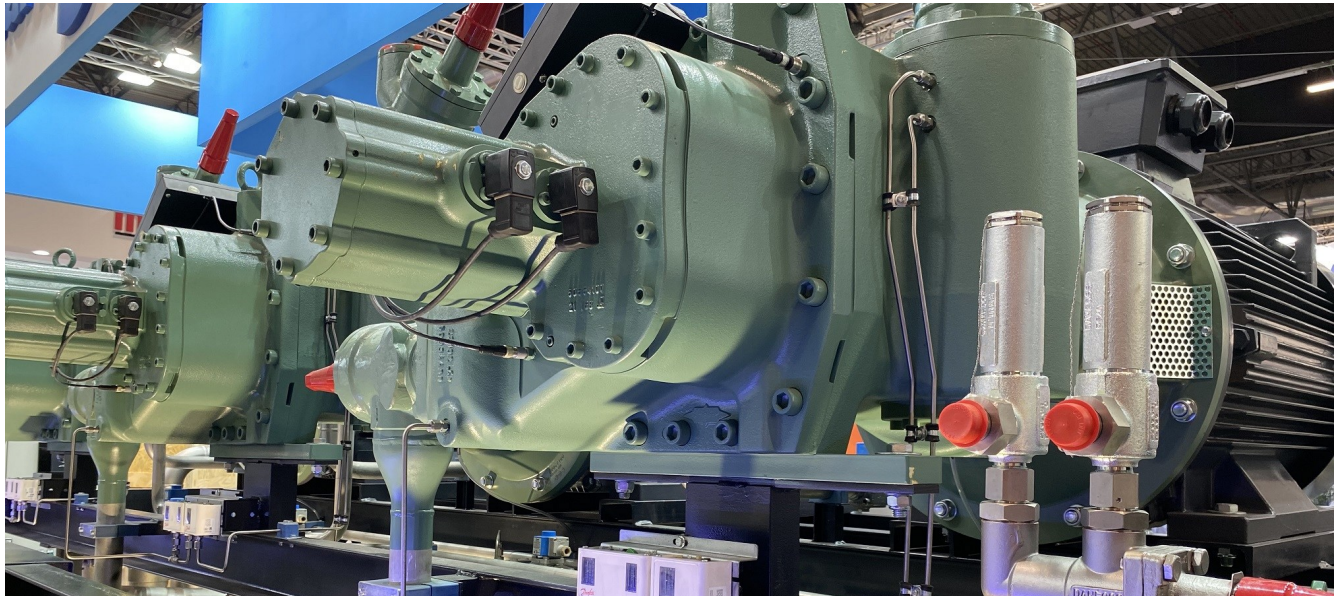
Place an advertising module or contribute an article on topics like sustainability or successful case studies, sharing your company's experience with the magazine audience. Discover more in our Media Kit.

For any inquiries, feel free to contact us at info@refindustry.com.



The opportunities

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