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October 2025

- 18 Maple Leaf Foods' Compressed Air System Upgrade
- 24 ADG Concepts and Compressed Air Piping
- 29 N<sub>2</sub> Generation for Food Packaging
- 33 Trane on Heat Recovery
- 37 Compressed Air Dryer Selection
- 40 Bottling Plant Cooling System

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**COMPRESSED AIR SYSTEM FEATURES**

- 18 Maple Leaf Foods Saves with Compressed Air and Heat Recovery Upgrade**  
By Troy Dreier, Compressed Air & Cooling Best Practices Magazine
- 24 ADG Concepts Solves Years of Piping Problems for Frozen Foods Plant**  
By Troy Dreier, Compressed Air & Cooling Best Practices Magazine
- 29 The Importance of Compressed Air Quality In Nitrogen Generation Systems for Food Packaging**  
By Mirko Krebs, KSI Technologies
- 37 Selecting the Right Compressed Air Dryer for Any Application**  
By Jayme Leonard, Atlas Copco Compressors



**COOLING SYSTEM FEATURES**

- 33 Inside the 55 Water Street Heat Recovery Transformation**  
By Corey Letcher, Trane
- 40 Combined Design Does the Work of Two Cooling Systems at Bottling Plant**  
By Clayton Penhallegon, Jr., Integrated Services Group

**LATEST NEWS**

- 10 Compressed Air Industry & Technology**
- 14 Chiller & Cooling Industry & Technology**
- 16 Industrial Energy & Water Conservation**

**EVERY ISSUE**

- 6 From the Editor**
- 8 Subscribers From Around the World**
- 46 Column | Better Plants**
- 47 Column | Sales Engineering Skills**
- 48 Real-World Installations & Maintenance**
- 49 Advertiser Index**
- 50 The Marketplace | Jobs and Technology**



Cover Image: Maple Leaf Foods of Hamilton, Ontario

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# » FROM THE EDITOR



## Food Processing Efficiency and Cleanliness

You won't find them on any nutrition label, but compressed air and nitrogen gas are industrial food ingredients, touching much of what we eat.

We start this issue with a trip to the Maple Leaf Foods plant in Hamilton, Ontario. A project to add an air compressor, swap in a heated blower purge desiccant compressed air dryer and add a heat recovery system led to 900,000 kWh in yearly energy savings.

ADG Concepts found a compressed air piping maze when hired to improve compressed air flow for a frozen food processor in North Texas. The plant's 30-year-old compressed air piping system included open blowing leaks and was filled with rust. The company replaced it with 2,650 feet of aluminum compressed air piping, about half the length of the previous system.

KSI Technologies explains why starting with clean, dry compressed air is essential for nitrogen generation systems in food processing plants, and explains how to achieve it. For example, membrane nitrogen generators usually require an ISO 8573-1:2010 compressed air quality of 1.4.1 to properly function.

Trane provides a fascinating feature on a heat recovery transformation in New York City's Financial District. The 55 Water Street project involved adding two centrifugal chillers, 27 modular chillers and multiple heat pumps, all while working in a dense urban environment.

Atlas Copco describes the five types of compressed air dryers and explains the pros and cons of each. Did you know nonstandard desiccant compressed air dryers can achieve dew points well below -40°F (-40°C)?

Frequent contributor Clayton Penhallegon, Jr., provides a case study from his work at a Southern California bottling plant. Clever engineering created one cooling system that satisfies two sets of requirements. Two 400-ton chillers were sized so they provided essentially N+1 redundancy when the plant operates at normal loads.

Finally, be sure to read the Blower & Vacuum Best Practices Magazine bundled inside. It includes a vacuum system audit Zorn Compressors performed for Midland Plastics of New Berlin, WI, and a look at how APG-Neuros's turbo aeration blowers treat industrial wastewater for poultry processors and food and beverage plants.

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# Subscribers From Around the World

We salute all Best Practices Magazine subscribers from around the world who own, operate, maintain, engineer and provide expertise for the on-site utilities (compressed air, nitrogen generation, vacuum, blowers, chillers, cooling towers and pumps) powering modern plant automation. This subscriber-driven monthly column hopes to build community and recognize all subscribers!



← In August, Compressed Air & Cooling Best Practices Publisher Roderick Smith was pleased to attend a celebration honoring 60 years of Sullair manufacturing air compressors in Michigan City, IN (Sullair became a Hitachi Group company in 2017). The day included a company picnic that brought together employees, their families and guests. While there, he got this picture of Brit Thielemann, Director of Application Engineering and Customer Experience (left), his wife Jodi (right) and their grandson Oliver (center). Look for a feature on Sullair's rich history in our next issue. Visit <https://www.hitachiglobalairpower.com>.

→ Advanced Compressor Technologies of Evansville, IN, was founded in 2010. It offers a wide range of compressed air services, including turn-key installations, routine maintenance and air or energy audits. Pictured here are Ward Furniss, Mackenzie Lukeman and Todd Riley (left to right). Owner and Founder Riley has over 30 years' experience in the compressed air industry. Look for a case study on a project the company did for a woodworking plant to appear in this magazine in 2026. Visit <https://advancedcompressortechnologies.com>.



← Imperion delivers industrial engineering consulting services designed to enhance resilience, operational efficiency and regulatory compliance. Specializing in the implementation and validation of ROI-driven energy efficiency projects, it has secured over \$22 million in FPIP grant funding for clients. Pictured here are Emma MacKinnon, Jack DiGiacomo, John Sturdivant and Thomas Cochran (left to right). In 2026, we'll present a case study on a project it did for a California meat processing plant. Visit <https://goimperion.com>.

## Submission Guidelines

We invite our subscribers to send in pictures so we can see the people who read our Best Practices magazines! Those holding a recent magazine issue will receive first consideration. Please send a high-resolution picture as a JPG with a note describing the team and company to Troy Dreier at [troy@airbestpractices.com](mailto:troy@airbestpractices.com).

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# NEWS / Compressed Air Industry & Technology

## Sullair Celebrates 60th Anniversary with Company Picnic and Public Art Donation

Hitachi Global Air Power celebrated a major milestone – 60 years of manufacturing air compressors in Michigan City, IN – with a company picnic that brought together employees, their families and distinguished guests to honor the company’s legacy, people and deep roots in the community.

The picnic took place at the company’s Michigan City campus and featured food, games, music and entertainment. The celebration welcomed special guests, including Mr. Masashi Mizobuchi, Consul-General of Japan in Chicago.

Since the company’s founding in 1965, the Sullair brand has become synonymous with durability and innovation in compressed air solutions. Today, Hitachi Global Air Power continues to grow, enjoying more than \$45 million in investments from Hitachi – mostly in the company’s Michigan City manufacturing facility that employs more than 500 staff regionally.

In honor of the company’s 60th anniversary, Hitachi Global Air Power is gifting the city of Michigan City a mural, painted by renowned artist Felix Maldonado, Jr. The mural will depict imagery reflective of the region’s industrial heritage and will be painted on several city-owned retaining walls along Michigan Boulevard. The mural is expected to be completed in September 2025.

“This anniversary isn’t just about honoring our past – it’s a celebration of the progress we’ve made and the future we are building together,” said Hideki Fujimoto, President and CEO, Hitachi Global Air Power. “For 60 years, our air compressors have earned a global reputation for reliability and durability. I’m excited for what the next 60 years will bring.” For more information, visit <https://www.hitachiglobalairpower.com>.



Sullair marked 60 years of manufacturing air compressors in Michigan City with a picnic for employees and their families.

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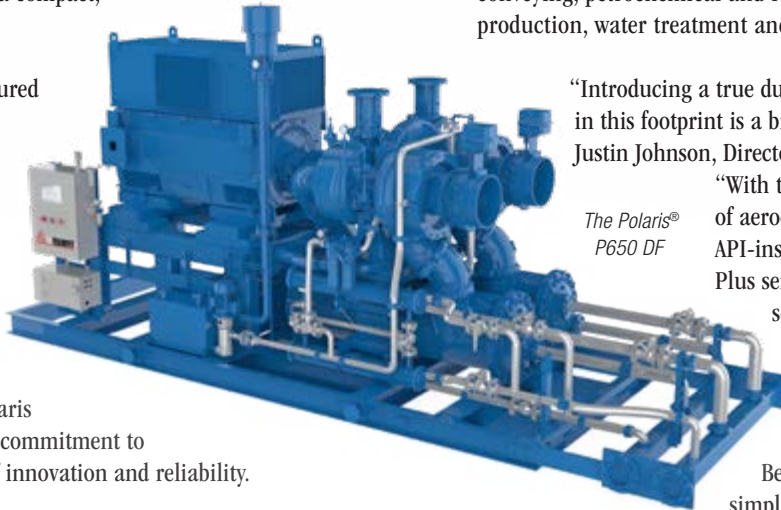
## FS-Elliott Unveils the Polaris® P650 DF, Combining Dual-Flow Capability with Compact Efficiency

FS-Elliott announced the launch of the Polaris® P650 DF, a dual-inlet, double-flow centrifugal air compressor designed to deliver exceptional capacity and efficiency in a compact, cost-effective package.

Engineered and manufactured in the USA, the P650 DF sets a standard for industries that demand large volumes of ISO 8573-1 Class 0 oil-free compressed air, without the footprint or cost of a larger frame air compressor. As the newest addition to the Polaris line, it reflects FS-Elliott's commitment to pushing the boundaries of innovation and reliability.

The P650 DF features two parallel air paths (dual inlets) that feed into a single combined discharge header, enabling flow rates of up to 20,000 cfm (280-560 m<sup>3</sup>/min) at pressures ranging from 30 to 50 psig (2.1-3.5 barg). By leveraging the proven P650 frame, FS-Elliott has doubled the flow capacity without increasing the physical footprint, enabling customers to reduce capital investment, simplify installation and avoid the operational complexities associated with larger units.

Designed for high-flow, low-pressure applications, the P650 DF is ideal for industries such as bio fermentation, pneumatic conveying, petrochemical and refinery operations, chemical production, water treatment and industrial gas applications.



“Introducing a true dual-flow centrifugal air compressor in this footprint is a breakthrough for our customers,” said Justin Johnson, Director of Product Management, FS-Elliott.

The Polaris® P650 DF

“With the P650 DF, we’ve taken decades of aerodynamic expertise and the same API-inspired design rigor that defines our PAP Plus series to deliver a compact, high-capacity solution. This air compressor sets a new benchmark for performance and efficiency, and we are proud to bring this innovation to the global market.”

Beyond performance, the P650 DF offers simplified maintenance through its split gear case, split bearing and seal design and fully removable airend, all of which allow for faster service without requiring major disassembly. Integrated with FS-Elliott's advanced Regulus® R2000 control panel, operators benefit from intuitive touchscreen monitoring, real-time energy optimization and proactive maintenance notifications, helping to ensure maximum uptime and efficiency. For more information, visit <https://www.fs-elliott.com>.





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# NEWS / Compressed Air Industry & Technology

## CS INSTRUMENTS Establishes North American Headquarters in South Carolina, Creating 13 Jobs

CS INSTRUMENTS, a manufacturer of compressed air measuring technology, announced it's establishing its North American headquarters in South Carolina's Beaufort County. The company's investment will create 13 new jobs.

"We are pleased to see CS INSTRUMENTS establishing its North American headquarters in our state. The company's investment is a testament to the thriving business environment we have created in Beaufort County and throughout South Carolina," said Gov. Henry McMaster.

Founded in Germany in 2002, CS INSTRUMENTS specializes in the production of reliable and innovative measurement technologies for compressed air and industrial gases. The company operates subsidiaries in 13 countries.

CS INSTRUMENTS will construct a new 11,000-square-foot headquarters facility, located at 8237 Pinellas Drive in Bluffton, which will house office space, warehousing and a service and training center. The new facility will increase product availability and the overall experience for North American customers.

"Establishing our North American headquarters in Bluffton is a strategic and exciting step forward for CS INSTRUMENTS. The region's

strong business climate, skilled workforce and exceptional quality of life make it an ideal home for our growing team. We are especially grateful to the town of Bluffton, the Beaufort County Economic Development Corporation and the Southern Carolina Alliance for their unwavering support and partnership throughout this process. Their commitment to fostering innovation and industry made our decision an easy one," said Martin Zeller, Country Manager, CS INSTRUMENTS.

Operations are expected to be online in December 2025. For more information, visit <https://www.cs-instruments.com>.



Rendering of CS INSTRUMENTS' new North American headquarters in Bluffton, South Carolina

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## Atlas Copco Group Acquires Talleres Haizea

Talleres Haizea, a service and spare parts provider of high-pressure reciprocating air compressors, has become part of Atlas Copco Group.

Haizea is located in San Sebastian, Spain. The company focuses on service, spare parts sales and energy efficiency optimization, and operates across Spain, Portugal and Latin America.

"With this acquisition, we will be able to offer our customers an even better service offering, particularly in the high-pressure air compressor service business. Moreover, the acquisition will allow us to reach a wide range of customers to carry out energy audits to improve energy saving in their factories, as well as increase opportunities in the refurbishment and replacement markets," said Philippe Ernens, President, Compressor Technique Business Area.

The purchase price is not disclosed. During 2024, Haizea had revenues of approximately 4,5 MEUR (51 MSEK). The company becomes part of the service division within the Compressor Technique Business Area. For more information, visit <https://www.atlascopcogroup.com>.

\*Average exchange rate in 2024.

### Compressed Air Challenge at 25: Celebrating a Legacy of Efficiency, Education and Collaboration

This year marks the 25th anniversary of the Compressed Air Challenge (CAC), a milestone in industrial energy management. Since its official formation in 2000, CAC has revolutionized how manufacturers and energy professionals approach compressed air systems, which were regularly overlooked and notorious for inefficiency and waste.

Founded through a partnership with the U.S. Department of Energy, ASME and leading industrial organizations, CAC was created to provide unbiased, practical resources for improving compressed air performance. Its mission is to help companies boost productivity while reducing energy use and environmental impact.

Over the past quarter-century, CAC has trained tens of thousands through programs including “Fundamentals of Compressed Air Systems” and “Advanced Management.” Its workshops, offered nationwide and online, have become essential tools for plant operators, engineers and utilities. CAC’s extensive library of fact sheets, articles and case studies continues to guide best practices in system design, maintenance and optimization.

The organization’s non-commercial, consensus-based approach has fostered collaboration across manufacturers, utilities and end-users. CAC-trained professionals have helped facilities save millions in energy costs and reduce greenhouse gas emissions.

Adaptability has been key to CAC’s success. It embraced digital learning and customized training for diverse industries, and integrated emerging technologies, including AI and remote monitoring. As industries face new challenges, such as decarbonization, global expansion and workforce development, CAC remains a vital resource.

In a landmark development in January 2025, CAC joined forces with the Compressed Air & Gas Institute (CAGI), becoming its official Education Foundation. This strategic alignment expanded CAC’s reach and reinforced its role as the go-to resource for energy-efficient compressed air systems. For more information, visit <https://www.compressedairchallenge.org>.

### Sales Engineering Workshop Debuting at Best Practices 2025 EXPO & Conference

The Best Practices 2025 EXPO & Conference is hosting its first Sales Engineering Workshop, designed for compressed air, industrial cooling, blower and vacuum sales engineers. It is one of the four new conference workshops being introduced at the conference this year. The show is in Kansas City, Oct. 21-23.

In the compressed air and industrial water cooling industries selling technical product solutions, it’s common for engineers and technicians to take on sales roles. They understand the products and applications, but rarely receive formal sales training. This workshop will help transform technical product experts into top-performing salespeople.

The workshop will deliver interactive training. Topics covered include the formal sales process, tips to earn meetings with new prospects, discovery questions, qualifying questions, closing skills and how to design conversations that lead to revenue.

The workshop will be led by Mark Allen Roberts, CEO, OTB Solutions. For over 35 years, Roberts has trained manufacturing company salespeople, including major OEM manufacturers like Timken, Step2, Gardner Denver, Sullair and others, as well as compressed air distributors and manufacturers’ representative sales teams.

The Sales Engineering Workshop takes place Tuesday, Oct. 21, 10:30 a.m. to 2:30 p.m., with an hour break for lunch. Attendees will earn three professional development hours. To register, visit <https://cabpexpo.com/ks-2025>.



Mark Allen Roberts, CEO, OTB Solutions, will lead the Sales Engineering Workshop.




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# NEWS Chiller & Cooling Industry & Technology

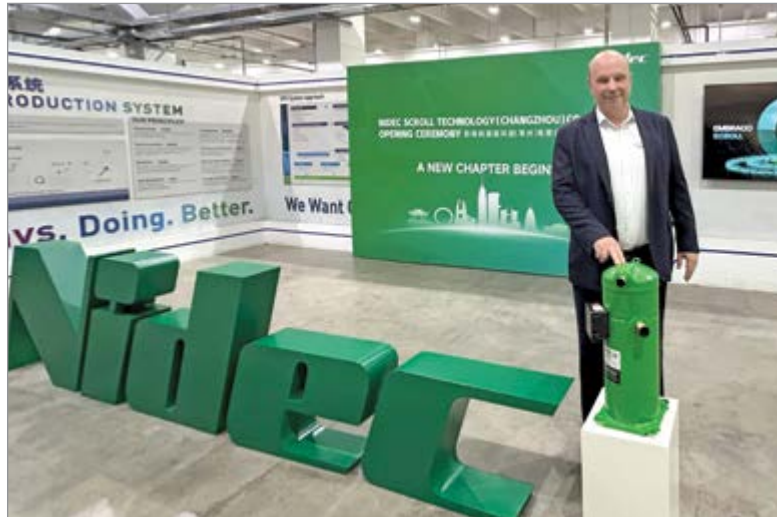
## Nidec's Embraco Brand Expands Its Scroll Refrigerant Compressors Portfolio and Enters the HVAC Market

Nidec Global Appliance (GA) announced its brand Embraco, a global provider of refrigeration technology for the residential and commercial cold chain, will significantly expand its product offerings. As part of GA's growth strategy, the company has acquired the scroll refrigerant compressors manufacturer Xecom, and this acquisition extends Embraco's capabilities to the HVAC markets while broadening its presence in the refrigeration segment, solidifying its position as a complete solutions provider.

Scroll refrigerant compressors, renowned for their reliability, energy efficiency and extended cooling capacity, have already been part of Embraco's portfolio, and this product offering expansion is a pivotal addition to the brand's market position. Embraco introduces a portfolio that extends its presence in refrigeration to heating and air conditioning. The new lineup includes solutions for commercial and residential applications such as cold

rooms, heat pumps, rooftop chillers, packaged units and central ducted home air conditioners. The newly-integrated scroll refrigerant compressors line ranges from 1.2 to 35 horsepower (hp) and supports multiple refrigerants, including R410A, R404A, A2Ls and R290.

Alberto Casnati, President, Nidec Global Appliance, said, "This is a milestone for Nidec Global Appliance and Embraco, as it now becomes a brand for all climates. This acquisition positions us as a more robust player in scroll technology, empowered to deliver high-performance solutions for refrigeration, heating and air-conditioning while enhancing our technological capabilities. The expanded scroll portfolio is tailored to meet the diverse needs of OEMs and the aftermarket in both residential and commercial segments and comply with strict international regulations." For more information, visit <https://www.embraco.com> and <https://www.nidec.com>.



Alberto Casnati, President, Nidec Global Appliance, with an Embraco scroll refrigerant compressor.

## Baltimore Aircoil Company Introduces QuickCross™ Replacement Fill Kits for Crossflow Cooling Towers

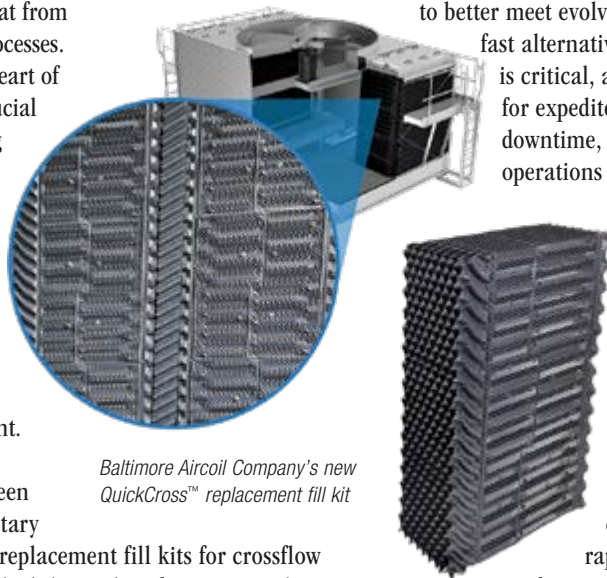
Baltimore Aircoil Company (BAC), announced the launch of QuickCross™ replacement fill kits, a new option for crossflow cooling towers designed to provide customers with a fast, cost-effective solution for fill replacement needs.

Cooling towers efficiently reject heat from condenser water and industrial processes. Maintaining the fill media – the heart of where heat transfer occurs – is crucial for energy efficiency and operating cost savings. The performance of the system depends on the fill to maximize evaporation and ensure even water distribution. Over time, the fill may degrade or get fouled, requiring replacement due to improper equipment maintenance, poor water treatment or aging equipment.

For over eight decades, BAC has been recognized for its original proprietary hanging fill. BAC offers BACross® replacement fill kits for crossflow cooling towers, delivering unmatched thermal performance and

efficiency. BACross kits are high-performing and efficient replacement fill, engineered for long-term reliability and optimal system operation.

With the introduction of QuickCross replacement fill kits, BAC is expanding its fill replacement options for crossflow cooling towers to better meet evolving customer needs. QuickCross kits offer a fast alternative for situations where rapid fill replacement is critical, and budget constraints are a priority. Designed for expedited installation, QuickCross kits minimize downtime, allowing customers to quickly restore operations with fill kits for select Series 3000 cooling towers available with one-week shipping.



Baltimore Aircoil Company's new QuickCross™ replacement fill kit

"BACross® replacement fill kits, BAC's OEM hanging fill, remain the gold standard for efficiency and thermal performance for crossflow cooling towers," said Henry Bodenshteyn, Business Manager, Aftermarket, BAC. "However, when installation speed and upfront cost are key considerations, QuickCross™ kits are the go-to solution, delivering a budget-friendly option with rapid turnaround backed by BAC." For more information, visit <https://baltimoreaircoil.com>.

### Automated Logic Canada Acquires Control Solutions

Automated Logic – Canada (ALC), a part of Carrier Global Corporation, announced it has acquired Control Solutions (CSL), an independent provider of integrated building-automation systems headquartered in Coquitlam, British Columbia. The transaction establishes ALC's first company-owned controls field office in Vancouver, significantly expanding its intelligent building-automation footprint in Western Canada.

Control Solutions designs, installs and services building automation systems for complex facilities across commercial real estate, education, data centers, residential and large mixed-use developments. The company's 100-plus employees deliver advanced building automation and control solutions, retrofit upgrades and multi-year service contracts that help customers optimize energy performance and operational resilience.

"This acquisition represents a strategic step in strengthening Automated Logic's presence in Canada and expanding our ability to deliver integrated, intelligent building solutions in high-growth sectors across British Columbia," said Andy Bierer, Managing Director, ALC Field.

CSL's existing leadership and employees will remain in place, continuing to serve customers from its Coquitlam office and project sites across the province. Terms of the transaction were not disclosed. For more information, visit <https://www.automatedlogic.com>.

### Tower Tech Launches ServiceShield™ Program, a Proactive Tower Performance Package Included with All Its Towers

Tower Tech, a leading manufacturer of modular FRP composite cooling towers, has announced the launch of its ServiceShield™ program. This package of benefits is included with every Tower Tech purchase with the goal of maximizing the performance of these top-of-the-line modular cooling towers.

By registering their cooling tower during installation, customers activate benefits such as year complete labor and warranty coverage, free inspection (within the first three years), on-site certified startup and customer service operator training, VIP customer support and access to OEM parts.

The ServiceShield program helps customers maximize the service life of their Tower Tech modular cooling tower, increase uptime and ultimately minimize costs, all at no additional cost. For more information, visit <https://towertechusa.com>.



*Tower Tech cooling tower installation at a school*

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# NEWS / Industrial Energy & Water Conservation

## Zentiva Climate Targets Validated by the SBTi, Commits to 63% Scope 1 and 2 Emissions Reduction by 2034

Zentiva, a European pharmaceutical company that develops, manufactures and markets a wide range of generic and OTC products, announced a significant step forward in its sustainability strategy with official validation of its targets by the Science Based Targets initiative (SBTi).

By setting near-term and long-term net-zero greenhouse gas (GHG) reduction targets in line with the SBTi, this commitment reinforces



Zentiva's headquarters in Prague, Czech Republic

Zentiva's dedication to sustainability and aligns its decarbonization roadmap with the European Union's goal of becoming the first climate-neutral continent by 2050.

Zentiva's overall net-zero target is to achieve net-zero greenhouse gas emissions across the value chain by 2050. For its near-term targets, Zentiva commits to reducing absolute Scope 1 and 2 GHG emissions 63% by 2034 from a 2021 base year and Scope 3 GHG emissions 63% by 2034 from a 2024 base year. The company's long-term targets are to reduce absolute Scope 1 and 2 GHG emissions 90% by 2050 from a 2021 base year and Scope 3 GHG emissions 90% by 2050 from a 2024 base year.

"We are proud the SBTi has validated our climate targets. Europe is heating up and climate change is no longer a distant threat, but our present reality. Ambition alone won't cool down the planet. We have to turn the ambition into action, and our strategy for decarbonization is the cornerstone of that. Thanks to the engagement of our team and our partners, we can make a meaningful impact across our operations and communities. We cannot fight climate change alone. At Zentiva, every small step counts, and we are proud of our achievements so far," said Ines Windigsch, Head of Corporate Affairs & Sustainability, Zentiva. For more information, visit <http://www.zentiva.com>.

## TreeHouse Foods Announces 2025 Sustainability Report

TreeHouse Foods, a leading private brands snacking and beverage manufacturer in North America, released its 2025 Sustainability Report, which captures progress made during 2024 toward the company's 2030 sustainability goals.

In the report, TreeHouse Foods highlights a focus on improving resource efficiency, with continued resources dedicated to meeting its targeted 25% Scope 1 and 2 greenhouse gas (GHG) reduction by the end of 2030. As of the end of 2024, the company had achieved a 6.6% reduction in Scope 1 and 2 emissions from the 2022 baseline. It also reduced water withdrawn in manufacturing operations by nearly 17% from the 2022 baseline.

"We are committed to continuing to improve resource efficiency on the pathway to achieving our 2030 reduction goal," said Steve Oakland, Chairman, CEO and President, TreeHouse Foods. "As is our practice, we will continue to communicate transparently with stakeholders on our emissions reduction activities, including progress within our operations throughout North America, and our global supply chain." For more information, visit <http://www.treehousefoods.com>.



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## Ferrero Group’s Sustainability Report Shows Commitment, Innovation and Impact in the Face of Global Challenges



Ferrero Group’s headquarters in Luxembourg

The Ferrero Group, a manufacturer of branded chocolate and confectionery products, announced the latest progress in its sustainability journey, with the release of its 16th sustainability report. Guided by Ferrero Group’s long-standing commitment to having a positive impact throughout its value chain, the report shares the significant and continued progress the business has made across its key sustainability priorities.

Ferrero has made strong progress toward its 2030 goal of halving greenhouse gas emissions, with significant reductions already achieved compared to its 2017/18 baseline. The company’s Scope 1 and 2 emissions were reduced by 21.7%. For Scope 3, FLAG (forest, land and agriculture) and non-FLAG emissions were disaggregated to improve carbon accounting and enhance data reliability and accuracy. 90% of electricity for manufacturing and warehousing is now sourced from renewables. 100% of Ferrero plants are certified against the Global Food Safety Initiative (GFSI) Standard.

“Sustainability is deeply embedded in Ferrero’s long-term strategy. It’s a fundamental driver of business resilience and shapes the decisions we make, as we grow responsibly,” said Giovanni Ferrero, Executive Chairman, Ferrero Group.

“We made steady progress on our sustainability agenda during fiscal year 2023/2024. I am particularly proud of the ongoing steps we are taking to achieve our long-term commitments. We have successfully advanced our sustainability journey while maintaining strong financial stewardship across the company,” said Lapo Civiletti, CEO, Ferrero Group. For more information, visit <https://www.ferrero.com>.

## Ingersoll Rand Celebrates a Landmark Year in Sustainability and Growth

Ingersoll Rand announced its most impactful year yet in sustainability, innovation and operational excellence. The company’s 2024 sustainability report, “Enabling Growth: Leading Sustainably with Purpose,” highlights transformative progress and responsible business practices.

The company was validated by the Science Based Targets initiative (SBTi) for scope 1, 2 and 3 near-term and net-zero targets aligned to 2.7°F (1.5°C). Ingersoll Rand achieved 61% progress towards its SBTi validated scope 1 and 2 greenhouse gas (GHG) emissions reduction goal of 42%.

Ingersoll Rand was named to the A List by CDP in the environmental stewardship and supplier engagement leadership categories for the second year in a row.

“2024 was a milestone year for Ingersoll Rand,” said Vicente Reynal, Chairman and Chief Executive Officer, Ingersoll Rand. “We proved that sustainability and growth are not only compatible but mutually reinforcing. Our commitment to sustainable innovation is accelerating value to customers, improving operational efficiency, expanding market opportunities and delivering long-term value for shareholders.” For more information, visit <https://www.irco.com>.

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# Maple Leaf Foods Saves with Compressed Air and Heat Recovery Upgrade

By Troy Dreier, Senior Editor, Compressed Air & Cooling Best Practices Magazine

► Maple Leaf Foods is a multinational prepared meat and poultry producer based in Ontario, Canada. It was formed in 1991, when Maple Leaf Mills merged with Canada Packers. It specializes in bacon, ham and chicken products. Committed to sustainability, the company set a goal to reduce its overall environmental footprint by 30% by 2030.

The company's 402,000-square-foot Hamilton, Ontario, plant produces 20 million kilograms of prepared proteins annually, including hot dogs, sausages, and sliced meats. To improve operational stability and efficiency, the plant opted to add a new air compressor, move to a more efficient compressed air dryer and add a heat recovery system. Doing so led to 900,000 kWh in energy savings and \$86,870 (USD) in incentives. We spoke with Behzad Hosseinpour, Manager, Energy and Sustainability, P.Eng, and Ivor da Cunha, an independent consultant, about the project.

**Best Practices:** What was the plant's compressed air system like before you started work, and what were the main uses of compressed air?

**Hosseinpour:** The plant had two air-cooled, lubricated, rotary screw air compressors – one

fixed-speed, one variable-speed, both 250 horsepower (hp) – and used an air-cooled, fixed-speed, 200 hp rotary screw rental air compressor to provide extra cfm. The rental was on-site for a couple of years. The plant also ran a heatless desiccant compressed air dryer.

The main users of compressed air are instrumentation and air guns used to blow off empty packages. All the pneumatic systems require compressed air. All the valves and



Behzad Hosseinpour, Manager, Energy and Sustainability, P.Eng

solenoids for the process instrumentation do, as well. We have sanitation drop-down stations within the plant at every production line, so employees can connect their hoses during cleaning, if needed.

We have a system inside the plant that uses compressed air for blow-off. It has a sensor, so it's efficient. When the sausages and wieners are going through a packaging machine, sometimes the packaging machine can't fill the product. You end up with empty packages. We have air knives that blow off the empty packages so they don't confuse the robot. It picks the packages up and puts them in a box.

Also, we use some compressed air to keep our electrical panel inside the plant pressurized. Otherwise, the water ingress will get into it and cause a host of issues. I'm trying to do away with that use.

When the plant is in full production and transitions to sanitation mode, compressed air consumption falls from 2,000 cfm to 100 cfm.

**Best Practices:** What was the reason behind this project? What was your goal?

**Hosseinpour:** The old system wasn't sustainable because we were paying monthly fees for the rental air compressor. Also, it

Above: The Maple Leaf Foods plant in Hamilton, Ontario

was inefficient. For more energy savings and to become more energy efficient, we decided to add a permanent 250 hp air compressor and upgrade the compressed air dryer from a heatless desiccant compressed air dryer with a purge rate of 18% to a heated desiccant blower purge compressed air dryer with a purge rate of only 3%.

We also added a heat recovery loop on the exhaust of the main air compressor, because now our fixed-speed air compressor is the lead machine, and the variable-speed air compressor is the trim. The heat recovery loop heats water for sanitation, heating about 19 gpm.

**Best Practices:** How was the old compressed air system inefficient?

**Hosseinpour:** One existing air compressor was a rental and not fully integrated into our compressed air system. We upgraded the desiccant compressed air dryer to improve operational efficiency, reduce energy consumption and save on the combined cfm. We save close to 900,000 kWh of electricity, and about 704 cfm every weekday.

The air compressors follow production so they pick up during production hours, then calm down during off-production hours. Having the VSD working at the optimal capacity is helpful. Before, the VSD was always maxed out. But now it runs at an optimum efficiency of 40-60% its rated capacity.

**A New Air Compressor and Flow Meters Deliver Efficiency Gains**

**Best Practices:** How did you select the new air compressor?

**Hosseinpour:** We bought directly from Ingersoll Rand. We already had two of its air compressors. To make service and maintenance easier, we decided to get the same unit so we could place one service call and have them all serviced. We bought the same model air compressor, but it's more modern.

Now that we have an extra fixed-speed air compressor on site, the second unit doesn't have to run as often. When there's a service call, they can shut down one air compressor and run the other unit. We can modulate between the two units.



*If packages aren't filled correctly, air knives blow them off the conveyor belt.*

**Best Practices:** This project involved a partnership with CDI Meters. How did that come about?

**Hosseinpour:** We rely on CDI Meters every day. It's a dependable company. I reached

out to Roger Dennison, the Owner, in 2021 and said, "We have a situation: It would be great to know the individual consumption for every part of our compressed air system, but there are no flow meters for the wet side." He said, "We're prototyping new flow meters

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## » Maple Leaf Foods Saves with Compressed Air and Heat Recovery Upgrade

now. Do you want to partner up?" We said yes, and we got two prototype meters at no cost. The condition was that we deploy them and share the performance data, because the company was still in the development phase.

The output of our two fixed-speed air compressors are four-inch lines. Luckily, CDI had four-inch line prototypes. Once we installed the flow meters, they helped us verify savings and uncover operational deficiencies, such as an issue at startup.

**Da Cunha:** When our fixed-speed air compressors would start, they would fight against each other. By having flow meters in place, we could see the issue and inform the operators to gradually start the air compressors. We got the VSD air compressor to load and unload as a secondary air compressor as opposed to a primary. In other words, the meters eliminated or reduced the issue of air compressors fighting against one another, and helped create more of a seamless transition.

**Hosseinpour:** At the time, we didn't have an air compressor control system, so it was crucial to have these flow meters. We



The plant's VSD air compressor now runs at an optimum efficiency of 40-60% of its rated capacity.

connected them to the building's automation system so the operators could see them. When they saw the results, it was an informative moment for them. Now, they knew exactly what was happening. Prior to installing those meters, they were acting blind. There was no oversight. These meters enabled them to make informed decisions based on data.

**Da Cunha:** With a large production plant like this, there's a big shift change and people go for lunch at certain times. During those times, there was quite a swing in the air compressor pressure between about nine psi and 120 psi. That was the most critical juncture where the air compressors needed to be sequenced and controlled; otherwise, they were just running full.

**Best Practices:** Have these flow meters led to significant energy savings?

**Hosseinpour:** Yeah, it's about 900,000 kWh of savings.

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**Best Practices:** How did you calculate that?

**Da Cunha:** The baseline was done prior to Behzad and me being involved in the project, back in 2017, by the previous consultant. I was involved in the project starting in early 2021. We used three-phase power meters and did a two-week analysis on the entire facility. We came up with the kilowatt-hours, kilowatts and cfm for that period. Then, we compared that to what the previous consultant had calculated.

**Heat Recovery Saves on Sanitation Hot Water Costs**

**Best Practices:** How did you decide you wanted to add a heat recovery system?

**Hosseinpour:** Everybody knows air compressors lose a lot of energy to the heat of compression. About 85% of the electricity used is converted to heat as opposed to compressed air. We knew right off the bat we had to do something about that instead of wasting heat and sending it to the atmosphere. We decided to make a loop out of that whole system, connecting to a loop of cold water. We have a sanitation tank in close proximity to the air compressor system. The heat recovery system heats 19 gpm of water to 145°F (63°C). That’s the temperature requirement for our sanitation water.

The loop only connects to the lead air compressor, so when we switch to the secondary air compressor we don’t gain heat, but the lead air compressor is on 90% of the time. The secondary air compressor is the backup.

**Best Practices:** What’s the sanitation water system used for?

**Hosseinpour:** Every food plant has two phases: a production phase and a sanitation phase, which starts right after the production phase. During the sanitation phase, the plant uses chemicals and hot water to clean the plant and sanitize it. It needs hot water for that purpose.

Our system uses natural gas to heat that water, but having a heat recovery system using wasted heat is a cherry on top because we recover that heat at no cost. We offset natural gas by reusing the wasted heat of the air compressor.

**Best Practices:** How do you transfer the heat?

**Hosseinpour:** We installed a small pump, then ran the water as a loop. It’s basically a heat exchanger. We capture the heat to that water, and it goes all the way to the tank.

**Calculating Savings to Qualify for Energy Incentives**

**Best Practices:** Was this project led by in-house engineers?



Prototype wet side compressed air flow meters helped the plant detect issues at startup.

## » Maple Leaf Foods Saves with Compressed Air and Heat Recovery Upgrade



The plant's heat recovery system uses heat from the main air compressor to heat water for sanitation.



numbers available at the time. The final numbers needed to be based on how much we could actually deliver. After the post-measurement and verification, we delivered that 900,000 kWh figure.

**Best Practices:** What was the ROI?

**Da Cunha:** Maple Leaf Foods, as a corporation, has set high and ambitious goals for reducing energy and saving greenhouse gases. The corporate office saw this as a great opportunity that – if it could be proven and demonstrated – would be a leadership project for other plants to follow.

**Hosseinpour:** We're the world's first major food processor that has committed to carbon neutrality. We follow the Science Based Target initiatives and have a mandate to reduce our overall environmental footprint by 30% by 2030. The project was a big investment that required significant commitment, but was demonstrated to tie nicely with our overall sustainability goals.

**Hosseinpour:** We're the world's first major food processor that has committed to carbon neutrality. We follow the Science Based Target initiatives and have a mandate to reduce our overall environmental footprint

**Hosseinpour:** We worked directly with Ingersoll Rand on the system design and engaged Ivor for his expertise in measurement and verification. To meet IPMVP standards for measurement authentication, Ivor helped quantify and validate the energy savings. We finished the measurement and verification in May 2021.

It was one of the factors that made the company decide to proceed with this big investment. We struggled a little bit before Ivor joined, but with his expertise we managed to satisfy the requirement.

We applied before the project started, and were approved based on the preliminary

**Best Practices:** This project received incentives from the Independent Electricity System Operator (IESO). Can you tell us more about that?

**Hosseinpour:** The IESO has a program called Save on Energy that's been around for as long as I can remember. It offered a funding opportunity that incentivized companies to install more efficient systems based on cumulative cfm savings. That's why it's important to follow the IPMVP protocol. Ivor's report provided a detailed technical assessment that satisfied the requirement and they granted us funding.

**Best Practices:** How did that contribute to offsetting costs?

**Hosseinpour:** It was crucial. The incentives were built in as part of the overall return on investment when the project was first presented to leadership.



Heated blower purge desiccant compressed air dryers are now standard for all upgrades at Maple Leaf Foods plants.

by 30% by 2030. It was a big investment, but leadership decided to proceed because it tied nicely with our overall sustainability goals.

**Best Practices:** How would you rate the overall stability and efficiency of the completed system?

**Hosseinpour:** Overall, the system is running more efficiently. The operators are happier because they get to see the numbers. They don't have to go all the way from the control room to the air compressors all the time. Now, when there's a concern, they can trend back in time and see what happened.

Having those flow meters and stabilizing the operation has been a great help, both for energy saving and overall operational efficiency. Sometimes, when you have a 250 hp air compressor modulating, oil gets into the compressed air system. For food plants, the compressed air must be dry and clean. We have a compressed air treatment system, but a large air compressor isn't designed to be modulated.

**Best Practices:** Do you need to meet certain ISO guidelines for food production?

**Hosseinpour:** Our air doesn't come in direct contact with the food. In Canada, we have to meet Canadian Food Inspection Agency guidelines, but that's why the oil we use is food-grade.

**Best Practices:** Has this project inspired work at other Maple Leaf Foods plants?

**Hosseinpour:** Absolutely, yes. As a result of the success of this project, the heated blower purge desiccant compressed air dryer has become the standard for every manufacturing site. Every upgrade the company does includes a heated blower purge desiccant compressed air

dryer because we wanted to do away with the 18% purge rate of heatless desiccant dryers.

We also advocate for installing flow meters on any new compressed air system. A plant operator might think he needs a new air compressor, but he doesn't need a new air compressor: He just needs to fix some of the leaks. How do you know how much compressed air leakage you have? You need a metering system. You need to make sure your air compressors don't fight each other all the time. It comes together under one umbrella when you start looking at it. The more you can do with heat recovery, it just adds up.

For more information, visit <https://www.mapleleaffoods.com>. **BP**

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## ADG Concepts Solves Years of Piping Problems for Frozen Foods Plant

By Troy Dreier, Senior Editor, Compressed Air & Cooling Best Practices Magazine

▶ A frozen food processor in North Texas had more problems with its compressed air system than it realized. All it knew for certain was that adding additional air compressors wasn't helping.

ADG Concepts is based in Saginaw, TX, and describes itself as a compressed air, industrial vacuum, and nitrogen solutions company. It operates like an engineering firm crossed with an installer, solving and fixing industrial utility problems for industrial clients.

ADG Concepts had a five-year history with this plant, having been brought in originally by an equipment salesperson to do installation work. Since then, it had been brought in many times for repairs. Each time there was a problem, plant management saw adding equipment as the solution. After years of attempting to educate its client, the company was finally hired to perform a compressed air system audit.

The audit of the existing system and the design of the new system were a collaborative effort

between the plant's engineers, the Quincy Compressor equipment salesperson, an auditor with the Draw Group and the ADG team.

"They got to a point where every time they added a new piece of equipment, it did not eliminate their rental, nor did it eliminate the water problems, the leaks and everything else



Ivan Suslaev, President, ADG Concepts

they were experiencing. The system had issues that adding more equipment simply could not fix," said Ivan Suslaev, President, ADG Concepts. "On top of the issues with the existing system, the plant was planning an expansion and buying new production equipment that required a lot more compressed air than the old production equipment provided. All their efforts at upsizing their compressed air system weren't getting any more air into production."

This plant has two main production facilities on the same campus, one older and one newer. The work described here was done in the older facility. Six air compressors in three locations fed this facility's compressed air system: four older air compressors in one location (all air-cooled, fixed-speed, 100 horsepower [hp] rotary screw air compressors, running partially loaded), a newer variable-speed drive (VSD) 200 hp rotary screw air compressor in a second location, plus an air-cooled, fixed-speed 75 hp rotary screw rental air compressor, which was located far from the production facility and lost much of its pressure due to undersized compressed air piping. All totaled, the plant should have gotten 2,855 cfm if all the air

Above: The employees at ADG Concepts of Saginaw, TX

compressors were fully functional. The company estimated the plant wasted \$41,500 yearly in energy costs. The rental cost was \$51,840 per year, and had been in place for over a year.

The plant uses compressed air for a variety of purposes, including shipping and receiving, running automated valves in the spice mixing room and combining ingredients in the bakery. Four electric industrial blowers powered the plant's air knives.

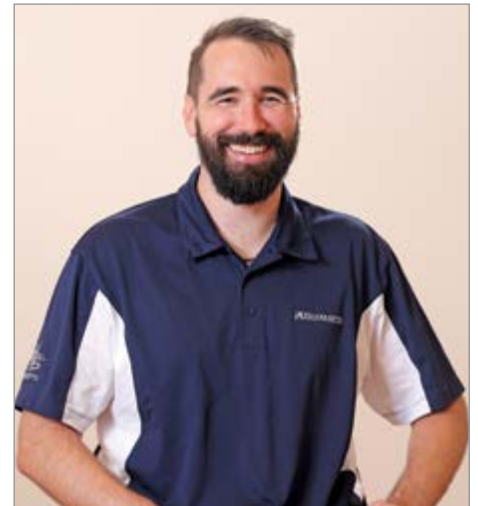
Water in the compressed air piping contributed to a variety of production problems. Shutdowns occurred routinely due to water interfering with the solenoid valves and actuators. Maintenance needed to perform frequent repairs to keep production machinery operational.

"A Schedule 80 stainless steel pipe for the plant's freezer was installed coming off the bottom of the header. Because of the improper installation and moisture in the compressed air system, it kept filling with water and freezing," Suslaev explained. "For as long as they had it, it never worked."

### An Interstitial Ceiling Hides Compressed Air Piping, But Also Hides Problems

The compressed air piping system was made from a variety of materials, including copper and stainless steel, but primarily black iron. Water in the compressed air system caused rust in the black iron piping, reducing airflow substantially. Half or more of much of the black iron piping was filled with rust. Oil seeped through most of the compressed air piping joints.

The plant has an interstitial ceiling, creating a space for compressed air piping, electrical lines, high-pressure water piping and process chemical piping that was kept separate from the food production area below in order to maintain cleanliness. The interstitial ranged in height from 18 to 48 inches. The building had been purchased from a different food processing company 30 years prior, and the plant simply added or modified piping over time, depending on its needs. The plant had no idea how many feet of compressed air piping were in the interstitial.



Jason Simon, Project Manager

The company's first task was to create a detailed map of the existing compressed air system. That took roughly a month, with Suslaev and his crew crawling every foot of the interstitial.

"Every possible inefficiency known to man, and then some new ones, we found in the interstitial," Suslaev said.

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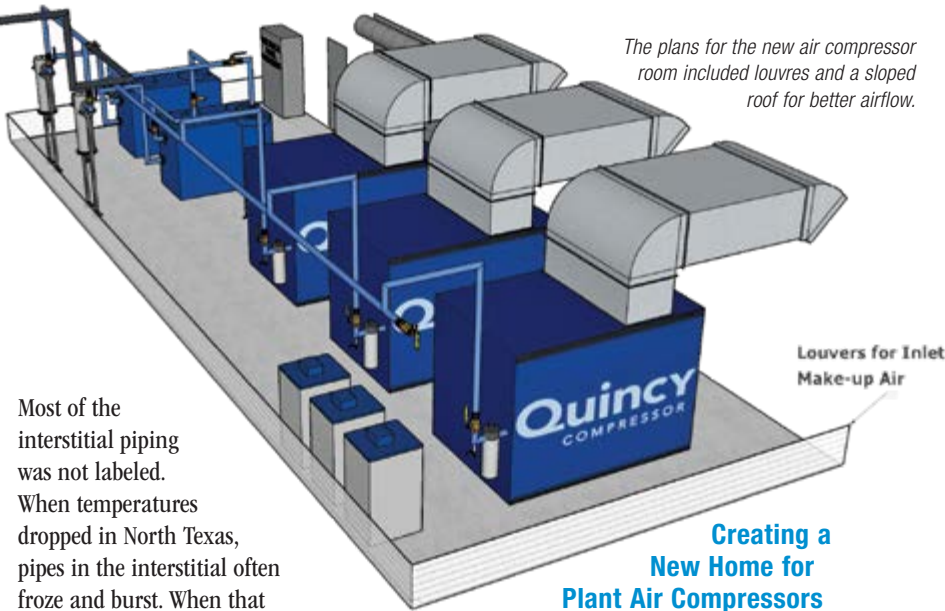
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## » ADG Concepts Solves Years of Piping Problems for Frozen Foods Plant



Most of the interstitial piping was not labeled. When temperatures dropped in North Texas, pipes in the interstitial often froze and burst. When that happened, plant management would send a technician up to cut out the damage and run new lines. This had gone on for 30 years, and the resulting system was a maze.

The company was surprised to find completely open pipes measuring one-half to three-quarters inches in the interstitial. Perhaps after a freeze, the wrong pipe was cut, Suslaev guessed. Multiple compressed air pipes blew openly.

The company's solution wasn't to repair or modify the existing compressed air piping system, but to create an entirely new system that delivered compressed air to the needed drops with the shortest amount of piping. It built this alongside the existing system so there would be no downtime. The new compressed air piping system took a different route from the older one, and unneeded drops were eliminated. Construction of the replacement compressed air piping system took six months. The company installed 2,650 feet of new Prevost aluminum compressed air piping, about half the length of the previous system. When it was ready, the company redirected compressed air from the older piping to the newly installed piping.

The compressed air piping includes six-inch headers from AIRnet aluminum piping connected to a 3,000-gallon dry storage tank, and a four-inch header running north to south. The company used pipe calculators from AIRnet, Prevost and the Department of Energy to verify it chose the right sizes. It opted to upsize piping slightly to leave room for future growth.

### Creating a New Home for Plant Air Compressors

The compressed air piping system wasn't the only thing that needed an overhaul; the control rooms and the air compressors did, as well. The compressed air system included two control rooms that fed into the same distribution piping. Due to the lack of a control system, the two control rooms fought each other.

The control rooms included controls for the compressed air system and other plant systems, including systems for ammonia, cold water and ambient heating and cooling. Three air compressors drew air next to five anhydrous ammonia compressors. In the event of a leak, this created the potential for contaminants to enter the compressed air system. Two old and poorly maintained refrigerated compressed air dryers were in this control room, as well. They couldn't keep up with the amount of compressed air fed into them, but there was no room for another refrigerated compressed air dryer. They allowed water into the compressed air piping, which is why pipes froze during cold snaps.

Even though space was at a premium, the company was able to demolish the second compressed air room and create one dedicated space for the compressed air system.

The company removed the process tanks that were there and demolished the old structure. It then poured concrete and built a new structure, one that only held compressed air equipment.



The new air compressor room gives the plant's air compressors and desiccant compressed air dryers a single home separate from other equipment.



Before starting work, the company created a detailed map of the plant's existing compressed air piping. The different colors in this map denote different sizes of compressed air pipes.

When the project was complete, this facility had just three air compressors: a new 200 hp fixed-speed and a 175 hp VSD, plus an existing 200 hp VSD used for redundancy, all located in a single air compressor room.

“One of the big wins we were able to accomplish with the new compressed air system was moving all of the compressed air equipment into its own dedicated building,” says Jason Simon, Project Manager. “Not only did that give a better environment for the compressed air system, it also provides a better environment for all of the other systems it used to share a space with.”

“In the two previous air compressor rooms, there was no way to get an adequate ambient air flow to keep the air compressors cool. This is one reason why we built the new air compressor room the way that we did,” Suslaev said. “The new air compressors are air-cooled. I’m proud of the way we designed the building. On one side of the building, we added louvres all across the bottom. We added hot air exhaust fans on top of the opposite side. We sloped the roof so the fans would draw cool air coming in across the air compressors and out the top. We ducted the air compressors on the opposite side of the building. Because it was a metal building, we



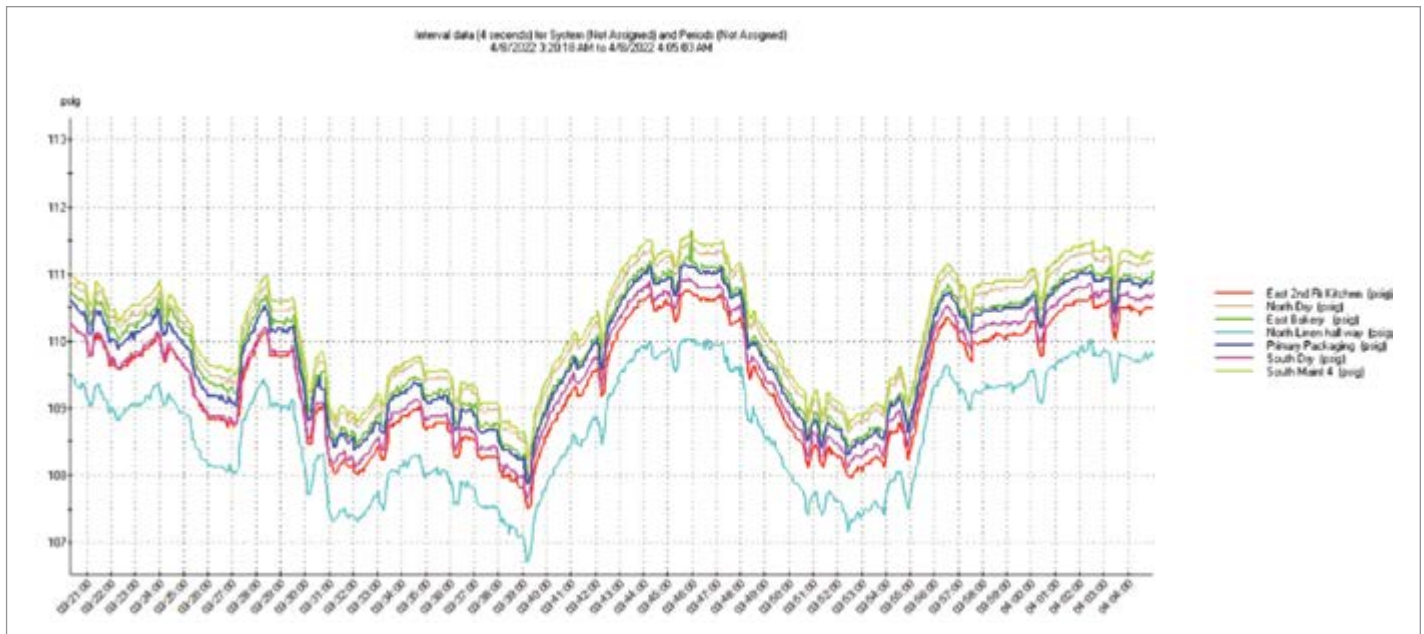
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## >> ADG Concepts Solves Years of Piping Problems for Frozen Foods Plant



Demand-side pressure measurements showed a 16-26 psi (1.1-1.8 barg) pressure drop. The company's study noted this was likely due to water as the filters and drains on the refrigerated compressed air dryers weren't working.

insulated it for sound attenuation and to reduce the heat load. You can walk into that building in the middle of summer, and the breeze created by pulling air across the equipment actually makes the room feel comfortable.”

The new compressed air system includes two large desiccant compressed air dryers, filtration and mist eliminators. The company didn't feel refrigerated compressed air dryers would provide a low enough dew point for the new production equipment, so it opted to go with a heated blower purge desiccant compressed air dryer with a 1.7% purge rate.

The company says the new compressed air system will satisfy the plant's compressed air demand and reduce energy use by 35-45% during production runtime. At current demand, it should lower energy costs by \$73,061 yearly.

### Installing a Compressed Air System Without Interrupting Operations

When the compressed air room was complete, the company brought the new compressed air system online while the old one was still working, and connected drops one at a time. The process took a month and a half.

“We worked around their schedule,” said Simon. “Whenever they had a cleaning or preventative maintenance on their

process equipment, they let us know the dates and the rooms that would be available. We never shut them down.”

Once the plant was switched to the new compressed air system, the company sent its technicians back into the interstitial, but this time to cut out and remove the old compressed air piping. Leaving it in would make future maintenance or expansion a challenge, so the company removed the old piping when it was no longer needed. At the end of the project, the rental air compressor was no longer needed, either.

With the rebuilt compressed air system now more efficient, the company's last step was to ensure it stayed that way in the future. It met with plant management to explain what should happen in the future.

“We educated the customer on the new system and gave them the compressed air system drawing once the project was complete,” Suslaev said. “We explained, ‘Anytime you

have somebody come in after this and make modifications to the compressed air system, please make sure you get updated as-built drawings. You have a fluid system. You constantly upgrade equipment. Here's the CAD file. If you need help updating it, we can help.” The plant has its own maintenance team, plus a contract with Quincy Compressors to provide routine maintenance to the air compressors.

Calculating energy savings for the project is difficult, as the plant upgraded its process equipment at the same time this work took place. However, the company was able to meet the increased production needs with fewer air compressors and provide a scalable system to accommodate future growth. **BP**

### About ADG Concepts

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# The Importance of Compressed Air Quality In Nitrogen Generation Systems for Food Packaging

By Mirko Krebs, President, KSI Technologies

► Consumers expect high quality and freshness from foods and beverages when shopping in supermarkets. Many processes in modern food and beverage technology employ compressed air. When compressed air is used in direct contact with food products, the highest purity demands need to be met to avoid contaminating the product. Shoppers expect long “best before” timeframes, giving them ample time to store the product until preparing and consuming it.

To achieve this, food manufacturers need to ensure their products survive the storage time in warehouses and on store shelves. To avoid the use of excessive amounts of preservatives, modified atmosphere packaging (MAP) offers a great alternative.<sup>1</sup>

MAP alters the gas environment inside food and beverage packaging to maintain product freshness and slow degradation and fouling processes. The exact gas mixture used needs to be tailored to the product and can vary significantly. For many products, nitrogen gas is part of the packaging mixture due to its inert nature. Nitrogen used for MAP is in direct contact with the food. However, for applications in the U.S., the Food and Drug Administration (FDA) does not have specific requirements or quality standards on nitrogen, so the general understanding is the use of Good Manufacturing Practice is sufficient with a minimum purity of 99.0%.

Applications in Europe need to be compliant with regulations that set the minimum specifications for food gas applications, where nitrogen is defined as additive E941 and requires a minimum purity of 99.0%.<sup>2</sup>

Best practices to navigate the sometimes unclear quality standards for compressed air in contact with food and beverages during production have already been established previously in this magazine. For a discussion of food safety practices and codes, read “Compressed Air GMPs for GFSI Food Safety

Compliance”, *Compressed Air Best Practices*<sup>®</sup> Magazine, January/February 2016.

## On-Site Nitrogen Generation Is on the Rise

While nitrogen in the quality outlined above can be purchased in bottles, many manufacturers are switching to on-site nitrogen generation. This offers a cheaper option in the long term due to free air that is used as an educt. It also avoids unnecessary transportation and nitrogen bottle management. However, since nitrogen generation systems use



Above: KSI Technology headquarters in Willich, Germany

Food and beverage production relies on contamination-free compressed air and nitrogen.

## >> The Importance of Compressed Air Quality In Nitrogen Generation Systems for Food Packaging



Example of a nitrogen generation system setup for food packaging.



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compressed air as an input, all investment costs should be evaluated before starting a project. Pressure swing adsorption generators producing nitrogen of quality 3.0 (99.9%) to 5.0 (99.999%) have an air factor between 5 and 7. This means that for every 1 scfm of high-quality nitrogen, between 5 and 7 scfm of compressed air are required. Membrane generators need an air factor of 2 to 5 to achieve nitrogen qualities of 1.5 (95.0%) and 2.5 (99.5%). Due to this large air requirement, nitrogen systems tend to require large air compressors and appropriately sized compressed air treatment systems. During operation, this incurs energy costs and ongoing maintenance, which should be highlighted in the total cost of ownership (TCO) calculation. Depending on the circumstances, this change can pose a profitable business case with a high ROI.

When changing from bottled nitrogen to self-generated nitrogen, food and beverage producers need to make sure the on-site generated nitrogen fulfills quality requirements and does not add contamination to their product. This article explores principles to separate air in industrial food production. The main focus is on quality requirements that protect the nitrogen generation systems

and result in compliance with industry standards or regulatory requirements for nitrogen gas used in food packaging.

**Nitrogen Generators and Inlet Quality Requirements**

Ambient air mainly consists of nitrogen (78%) and oxygen (21%). An industrial air separation system splits air into these two main parts in order to receive one of those gases in a given purity. For different applications, either oxygen or nitrogen is the desired output of the air separation system. In this article, we'll concentrate on nitrogen generators. In a nitrogen generator, oxygen is separated from the gas stream and discharged to the ambient air while the nitrogen is purified to reach the desired quality class and used in downstream processes. This separation process operates under pressure, since the phenomena used require a minimum pressure to function. The phenomena used in air separation units can be classified as selective permeability on membranes and adsorption forces on specialized desiccants.

In membrane nitrogen systems, generators guide the inlet compressed air stream through small, hollow membrane filaments. The specific material used for these fibers is more permeable to oxygen molecules than to nitrogen molecules. Therefore, the oxygen content is reduced by flowing through the membrane module, leaving nitrogen of a higher purity. The discharged oxygen escapes the membrane module through openings in the membrane housing. Membrane systems are often used for applications up to 150 cfm nitrogen and can deliver air factors of up to 2.5 or 3.0, depending on the system parameters. Given these constraints, membranes are a great choice for smaller applications or applications with medium purity requirements. The relatively simple process does not require regular maintenance or involve any moving parts, making it a stress-free option for many applications. The membrane filaments used in nitrogen generators are typically made from polymers. Membrane nitrogen generators usually require an ISO 8573-1:2010 compressed air quality of 1.4.1 to properly function and keep a long service life.

For larger nitrogen demands or higher purity requirements, PSA systems are usually a better choice. PSA stands for pressure swing adsorption, and it describes the regenerative

system consisting of two pressure vessels filled with a desiccant. At any given time, one of these vessels is used to adsorb mainly oxygen molecules, producing nitrogen at the outlet. Once the desiccant bed is saturated with oxygen molecules, the flow is redirected, and the inlet compressed air stream flows through the other vessel. The saturated desiccant bed is regenerated by a depressurized part of the purified nitrogen. This purge stream is guided through the bed in a counterflow direction and then ejected to the ambient air. Once the first vessel is regenerated, it stays on standby until switch-over. PSA nitrogen generators are more complex than membrane generators. Given the right system layout and inlet air treatment, they

can achieve the required results and maintain a relatively low total cost of ownership.

PSA nitrogen generators use a carbon molecular sieve (CMS) as desiccant material in the pressure vessels. CMS is not very hygroscopic, but it has been shown that moisture can negatively influence the adsorption performance of oxygen.<sup>3</sup> Since oxygen molecules have a slightly smaller kinetic diameter than nitrogen molecules (2.9 angstrom compared to 3.1 angstrom), oxygen adsorption to CMS is faster, and oxygen diffuses much faster in CMS than nitrogen.<sup>4</sup> Since oxygen accounts for roughly 1/5 of the inlet air, saturation of the desiccant bed is

Solid particles				Water		Oil	
Class	Maximum number of particles per m <sup>3</sup> with a particle size of d [µm]			Class	Pressure dewpoint	Class	Total oil (liquid, aerosol & vapour) [mg/m <sup>3</sup> ]
	0.1 ≤ d ≤ 0.5	0.5 ≤ d ≤ 1.0	1.0 ≤ d ≤ 5.0				
1	≤ 20,000	≤ 400	≤ 10	1	≤ -94.0°F / -70°C	1	≤ 0.01
2	≤ 400,000	≤ 6,000	≤ 100	2	≤ -40.0°F / -40°C	2	≤ 0.1
3	-	≤ 90,000	≤ 1,000	3	≤ -4.0°F / -20°C	3	≤ 1.0
4	-	-	≤ 10,000	4	≤ 37.4°F / +3°C	4	≤ 5.0
5	-	-	≤ 100,000	5	≤ 44.6°F / +7°C	5	> 5.0
				6	≤ 50.0°F / +10°C	X	

Quality classes according to ISO 8573-1:2010



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## » The Importance of Compressed Air Quality In Nitrogen Generation Systems for Food Packaging

reached significantly quicker than in the comparable desiccant dryer process. Nitrogen PSA systems have short cycle times of 2-3 minutes to allow for a compromise between cycle time and vessel volume. Typical compressed air quality demands for PSA nitrogen generators according to ISO 8573-1:2010 are 1.4.1.

### Achieving Inlet Air Quality for Nitrogen Generation

After having established the recommended inlet conditions for the most common types of nitrogen generators, we will now analyze them and draw conclusions on how to set up a proper treatment line.

The required quality class for particles is 1, meaning less than 20,000 particles with a diameter between 0.1 and 0.5 micron are allowed, less than 400 particles between 0.5 and 1.0 micron and less than 10 particles between 1.0 and 5.0 micron. Class 4 for water indicates a pressure dew point of less than 37°F (3°C) and class 1 oil requires less than 0.01 mg/m<sup>3</sup> total oil (liquid, aerosol and vapor).

First, let's break down where contamination could enter the compressed air system. An air compressor takes in ambient air and compresses it to operating pressure. Although air compressors have an intake air filter, most of the contamination already present in the intake air ends up in the compressed air. Moisture content in ambient air can differ significantly depending on plant location, layout and season. Due to the air compression process, air exiting the air compressor is usually saturated with water, which needs to be removed prior to entering the nitrogen generator. Particles may



Activated carbon towers reliably adsorb hydrocarbons.

stem from dust in the atmosphere, industrial emissions or abrasion particles. The air compressor itself can add particles due to friction on moving parts, degrading sealings and corrosion. Oils or hydrocarbons can be present in the intake air from unburnt vehicle emissions, refinery emissions and other emitants close by (such as airports, highways and generators), even if an oil-free air compressor is used. Of course, if an oil-lubricated air compressor is installed, this adds more hydrocarbon contamination to the system. The compressed air piping system, valves and instrumentation devices might add further contaminants due to leaks, sealings and aging materials.

Particle removal down to ISO class 1 can be safely achieved by using a 0.01 micron filtration system. To distribute the buildup of particles in different filters and not have excessive rise in pressure drops, KSI Technologies suggests using a coarse general filter (5 micron), a fine filter (1 micron) and a submicron filter (0.01 micron) before the first treatment stage.

In order to achieve class 4 moisture levels, a refrigerated compressed air dryer is usually sufficient. However, since class 1 oil is required, an activated carbon tower should be integrated to safely remove any hydrocarbons that might be introduced via intake air.

An activated carbon desiccant used for compressed air treatment is specially treated to adsorb predominantly hydrocarbon combinations; however, it still attracts humidity. Therefore, to reliably ensure the long-term operation of the activated carbon tower, a desiccant compressed air dryer should be used. Especially in locations with higher humidity levels during summer months, a properly sized desiccant compressed air dryer

producing air of moisture class 3 (with a pressure dew point of -4°F/-20°C) can add a safety margin for the nitrogen generator.

Therefore, a properly sized desiccant compressed air dryer followed by an activated carbon stage treats the nitrogen generator inlet air in order to achieve the required quality levels. A dry filter with 0.01 micron filtration grade ensures no harmful dust particles can enter the nitrogen system and damage either the membrane filaments or add unnecessary wear and tear on valve systems in PSA units. Particle contamination reduces the service life of valve systems and damages monitoring instruments.

Behind the nitrogen generation system, pure nitrogen is distributed throughout the plant to the point of use. To avoid any contamination during distribution, a point-of-use filtration system should be included. A sterile filter is a good option to capture any microorganisms in the system. Finally, high-quality nitrogen with minimal contamination is released to the packaging application. **BP**

### About the Author

Mirko Krebs is the President of KSI Technologies North America and has been active in the KSI Group for over ten years. Mirko has a Master of Science in Mechanical Engineering and Business Administration from RWTH Aachen University.



### About KSI Technologies

KSI is an independent manufacturer of compressed air treatment products based in Germany. Founded in 1996, the company expanded to the North American market in 2022 and supports compressed air shops with locations in North Carolina and Ontario. The product portfolio contains filtration and drying solutions, condensate management equipment and service parts. For more information, visit <https://ksi-technologies.com>.

1. <https://www.airproducts.com/applications/modified-atmosphere-packaging#:~:text=A%20proven%20way%20to%20effectively,to%20getting%20you%20started%20up.>

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3. S. Largsorse, F.D. Magalhaes, A. Mendes, Aging Study of carbon molecular sieve membranes, Journal of Membrane Science, Volume 310, Issues 1-2, 2008, Pages 494-502

4. Timothy J. Giesy, M. Douglas LeVan, Mass transfer rates of oxygen, nitrogen, and argon in carbon molecular sieves determined by pressure-swing frequency response, Chemical Engineering Science, Volume 90, 2013, Pages 250-257

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# Inside the 55 Water Street Heat Recovery Transformation

By Corey Letcher, Comprehensive Solutions Account Executive  
and Strategic Existing Buildings Solutions Team Leader, Trane

► In the world of commercial real estate, few buildings command a presence like 55 Water Street. Spanning 3.8 million square feet, it's the largest office building in New York City and the second largest privately-owned office building in the United States<sup>1</sup>, so large it claims to have its own ZIP code. For decades, it has been a cornerstone of the city's skyline and business community. But like many legacy buildings, it faced a modern-day reckoning: aging infrastructure, inefficient steam heating and the looming financial impact of New York's climate legislation, Local Law 97 (LL97).

The challenge was immense. How do you fundamentally transform the utility carbon make-up of a fully occupied, 53-story skyscraper without disrupting the high-profile tenants who depend on its seamless operation? The answer, it turned out, was not just to replace old equipment, but to completely reimagine how the building uses and reuses energy.

The 55 Water Street project is a first-of-its-kind electrification and heat recovery retrofit that has become a new benchmark for decarbonization, resilience and operational intelligence in dense urban environments.

## Thermal Storage Becomes a Source for Electrified Heating

Trane's journey with 55 Water Street began long before this project, with a collaboration spanning over a decade on various

infrastructure and energy upgrades. This long-standing relationship, built on trust and a deep understanding of the building's operational intricacies, was critical.

"I have a lot of trust with Trane," said Dan Palino, Chief Operating Officer, 55 Water Street. "It was a big commitment to get a project of this size completed in a year with no disruption to tenants, but I was confident in their ability to get it done."

The initial impetus for the project was a planned infrastructure upgrade. The building, constructed in the late 1970s, still relied on some of its original, 50-year-old steam-fired infrastructure. Management was considering a cooling resiliency project to replace these massive, inefficient machines. However, the passage of LL97, which sets strict carbon emission caps for buildings, changed the conversation. The potential for significant annual fines forced a broader, more strategic evaluation. Was a like-for-like replacement the right investment, or was there a more cost-effective long-term solution that could also improve heating resiliency?

This question led the building's owner, the Retirement Systems of Alabama (RSA), its energy management consultant and its engineering consultant to conduct a comprehensive energy master plan. It was during this analysis that a groundbreaking

concept Trane had been developing came into focus: a storage-source heat pump system. The idea was to leverage the building's existing assets, including a large thermal storage system, not just for cooling, but as a source for electrified heating.

The business case was compelling. Data from the building's Building Management System (BMS) showed that a heat recovery project could be financially viable on its own merits, based on the raw cost of district steam versus electricity in winter. What began as a compliance concern evolved into an opportunity for profound, long-term value creation through efficiency, resilience, flexibility and sustainability.

## Engineering a Hybrid-Electric Heating Solution

The core challenge was to electrify the building's heating without a cost-prohibitive, invasive overhaul of its end-use distribution systems. The solution was a sophisticated, cascaded heat recovery system designed to sequentially capture low-grade waste heat from multiple sources, concentrate it and repurpose it for high-grade heating. Multiple heat pumps work together to raise the hot water temperature to meet building requirements. It acts as an energy funnel, collecting diffused heat and channeling it where it's needed most.

*Above: 55 Water Street, New York City*

## >> Inside the 55 Water Street Heat Recovery Transformation

### Is Thermal Energy Storage Right for Your Industrial Facility?

The 55 Water Street project is a landmark for commercial real estate, but the principles of heat recovery and thermal energy storage (TES) have significant potential in the industrial sector, as well. However, the application and economic drivers can be different. Here are some key considerations and next steps for industrial facility managers evaluating TES or a heat recovery project.

#### Lay the Groundwork for a Business Case

- **Load Profile Analysis:** TES delivers the most value when it can shift energy consumption from high-cost to low-cost periods. Facilities with variable loads, or those with distinct office or climate-controlled warehouse spaces, are excellent candidates.
- **Fuel Source Identification:** The financial viability of electrifying heat is dependent on the cost delta between electricity and the incumbent fuel. In New York City, the high cost of district steam made the economics compelling. If a facility uses inexpensive natural gas, the payback period for a purely financially driven project will be longer.
- **Non-Energy Drivers:** The evaluation should extend beyond utility costs. Are there corporate sustainability mandates to meet? Are there legislative pressures like LL95 that penalize fossil fuel use and inflate these operating costs? Could the added resiliency from a TES system help avoid costly downtime during a grid event? Are there infrastructure constraints that TES can help solve like electrical capacity issues or condenser water capacity constraints with an existing system? These benefits often have compelling numbers attached to them.
- **Waste Heat Discovery:** The most successful industrial heat recovery projects that eliminate wasted energy. Processes that generate waste heat (from air compressors, process cooling or exhaust stacks, for example) present an opportunity. Capturing and repurposing this heat can improve project ROI.

#### Four Steps to Assess a Project's Feasibility

1. **Conduct a Comprehensive Energy Audit:** Go beyond a utility bill analysis. Map the facility's thermal and electrical loads over time to understand the consumption profile and identify all potential sources of waste heat.
2. **Model the "Sunk Cost Avoidance":** This is a powerful but often overlooked analytical tool. If a facility is already planning to replace an aging boiler or chiller, the evaluation should not be based on the full capital cost of the new system. Instead, the cost of the conventional replacement should be treated as a sunk cost, and the incremental spend for the more advanced system should be evaluated. This can shorten the payback period.
3. **Adopt a Holistic View:** A TES system is not a standalone asset; it's part of an integrated system. Its value is maximized when combined with other measures, such as a robust Building Management System (BMS), high-efficiency equipment and an intelligent control strategy.
4. **Consult with Experts:** Engage with engineering and technology partners who have experience in industrial heat recovery. They can help perform a detailed feasibility study that models the interplay between a facility's unique load profile, local utility rates and available incentives to determine the true potential for the site.

The project involved a replacement of the legacy HVAC equipment, including the installation of two CenTraVac® centrifugal chillers, 27 Thermafit™ modular chillers and a series of water-to-water domestic hot water heat pumps that made up the bulk of the heat recovery assets. This configuration allowed for greater heating and cooling flexibility by spreading capacity across multiple systems, rather than relying on a few large machines. The new system was built around three primary sources of waste heat:

#### 1. Tenant Condenser Water Loops:

Like many large commercial buildings, 55 Water Street has dedicated condenser water systems that run 24/7 to cool tenant IT closets, data centers and supplemental cooling needs. This is a constant, year-round source of waste heat that was previously rejected through cooling towers. Plate-and-frame heat exchangers were installed to pull this heat from the tenant loops into the central chilled water system, capturing it before it could escape.

2. **Air Handling Systems:** A pivotal move, enabled by a recent BMS upgrade in which demand-controlled ventilation was commissioned, was to rethink the approach to ventilation. In winter, buildings traditionally use "air-side economizing," bringing in cold outside air for cooling and exhausting warmer interior air. This exhaust air – typically 75-76°F (24°C) – was identified as an untapped heat source. The strategy was adjusted to disable air-side economizing, reverting to minimum ventilation setpoints and using the existing chilled water coils in the air handling units to absorb the internal heat load from people, lights and equipment. This captured heat was then transferred into the chilled water loop, ready to be repurposed.

#### 3. Thermal Energy Storage (TES):

The building's existing TES system, installed in 2012, included 6.5 MWh of electrical equivalent energy storage as a strategic reserve. The TES system's chillers and CALMAC Ice Bank tanks

were originally installed for cooling electrical demand management only – making ice at night during off-peak hours, and using the ice to reduce peak cooling electrical demand during the day. In 2024, the TES tanks were repurposed for heating the building in addition to cooling. The process of making ice is a heat extraction process. By running the chillers to freeze the water in the tanks, a tremendous amount of heat could be harvested and transferred into the condenser water system to feed the heat pumps. This became the final stage of heat recovery, deployed on the coldest days of the year when other sources were insufficient.

This cascaded system allowed for approximately 95% electrification of the building’s perimeter heating. The system is designed to produce the 140°F (60°C) hot water required by the existing perimeter heating loop, all without disrupting the equipment withing tenant spaces.

This is an “electrification-plus-resiliency” strategy, giving the building unparalleled fuel flexibility. Based on real-time utility costs, demand charges or carbon triggers, the building’s operators can choose to run the electric heat pumps, the steam system or a hybrid of both. This operational flexibility is a powerful asset in an ever-changing energy market and increases the building’s asset value.

**Removing Old Steam Turbines from the 14th Floor**

Designing the system was only half the battle. The installation was a monumental feat of logistics and coordination. To secure millions in utility rebates and lock in available tax credits, the project also had to be completed within a tight 12-month window.

To avoid disrupting tenants, removing the legacy steam turbines – which took nearly six months – had to be performed exclusively on overnight shifts. They were colossal machines, some weighing as much as 5,000 lbs. All this equipment was located on the 14th floor of the occupied building. Therefore, to overcome some of the logistical challenges, the machinery was cut into small pieces that could fit into three-yard dumpsters and be removed via freight elevators.

Coordination between Trane, the engineering firm, the building owner’s representative and

the hands-on building management team was paramount. Every possible aspect of the project



The 55 Water Street electrification retrofit features three banks of Thermafit™ water-cooled, modular heat recovery chiller units, providing heating for the building.

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## » Inside the 55 Water Street Heat Recovery Transformation



55 Water Street's thermal management system includes two CenTraVac® water-cooled centrifugal chillers, one designed for heating and one for chilled water and making ice for the building's Thermal Energy Storage system.

already planning a multi-million-dollar resiliency project. When viewed as an incremental spend on top of that planned investment, the return on investment for the heat recovery portion is under four years.

Today, 55 Water Street stands as a proof point demonstrating that ambitious decarbonization goals are achievable no matter the size. It can become a working model for building owners across commercial and industrial real estate, proving that sustainability and financial performance can go hand-in-hand. This project shows that with the right strategy, technology and partners we can create new models for 21st-century efficiency and resilience. **BP**

1. <https://www.55water.com/ownership/>

All photos and illustrations courtesy of Trane Technologies.

### About the Author

Corey Letcher, Comprehensive Solutions Account Executive and Strategic Existing Buildings Solutions Team Leader at Trane, holds a Bachelor of Science in Chemical and Biomechanical Engineering from Cornell University. He's been with Trane for 10 years, specializing in identifying, developing and executing energy contracting projects. His expertise spans decarbonization, building optimization and innovative project development.



### About Trane Technologies

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was expertly coordinated, developing a detailed execution plan that accounted for the complex logistics of working in a dynamic, occupied facility. This proactive approach was essential in eliminating delays and conflicts, allowing for the completion of the entire demolition and installation within the one-year timeframe.

The building had an existing control system in the chiller plant that the team expanded and also integrated with the third-party system for the airside equipment to enable the heat recovery strategies. Trane collaborated to provide hands-on training for the building's engineering team, ensuring the operations staff were equipped to manage the new system with confidence and to support ongoing, reliable performance from day one.

### An Ambitious Project Leads to Huge Financial and Energy Savings

The project was completed on time and on budget, delivering a cascade of financial, operational and environmental benefits that exceeded expectations.

- **Financial Windfall:** The project unlocked approximately \$14.5 million in incentives, including

\$5.5 million in utility rebates and \$9 million in available tax credits. The owners were also able to avoid nearly \$1.2 million in annual fines for 2030-2034 under LL97.

- **Operational Savings:** The new system reduced the building's reliance on expensive district steam, resulting in a 72% reduction in steam consumption and \$1.5 million a year in utility spend savings.
- **Energy Efficiency:** The building's overall Energy Use Intensity (EUI) has been reduced by nearly 20%, a massive achievement for a building of this scale.
- **Remarkable ROI:** While the total project payback is around 10-11 years, the context is key. The building was

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# Selecting the Right Compressed Air Dryer for Any Application

By Jayme Leonard, Digital Marketing Specialist, Atlas Copco Compressors

► If an efficient and reliable compressed air system is crucial to an industrial plant's success, then a compressed air dryer is an essential component. Moisture in compressed air can cause corrosion, damage to equipment, compromised quality and expensive downtime. Choosing the right compressed air dryer protects the entire production system and delivers clean, dry air when it's needed, while maximizing energy savings.

With a vast selection of compressed air dryer technologies and varying operating conditions, how do you determine which option works best for your plant?

## Dry Compressed Air Is Essential for Productive Plants

Why do we need to dry compressed air? All air contains some amount of water vapor. When air is compressed, the concentration of water vapor increases. As the air cools, the vapor condenses into liquid.

If the moisture in compressed air isn't removed, it can create problems with your system, causing corrosion in piping and equipment, rust and damage to pneumatic tools and valves, contamination of end products and – in cold environments – even freezing.

This makes compressed air dryers essential, not just to protect your equipment, but also to meet industry standards like ISO 8573-1 purity classes, which creates a way to specify compressed air quality.

## Understanding an Industrial Plant's Dry Compressed Air Needs

Before choosing a compressed air dryer, it is important to look at the specific needs of your operation. The compressed air system of a food and beverage manufacturer will have different requirements than an electronics manufacturer or a pharmaceutical cleanroom. It is important

to know the answers to key questions. What air quality level is required for your plant's process? What is the required operating pressure and flow rate? What are the ambient and dryer inlet air temperatures in your plant? Is the compressed air dryer for a specific point-of-use application or a full plant system? Are there any space, power or environmental constraints?

Knowing the answers to these questions will help you to find a suitable compressed air dryer and help avoid over- or undersizing.

## The Five Types of Compressed Air Dryers

There are various types of compressed dryers, each with its own advantages, operating principles and ideal use cases.

**Refrigerated Compressed Air Dryers.** The most common compressed air dryers for general industrial applications are refrigerated. These compressed air dryers cool compressed air to around 35-40°F (1.5-4°C), causing water vapor to condense and drain away. The compressed air is then reheated to room temperature before exiting the refrigerated dryer.

Refrigerated compressed air dryers are available in non-cycling and cycling designs:

- Non-cycling refrigerated compressed air dryers maintain a constant cooling operation for consistent dew point, making them simple and reliable but less energy-efficient at partial loads.
- Cycling refrigerated compressed air dryers automatically adjust cooling operation based on demand, reducing energy consumption when air flow is lower.

For operations where inlet temperatures are higher, such as with oil-free piston compressors or in hot environments, high inlet temperature refrigerated compressed air dryers are designed with larger heat exchangers and aftercoolers

to handle compressed air up to around 180°F (82°C) without a separate aftercooler.

### Pros:

- Cost-effective and reliable
- Easy to install and maintain
- Suitable for ISO Class 4 air quality for moisture content
- Low energy consumption

### Cons:

- Moisture risk in extreme conditions

Refrigerated compressed air dryers are best for: Workshops and garages, general manufacturing, food and beverage processing, woodworking, textile manufacturing, printing, agriculture, pharmaceutical packaging, electronic assembly, bottling and beverage distribution or any application not requiring ultra-dry air.

**Desiccant Compressed Air Dryers (Adsorption Dryers).** Desiccant compressed air dryers use hygroscopic material (often activated alumina or silica gel) to adsorb water vapor from the compressed air. They can achieve dew points as low as -40°F to -94°F (-40°C to -70°C), making them ideal for critical applications.

There are several subtypes of desiccant compressed air dryers including heatless regenerative compressed air dryers (the most common type), heated purge compressed air dryers, heated blower purge compressed air dryers and nonstandard desiccants which can achieve dew points well below the standard -40°F (-40°C).

### Pros:

- Low dew points for moisture-sensitive environments
- Operate in cold or remote settings

*Above: A variable speed drive refrigerated compressed air dryer*

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**Cons:**

- Higher energy consumption due to purge loss
- Requires periodic replacement of desiccant

Desiccant compressed air dryers are best for pharmaceutical, electronics, food and beverage, aerospace and any process where moisture can damage products or processes.

**Membrane Compressed Air Dryers.** Membrane compressed air dryers use selective permeation to separate water vapor from compressed air. The compressed air passes through a membrane that allows only water vapor to escape.

**Pros:**

- Smaller, lightweight and quieter
- No moving parts or electrical components
- Ideal for point-of-use compressed air drying



A heat of compression, rotary drum compressed air dryer and an oil-free rotary screw air compressor

used in natural gas or remote pipeline installations. They require regular media replacement and offer limited control over dew point.

**Pros:**

- Low initial cost
- No electricity needed
- Simple design
- Good for low-demand, outdoor or seasonal use

**Cons:**

- Limited capacity
- Dew point suppression is lower compared to desiccant compressed air dryers

Membrane compressed air dryers are best for applications with small flow requirements, such as medical or laboratory applications.

**Deliquescent Compressed Air Dryers.** These compressed air dryers use a chemical agent that absorbs moisture and then gradually dissolves. These units are simple and often

**Cons:**

- Ongoing chemical cost
- Limited drying capability
- Variable performance
- Potential chemical handling issues

**Heat of Compression (HOC) Dryers.** Heat of compression dryers use the heat generated during air compression to regenerate their desiccant material, eliminating the need for external heaters or purge air. They are most effective when paired with oil-free rotary screw or centrifugal compressors that run continuously.

**Pros:**

- Energy efficient
- Continuous operation
- Low operating costs
- Environmentally friendly

**Cons:**

- Dependent on air compressor heat
- Higher upfront cost
- Limited to certain applications
- Requires a consistent inlet temperature

### What to Know Before Selecting a Compressed Air Dryer

To help you choose the right compressed air dryer for your industrial operations, here are some key points to consider:

**Dew Point Requirements:** What level of dryness is needed in your compressed air? For general applications, a refrigerated compressed air dryer may be sufficient. For processes where even trace moisture is a risk, a desiccant compressed air dryer is the better choice.

**Flow Rate and Sizing:** Compressed air dryers must be sized correctly for your air compressor's

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output. Too small, and they won't keep up. However, bigger is not always better. If they're too large, they may result in unnecessary energy costs and poor performance.

**Temperature Requirements:** Both environmental and inlet temperatures impact a compressed air dryer's performance. Some compressed air dryers struggle in hot, humid environments or in spaces that are not temperature-controlled. It's important to choose a compressed air dryer rated for the conditions of your environment.

**Pressure Drop:** All compressed air dryers cause some pressure drop. Look for models that minimize this, as excessive pressure drop forces your air compressor to work harder, reducing efficiency.

**Energy Efficiency and Lifecycle Cost:** When looking at the cost of ownership of a compressed air dryer, it is important to consider not only the initial price but also the long-term cost. What will its energy use be? What is the maintenance schedule like? Desiccant compressed air dryers, for example, consume more energy than other compressed air dryers due to purging compressed air to regenerate the desiccant beds. Some models include energy-saving features such as dew point demand sensors, which pause the regeneration cycle while the desiccant compressed air dryer is maintaining the required dew point in order to minimize purge loss.

**Maintenance Needs:** When choosing a compressed air dryer, it's important to learn how often it needs service and how easy it is to maintain it. Some compressed air dryers are almost maintenance-free, while others require regular part replacements or system checks.

### What to Avoid When Selecting a Compressed Air Dryer

Avoid these common mistakes when selecting and installing a compressed air dryer:

- **Improper Sizing:** This can lead to inefficiency and moisture breakthrough.
- **Skipping Pre-filtration:** This will damage compressed air dryers and may reduce their effectiveness.
- **Choosing the Wrong Compressed Air Dryer for Your Application:** For example, don't use a refrigerated compressed air dryer where ultra-dry air is required.
- **Ignoring Seasonal Variations:** Be sure to

consider the seasons if your compressed air system is outside. Air temperature and humidity can fluctuate dramatically.

- **Focusing Only on the Purchase Price:** Saving money upfront may cost more over time in energy use and maintenance.

### Work With a Compressed Air Specialist

A compressed air system audit can help a plant figure out its needs more precisely and discover if there are opportunities for improvement. A trusted supplier will not only recommend the proper equipment, but also support the plant with installation, training and ongoing maintenance.

Look for a partner who understands your industry and offers a range of solutions, not just a one-size-fits-all product. **BP**

### About the Author

Jayne Leonard is a marketing communications professional at Atlas Copco Compressors, specializing in strategic planning, graphic design, website management and social media. She has developed a wide range of materials including marketing plans, brochures, newsletters and digital content.



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## Combined Design Does the Work of Two Cooling Systems at Bottling Plant

By Clayton Penhallegon, Jr., P.E., Managing Member, Integrated Services Group

▶ A plastic bottle plant manufacturer in Southern California needed to renovate the process cooling systems for a blow-molding facility. As is typical for this type of plant, there were separate chilled water systems to provide bottle machine process cooling distinct from manufacturing space humidity control due to the significantly different characteristics of the two applications. One factor driving the renovation was the need to add more humidity control. The existing system was not keeping up and conditions in the plant were unsatisfactory.

Given the two-system design, the standard approach would be to add a chiller, pumps, piping and production room air handler. These would be added incrementally to the existing humidity control system or set up as a standalone system. Unfortunately, several inescapable disadvantages would be compounded by adding more equipment to the two current systems.

Having separate systems to meet these distinctly different requirements mandates significant capital investment for the duplication. Each system has its own chillers, pumps, and support equipment, including makeup systems and water treatment, which was taxing the space-constrained site. Maintaining the separate systems means there are multiple, minimally supported sets of equipment that were more or less ignored as long as they were running. The overall efficiency of the

systems was low due to the challenging operating characteristics of the machine cooling system and the seasonally off-design loading of the humidity control system.

An innovative approach successfully combined both requirements into a single, high-performance system that provides improved cooling to the plant with reduced investment and at significantly lower operating costs.

### Two Cooling Systems with Two Sets of Requirements

The two cooling applications have nearly opposite features. The humidity control system is intended to keep the room air dry enough to minimize moisture condensation

on the bottle molds, while the mold cooling system removes heat from the material forming the bottles. Like a cold beverage container, the molds sweat if their surface temperature drops below the room air dew point. Any droplets hurt product quality.

The humidity control system is essentially conventional air conditioning with standard mid-40°F (around 7°C) chilled water (CHW) supply temperatures combined with air handling units (AHUs) optimized to remove moisture. The AHUs require moderate cooling water flow and pressure requirements of around 2½ gallons per minute (gpm) per ton and 12 psi differential at the AHUs. When functioning properly, the total AHU CHW flow varies with the actual dehumidification load. Seasonal and



The legacy cooling systems included complicated piping.

Above: The new cooling system provides dramatic improvements in performance and efficiency.

daily variations are typical as the AHUs operate to keep the dew point below a setpoint target.

The machine cooling system requires moderately warmer CHW, typically from the high 40s to the low 50s°F (8°C-12°C), with a higher pressure requirement for the bottle molds. Ideally, the flow through the molds is high to maintain uniform temperatures, resulting in relatively little water temperature change from inlet to outlet. This application requires 5-6 gpm per ton and 40-50 psig (2.8-3.4 barg) differential. The total cooling load varies with the number of machines running, the specific mold requirements and the material being run. While these vary with production requirements, there is little seasonal change driving the variations.

**A Fluctuating Relationship Between Humidity Control and Mold Cooling**

Given the distinct characteristics of the load types, the humidity control system could be a higher or lower load than the machine cooling system depending on the time of year and the machine operations. One observation from the initial system review was

that part of the mold cooling system supply temperature variation was compensation for the ineffectiveness of the humidity control.

At times when the humidity control system underperformed, the mold temperature was raised to reduce droplet formation. This, in turn, hurt the plant's throughput, as cooler molds can run slightly faster cycles. In a real sense, the plant had to reduce production due to the limitations of the cooling systems. Not only did the plant have to forgo greater output, but it also had to constantly adjust the cooling systems to get the most out of them as conditions changed. This taxed the operations and maintenance staff as they tweaked the temperatures up and down over the seasons and sometimes even through the day, trying to get the optimum balance of mold temperature and ambient humidity.

**A Default Plan to Add a New Chiller and Air Handler**

Given these cooling system issues, the corporate engineering and plant management team decided to explore its options. These ranged from adding incremental equipment to

replacing both cooling systems under the presumption that new equipment would improve plant conditions. At this point, the plant involved ISG in the analysis. The default plan was to add a new chiller and air handler. This approach required more space, however, which was challenging given the location.

The existing cooling systems had two 225-ton air-cooled process cooling chillers and one 200-ton air-cooled chiller dedicated to the AHU system, with separate pumping and piping for each system. The process cooling system had hot well and cold well tanks with a recirculation loop to the chillers and a separately pumped loop to the machine load. The AHU cooling system was a closed-loop system with dedicated pumps. The planned humidity control modification would add at least another chiller and pumps.

The maintenance staff manually turned the constant speed pumps on and off as they deemed necessary. The result was that both loops into the plant saw significant pressure variations as the number of pumps and the number of lines running changed, and as the

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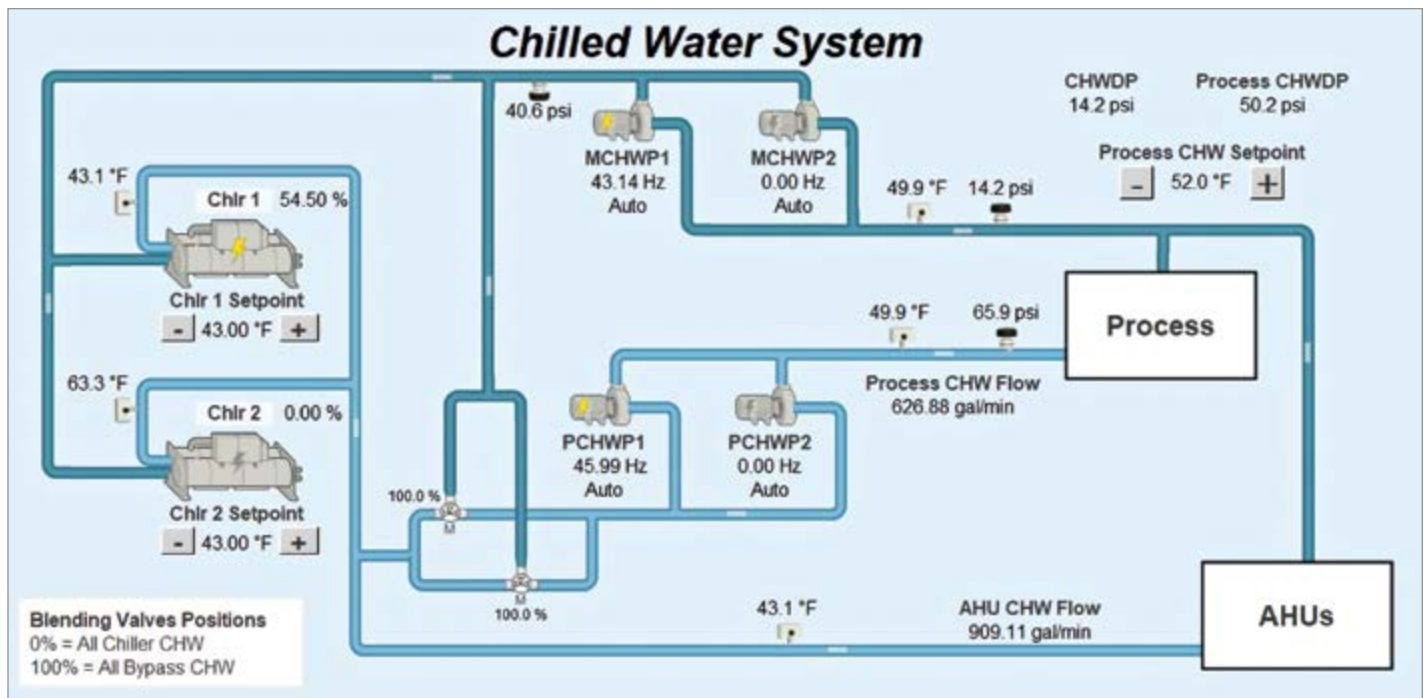


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## » Combined Design Does the Work of Two Cooling Systems at Bottling Plant



A combined cooling system schematic from the controls display shows how the system operates.

AHU cooling control valves thermostatically adjusted. Typically, seven or eight of the 10 installed pumps ran at any given time.

### Analyzing Flows, Temperatures, Pressures and Power Logging

The company had worked with ISG before on cooling system performance improvements and requested help selecting replacement cooling equipment. It needed to know the size and type of chillers that should be used, and whether or not pumping or piping changes would improve the performance of the new chillers. To answer these queries, ISG performed a design analysis and an operating data survey with detailed field measurements (including flows, temperatures, pressures and power logging). The results served as the basis for evaluating potential options.

After evaluating the current and projected design loads and conditions, ISG proposed creating a combined cooling system. The plant was willing to consider this approach as long as the firm also analyzed other, more conventional options.

The plant was doubtful a single system could meet its two separate cooling requirements, and concerned that if the installation didn't function as planned, production would

suffer. However, it ultimately accepted the idea that a combined cooling system could meet the total cooling requirements with less capital investment while providing reduced maintenance requirements, a smaller total footprint and greatly improved efficiency. Lower energy costs were important, as the California plant is in an area with high energy rates.

### Adding Two 400-ton Water-Cooled Chillers

The firm's combined cooling system recommendation consisted of two larger water-cooled chillers served by a single cooling tower. The 400-ton chillers were sized so they provided essentially N+1 redundancy when the plant operates at normal loads. In addition to



The cooling tower and pumps for the combined cooling system.

the chiller change, this design eliminated the tanks and recirculation loop in the process cooling system. Instead, it offered a single closed-loop system with separate branches to meet the distinct cooling requirements of the AHUs and the molding machine.

The separate branches have independent pumps selected specifically to meet the two applications' different pressure and flow requirements. The piping design has the main CHW pumps providing circulation to the total CHW flow. This is followed by the process pumps only pumping to the machines at the higher pressure required for their cooling. With the improved design, there are only six pumps in the system, and normal operations only require three to be running. This is reduced from 10 pumps total and six pumps running before.

The critical characteristic of the combined cooling system is the use of three-way valves in the water supply to the process cooling pumps. These three-way valves (there are two in parallel operating in an overlapping manner) enable the process cooling pumps to flow chilled water that can be either 100% chiller-cooled water, 100% return CHW (blended AHU and process cooling coming back from the plant) or anything in between. The three-way valve control is critical, as it provides the higher process cooling supply temperature needed to avoid mold condensation. The process supply temperature can be as warm as the blended return, so practically speaking it is limited to around 8-10°F (4-6°C) warmer than the AHU supply temp.

The last component of the combined cooling system plan was several changes to the piping system that, in combination with improvements in the pumping control, provide more uniform cooling throughout the plant. These include adding an intertie pipe that connects the two process cooling branches (somewhat like adding a loop pipe in a compressed air system), as well as moderately oversizing some of the added piping for minimal pressure drop in the distribution system.

**Combined Use Chillers Save on Energy Costs**

The combined cooling system installation is now complete, and provides the plant with many advantages including the following:

- **Dramatically improves process cooling conditions:** more stable temperature

and pressure supply to the production machinery, as well as more uniformity across the plant, virtually eliminating issues with mold condensation and other inadequate cooling conditions

- **Significantly reduced maintenance costs:** improved operating conditions for the new equipment (which is variable in response to needs, and no longer in constant use at full speed) with automatic rotation between components for consistent use
- **Improved water conditions with closed system operation:** removing open tanks enables air removal and better anti-corrosion treatment standards, and also saves the space formerly required for tanks
- **Major reduction in energy use:** improved loading of chillers from combined uses (higher delta T across evaporators), conversion to higher efficiency water-cooled chillers, high-efficiency pumping and piping design (pump selections, reverse return and low-loss system piping



Three-way valves and dedicated pumps enable the combined cooling system to meet distinct cooling criteria.

features), elimination of constant-flow chiller recirculation loop and dynamic control of the cooling system according to actual production and AHU requirements

- **Lower staff support requirements:** much less required daily maintenance



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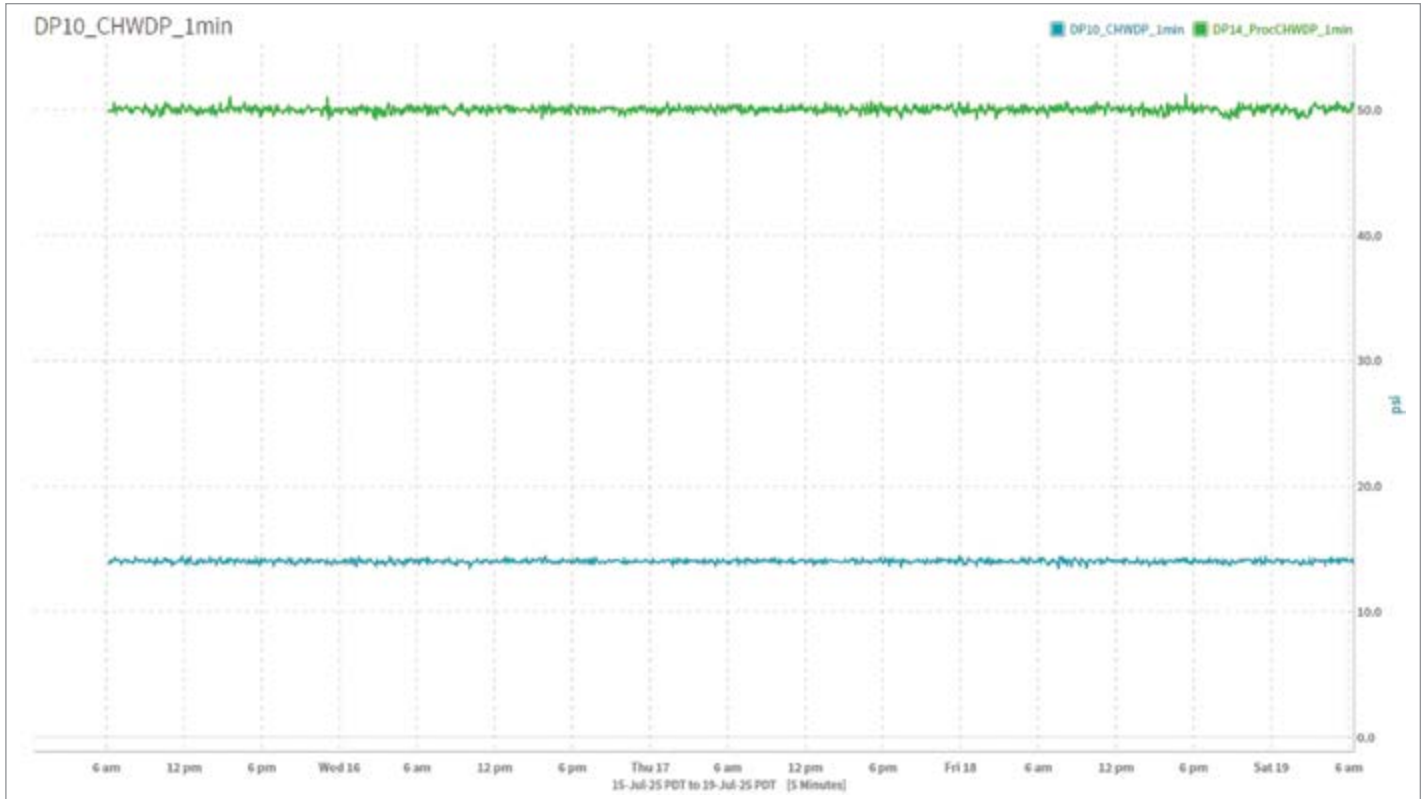
## >> Combined Design Does the Work of Two Cooling Systems at Bottling Plant

team activity, simple one-switch system starts and stops, fewer components to support, fault handling to defer most equipment issues to day

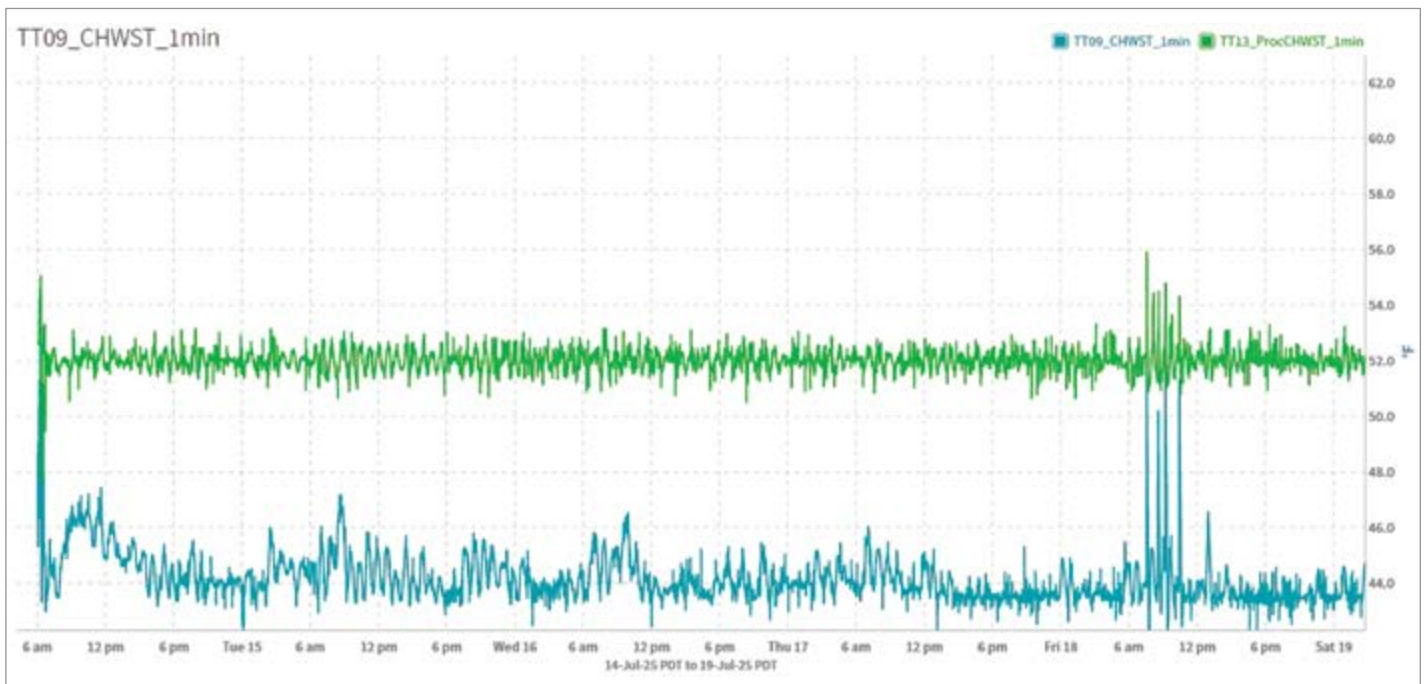
shift maintenance availability

- **Reduced space requirements:** while the original chillers and pumps were outside,

the plant site is space-constrained; the revised cooling system uses less space than the original system with the required AHU expansion would have needed



As this graph shows, differential pressures are nearly flat in the combined cooling system.



Temperature stability is dramatically improved, typically under +/- 1°F (0.6°C) variation.

The combined cooling system design was sufficiently beneficial that the plant worked with ISG to recreate it in a new construction project that followed 18 months later.

### Energy Savings of 55%

In the several years since the project was completed, the combined cooling system has provided dramatically improved operations for the plant. The cooling water temperatures and pressures have less than 10% of the typical variation of the previous systems. The improved conditions have led the plant to install additional bottle molding lines, with the additional sales volume delivering a significantly greater return than simply the energy cost savings.

Energy savings are around 55%, which is extraordinary for a cooling system that relies on mechanical cooling year-round (the location does not support free cooling, as winter is not cool enough to justify the investment). This has been particularly beneficial for the plant as its energy costs have increased by over 50% since the project was approved. As a result of this project, the plant saves over \$270,000 per year on energy costs.

As noted, the client has used the combined cooling system design on a new project. While the wholesale replacement approach is too costly for some existing system renovations, many of the specific concepts have been applied as improvements to other systems. These include differential pressure control and (where applicable) cooling tower operation optimization, in particular resetting the set point based on the wet bulb temperature and managing the tower water flow based on actual temperature.

The project team learned several lessons in implementing and starting the revised system. One key insight was to train the maintenance staff on the different requirements of the new system, as the addition of a cooling tower was new to the plant. Somewhat unique to the location, which is temperate and typically has low precipitation, keeping the equipment protected from weather during rare but intense storms was a hard-learned lesson. The previous systems were installed outdoors and were unaffected by rain. The new system, with variable frequency drives and standard NEMA 12 rating control enclosures, had several instances where the dock-style roof leaked, necessitating various temporary and now permanent fixes.

### Summary

Faced with the requirement for improved cooling, a blow molding plant chose to invest in a significant redesign of its cooling systems that combined two separate systems into a single, integrated system. The combined design leveraged the components to provide a more controlled, efficient system while also requiring less space than the alternative would have needed. The new system has demonstrated significant benefits and will perform for many years to come. **BP**

### About the Author

Clayton Penhallegon, Jr. is the Managing Member of Integrated Services Group, which specializes in industrial cooling water system operational effectiveness and cost reduction. He has worked for



over 35 years with various industries, including plastics, paper, wood products, metal containers and textiles. He holds a Bachelor of Mechanical Engineering from Georgia Tech, an MBA from Georgia State University and is a registered PE in Georgia.

### About Integrated Services Group

Integrated Services Group performs industrial cooling water system operational effectiveness and cost reduction technical services. Its services include system assessments, new and upgrade system design, system start-up and retro-commissioning and high-efficiency control design and implementation. ISG celebrated its 25th anniversary in 2022 and serves clients throughout North America. For information, visit <https://www.isg-energy.com>.

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BETTER PLANTS  INSIGHTS

# Discover MEASUR, the DOE's Free Energy Assessment Software

By Alex Botts, Research Associate, Oak Ridge National Laboratory



► The Better Plants program offers several technical assistance resources at no cost, most notably, our free software. This column focuses on, in my opinion, one of the most powerful tools offered, MEASUR.



The MEASUR interface

MEASUR is a free, open-source software suite developed by the U.S. Department of Energy (DOE) to help industrial facilities optimize energy efficiency at the system level. MEASUR provides detailed analyses of industrial systems to identify energy-saving opportunities and enhance sustainability. The creation of MEASUR was a result of the revitalization of DOE legacy tools that had been used by industry for decades, MotorMaster+, PHAST and AirMaster+, to name a few. Now that the legacy tools have been combined into one user-friendly suite, the team has begun to expand the software into additional systems not previously included in DOE software, including water and process cooling.

## Why Should Industrial Plants Use MEASUR?

MEASUR helps facility and energy management teams identify and quantify energy efficiency opportunities in their most energy-intensive systems, including compressed air, pumps, fans, process heating, steam, motors and other industrial systems. We use MEASUR throughout our events and it has been adopted across industry as the free, vendor-agnostic tool.


The software is organized into two main categories: quick calculators and system-level assessments. It also includes ancillary support modules

like equipment inventory tracking and data set processing. The software boasts over 80 quick calculators and counting. Calculators are simple, on-the-spot tools that can be used as a starting point for more in-depth analysis or reference calculations. Think back-of-the-napkin calculations but based on sound engineering principles. You might wonder, “Is it worth considering a lower pressure set point for my air compressor?” Alternatively, the assessment modules require more data and measurement but produce a more detailed analysis of the whole system.

MEASUR assessment modules allow users to model their equipment and systems based on foundational energy assessment processes. Users enter operational and measured data for an entire system to establish a baseline, then create and compare multiple “what-if” scenarios to determine the most impactful efficiency projects. “What if I re-sequenced my entire air compressor system and lowered my setpoint pressure?” Each assessment concludes with a report summarizing estimated savings in energy, costs and emissions. Reports include graphs and tables for easy integration into proposals or presentations. While using the software, it’s important to remember quality in determines quality out. Software alone will never replace a well-trained assessor.

## How to Access MEASUR

MEASUR is available online from a computer or mobile device at <https://measur.ornl.gov> or for free download from <https://IndustrialResources.ornl.gov/>. MEASUR is platform-agnostic and ensures data privacy by storing information locally on the user’s device. The software is regularly updated with new features and enhanced capabilities.

For support, training or general questions, contact the MEASUR help desk at [measur-help@ornl.gov](mailto:measur-help@ornl.gov). 

## About the Author

Alex Botts, CEM, is a Research Associate at Oak Ridge National Laboratory, serving as a Technical Account Manager for the DOE’s Better Plants Program. She supports industry partners with data analysis, Energy Treasure Hunts and software, guiding them to achieve energy savings and developing training programs.

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SALES ENGINEERING  SKILLS

# What Is the Best B2B Sales Approach for Today?

By Mark Allen Roberts, CEO, OTB Solutions



► When I'm asked about the best sales approach for B2B industrial sales, my response often surprises people. All the popular methods have some value. When used in the right sales environments, they all drive sales. To help you focus, a Gartner report called "The Sense Making Seller" identified three approaches successful B2B salespeople use to engage customers:

**Giving:** This is the "more is better" model. Share lots of collateral, data, specs, features and benefits at the customer's request.

**Telling:** This is an expert-led approach where the rep relies on personal authority and experience to guide decisions.

**Consultative Sense Making:** This is a consultative sales model where the salespeople assess where the decision maker is in their buying journey. This approach helps the buyer make sense of existing, often conflicting, information. This method requires empathy, collaboration and emotional intelligence, as well as industry knowledge.



Mark Allen Roberts will conduct a Sales Engineering Workshop at the Best Practices 2025 EXPO & Conference in Kansas City. Visit <https://cabpexpo.com/sales-engineering-workshop/>.

## The Consultative Sense Making Approach

What's stalling your B2B sales? According to Gartner's survey, while 89% of B2B buyers say they receive high-quality information, getting too much of it makes decision-making harder.

Consultative Sense Making is about being a trusted guide. Lead customers through the information, assessments, questions and design applications, then help them arrive at their desired outcome.

Instead of inundating or pitching, the salesperson actively helps the buyer make the best decision based on their experience. This is particularly effective in industrial sales, as many salespeople have an engineering or technical service background. This approach positions your salesperson and your company as industry experts and increases the lifetime value of customers.

## Questions Your Salespeople Should Be Asking

- *Can you help me understand your decision-making process?*
- *What happened that made your team want to improve this process now?*
- *Where are you in choosing a solution?*
- *What options are you considering?*
- *Is there information you find confusing or contradictory that I can help with?*
- *What's your desired outcome, and how will you measure it?*

From my experience as a regional sales manager for Gardner Denver working with compressed air distributors, the best questions start with what, how, where and when, but not why. *Why* makes the decision-maker guarded and less open to sharing information.

Consultative sense making fosters confidence, minimizes skepticism and is strongly linked to higher-quality deals. This approach led to the largest sale in the history of my compressed air region. While competing compressed air dealers were pitching one prominent company, we became its trusted advisor and made a sale to one location. Over the next two years, 11 other locations followed.

In our current environment of information overload, salespeople skilled at consultative sense making are the top producers in their industries. Help your salespeople develop consultative sense making questions for your products and you'll increase your close rate while shortening the sales cycle. **BP**

## About the Author

Mark Allen Roberts is the CEO of OTB Solutions, which provides professional training and coaching. Visit <https://www.nosmokeandmirrors.com>.

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# Real-World Installations & Maintenance

Edited by Troy Dreier, Senior Editor, Compressed Air Best Practices® Magazine

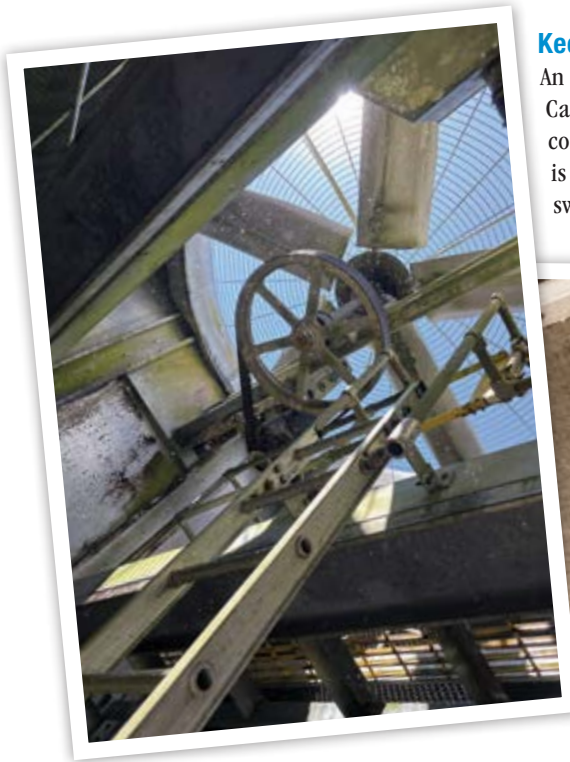
There's much we can learn from real-world compressed air, blower, vacuum, chiller and cooling tower installations. This column asks readers to share lessons learned from system installations and maintenance practices they encounter in the real world.

## Keep Up With Routine Cooling Tower and Chiller Maintenance

An account manager with a building maintenance and facility services company in Northern California sent us these pictures of a cross-flow cooling tower he recently inspected. Its condition, he noted, was due to improper cleaning and incorrect water treatment. While scale is apparent, the problem is that the owners aren't treating algae properly. Also, there are no sweepers, sand filters or centrifugal separators removing solids from the cooling water.

The condensers in the second picture are dirty because the owners aren't conducting proper maintenance on the chillers, he noted. The chiller is installed on the ground level in an industrial area and runs 24/7. For best performance, it needs to be washed out with fresh water at least quarterly. Don't use chemical treatments on the coils more than once per year, he noted.

*Skipping proactive maintenance and proper water treatment leads to cooling towers filled with scale, algae and debris.*



## Grain Processor Suffers from Poor Ambient Air Quality

Ron Marshall is Chief Auditor for Marshall Compressed Air Consulting in Winnipeg, Manitoba, and Training and Social Media Coordinator for Compressed Air Challenge. Visit <https://www.compressedairaudit.com> and <https://www.compressedairchallenge.org>.

Marshall snapped a picture of this modular desiccant compressed air dryer in a grain processing facility, where it was installed under a duct with a hole in it. Grain fell out and covered the modular desiccant compressed air dryer. Having clean ambient air in air compressor rooms is crucial to the optimal functioning of compressed air systems. Repairing this hole should be a high priority for the facility's owners.

*For optimal compressed air system performance, be sure ambient air quality is free of contamination.*



## Submission Guidelines

We invite subscribers to share stories and photos of remarkable system installations they've come across. Email Troy Dreier at [troy@airbestpractices.com](mailto:troy@airbestpractices.com). Please send a high-resolution image as a JPG or GIF file and a note describing the installation.

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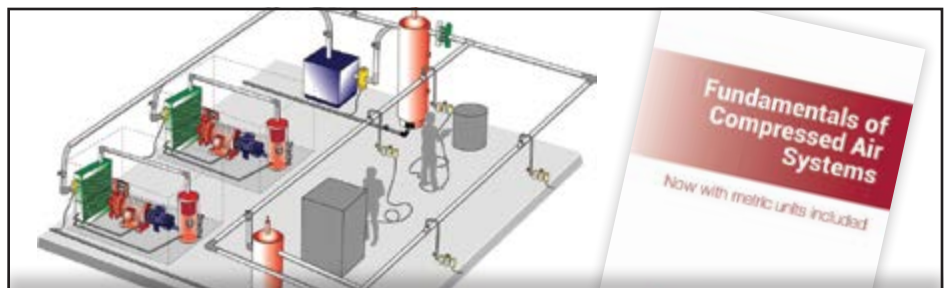
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