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EVERY ISSUE

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FROM THE EDITOR

The Best Practices 2022 EXPO & Conference

We will be distributing this September 2022 Issue at the Best Practices 2022 EXPO & Conference, taking place October 4-6, 2022 in Atlanta.

We hope you will consider attending the largest North American event dedicated to *Sustainable, Safe & Reliable On-Site Utilities Powering Automation.* The focus is on the systems making plant automation possible – compressed air, vacuum, nitrogen and cooling/chilled water systems.

Sustainable On-Site Utilities content focuses on Energy and Water Conservation Measures. In Track #1 of the Conference, leading experts will share how these can be the biggest projects supporting a corporate sustainability strategy with science based kW and water-use reduction targets. A particular emphasis will be placed on the recommended measurement and monitoring of energy/water consumption.

Safe & Reliable On-Site Utilities topics target Environmental, Health & Safety job titles and all Maintenance personnel. Safety and Reliability is the focus of Conference Track #2 and Chair Tom Taranto's focus will be on the idea that, "On-site utilities are production variables." Compressed air is a food ingredient, yet is it part of a firms' formal SQF/BRC/ISO quality management system? What maintenance practices are mandatory to ensure quality/safety compliance and to ensure reliability? How can we eliminate down-time, product rejections and increase production machinery output? What temperature, flow, dew point measurements are needed?

The goal of the event is to support all people directly involved with on-site utilities. Equipment sales engineers, engineering firms and manufacturing personnel receive many experience options including formal Compressed Air Challenge training, an exciting EXPO, a conference with Continuing Education (PDH Credits), CAGI Certification Exams and Networking Opportunities.

How much does your firm invest in training? Are your people armed with the absolute best knowledge and certifications? Are they motivated? The Best Practices 2022 EXPO & Conference will gather the leading experts in the world and we hope to see you there! Register today at https://cabpexpo.com/registration/

Thank you for investing your time and efforts into ***Compressed Air and Chiller & Cooling Best Practices.***

BEST PRACTICES
2022 EXPO OCTOBER 4-6 ATLANTA
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Manufacturing Forward

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Compressed Air Technology & Industry News

Kaeser Marks a Full Year of Green Energy

Both Kaeser Compressors, Inc, in the US and Germany's Kaeser Kompressoren SE are marking a full year of operations using only green energy. Not only are all Kaeser compressors manufactured with 100% renewable energy, Kaeser matches its consumption with renewable energy in both the US and Germany.

This milestone has been achieved with three key programs. First, over a year ago Kaeser Kompressoren SE installed a photovoltaic system which generates approximately 650 MWh for our main manufacturing plant in Coburg, Germany. Second, Kaeser purchases renewable energy credits for our remaining manufacturing facilities. And third, in the US, Kaeser Compressors is part of Dominion Energy's Green Power Program and pays a premium per kWh for the US headquarters in Fredericksburg, Virginia to match energy consumption with renewable resources. And for our 20+ branch locations across the country as well as our teleworkers, we purchase RECs (Renewable Energy Certificates) from Dominion Energy exceeding the amount of power consumed. Energy for the RECs is purchased from a broad range of renewable energy sources such as wind, solar, biomass, geothermal, hydropower, wave/tidal power, and landfill gas recovery.

These initiatives align with Kaeser's ongoing commitment to reducing, and where possible, eliminating impact on our shared environment.

"Not only are our products and systems designed for exceptional energy efficiency and maximum environmental compatibility, but Kaeser also incorporates environmentally responsible practices in our everyday operations and in the design and selection of our facilities," said Frank Mueller, president of Kaeser Compressors, Inc. "We are committed to lowering our carbon footprint by manufacturing with green energy, to support renewable energy through Dominion Energy's Green Power Program, and to demonstrate community leadership in this immediate and sustainable way."

Kaeser marks one year anniversary in using green energy for compressor manufacturing and US operations.

For more information on our commitment to the environment, visit https://us.kaeser.com/goyellowbegreen. For more information on our products and services, or to be connected with your local authorized Kaeser representative, please call (877) 417-3527.

About Kaeser Compressors, Inc.

Kaeser Compressors is a leader in reliable, energy efficient compressed air equipment and system design. We offer a complete line of superior quality industrial air compressors as well as dryers, filters, SmartPipe™, master controls, and other system accessories. Kaeser also offers blowers, vacuum pumps, and portable gasoline and diesel screw compressors. Our national service network provides installation, rentals, maintenance, repair, and system audits. Kaeser is an ENERGY STAR Partner. For more information, visit https://us.kaeser.com.

Atlas Copco Invests in Production Technology and R&D in Belgium

Atlas Copco will invest 70 MEUR over three years in production capacity and expanded R&D facilities in Antwerp, Belgium. The investments include an extension of the Compressor Technique business area's smart factory, as well as production technology.

The investments in Wilrijk, where Atlas Copco develops and produces compressors, include production technology and machinery, increased R&D capacity through expansion of laboratories, additional production space for key compressor components, and more office space.

Atlas Copco will also continue to invest in upskilling and reskilling the workforce.

"The site in Wilrijk is our most advanced R&D excellence center for compressed air," said Vagner Rego, Business Area President Compressor Technique. "Here more than 800 engineers develop, test and produce new sustainable technologies and more energy-efficient solutions for our customers. We are investing in creating an attractive and future proof work environment for our employees, putting maximum effort into a lifelong learning mindset."

About Atlas Copco Group

Great ideas accelerate innovation. At Atlas Copco we have been turning industrial ideas into business-critical benefits since 1873. By listening to our customers and knowing their needs, we deliver value and innovate with the future in mind. In 2021, Atlas Copco had revenues of BSEK 111 and at year end about 43,000 employees. For more information, visit www.atlascopcogroup.com.

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Compressed Air Technology & Industry News

Doosan Industrial Air Launches VSD Air Compressors

Doosan Industrial Air announced the launch of the Doosan® D50vsd and D100vsd oil-flooded, variable speed drive (VSD) air compressors for industrial manufacturing operations. Doosan VSD models adjust their motor speeds in real time to match facility demands, which reduces their energy consumption to industry-low levels. The D50vsd and D100vsd are the first Doosan Industrial Air VSD models.

"Facility air needs fluctuate throughout the day, and these models match those fluctuations," said Patrick Jakeway, general manager for Doosan Industrial Air. "Replacing a conventional compressor with a VSD model can dramatically reduce energy costs in a manufacturing plant."

The D50vsd and D100vsd are the first Doosan Industrial Air VSD models.

Doosan Industrial Air backs its products with strong aftermarket support, starting with an industry-leading, five-year bumper-to-bumper warranty on all purchases of new D50vsd and D100vsd compressors. Parts for the compressors are available and ready-to-ship, and a network of technicians are trained and supported by the Doosan Industrial Air factory in Statesville, N.C., U.S.A..

For more information on the Doosan D50vsd and D100vsd oil-flooded, variable speed drive compressors, call Doosan Industrial Air at 800-633-5206 or email industrialairsales@doosan.com.

About Doosan Industrial Air

Doosan Industrial Air offers one of the broadest, most comprehensive rotary air compressor lines on the market and unrivaled customer service for industrial manufacturing operations. Doosan Industrial Air is a brand of Doosan Portable Power, a company with more than 100 years of manufacturing expertise and application experience with a focus on providing the highest quality machines. Doosan Portable Power is headquartered in West Fargo, North Dakota, with manufacturing operations in Statesville, North Carolina. For more information on Doosan® products, visit doosanportablepower.com.

Brehob Expands into Evansville, Indiana

Indianapolis-based Brehob Corp. has hired territory manager Kevin Duke to drive growth in its new Evansville, Indiana service area. Duke brings 25 years of sales experience in the local area to the role – including a recent position as territory manager for a crane and hoist company. He will help Brehob expand its air compressor product line and accelerate growth along the Ohio River.

The decision to expand into the Evansville area was driven by Brehob's partnership with Quincy – one of the leading air compressor manufacturers in the world – and the growing number of industrial customers Brehob serves in southern Indiana and western Kentucky. Expansion into the market was a natural move

for the company, Duke said. "Evansville and Owensboro are what I like to call production-based cities. Between compressed air sales and service and preventative maintenance, there's a lot of companies Brehob could support in the area," he said.

The territory will initially focus on supporting Brehob's air compressor product line, but will expand to also sell and service electric, crane and hoist product lines to customers in the area. Future plans include opening a physical facility in the area that will be home to not only Duke, but a team of local technicians and support staff to help Brehob fully serve its local customer base. Until then, Duke will manage the territory out of Brehob's Louisville offices. He is excited to be part of the Brehob team.

"You've heard the old saying, if you can't beat 'em, join 'em? I'd do bids against companies who had Brehob as their service provider, and Brehob did them right. Being a family owned company, they have 69 years of doing things right," Duke said.

About Brehob

With operations in seven cities and four states, Brehob has been a one-stop shop for industrial equipment service needs since 1953. From motors to maintenance, compressors to customer service, and hoist to help, Brehob has the machines, resources and expertise to help your business run smoothly and efficiently, while keeping your downtime down and your bottom line strong. Learn more at www.brehob.com.

FS-Curtis Announces the DLX Series Dryer

FS-Curtis is excited to announce the newest addition to the D Series desiccant dryer line, dryers that combine the benefits of desiccant drying technology with an industry-leading design. The DLX dryer delivers heatless, clean, and dry compressed air to your operation at significantly lower operating costs. The dryer design incorporates upward gas flow for maximum efficiency, desiccant bed protection and will continuously produce a -100˚F dew point. DLX heatless desiccant dryers are also equipped with advanced controls to help with troubleshooting and maintenance ease, data logging, remote monitoring, and intuitive, user-friendly viewing.

Please contact your local FS-Curtis channel partner for more information at https://us.fscurtis.com/support/distributor-finder/.

About FS-Curtis

FS-Curtis is committed to offering a world-class portfolio of compressed air technology products. Through the dependability of our people and our quality-focused manufacturing, FS-Curtis will continue to be a leading company in the compressed air industry serving markets through our ever-growing global presence. For more information find us online at www.fscurtis.com.

FS-Curtis DLX Dryer.

Compressed Air Technology & Industry News

Teledyne FLIR Extends Si-Series Acoustic Imaging Camera Family

Teledyne FLIR, part of Teledyne Technologies Incorporated, announced the expansion of its Si124 industrial acoustic imaging family of cameras by introducing a new set of sound imaging cameras that feature a wider acoustic detection range, up to 65Khz, and an integrated battery with a quick start power button to make condition monitoring and inspection more efficient and effective.

In the industrial world, vacuum leaks, compressed air system leaks, electrical partial discharge, and mechanical troubleshooting can create troublesome challenges that require specialized tools to detect.

The redesigned Si124, Si124-PD for partial discharge inspection, and the Si124-LD for air leak detection, feature an expanded acoustic imaging range from 2 kHz to 65 kHz. The ability to detect sounds in the expanded 36 kHz to 65Khz frequency range provides condition monitoring professionals the ability to increase the utility of the camera by detecting very small leaks and discharge at short distances.

"With our updated ULTR mode, inspectors can isolate 30 kHz to 65 kHz soundwave frequencies to quickly locate the smallest of air leaks, making the Si124 family of acoustic imagers even more effective," said Rob Milner, Director, Global Business Development, Teledyne FLIR. "At the same time, our new integrated battery design further improves on the one-handed tool operation that is so important for safe use."

The new hard carrying case included with each new purchase offers slots for up to four integrated batteries for eight full hours of continuous operation. For those who prefer the tethered battery option, which is carried in a shoulder bag or pouch, users can still purchase it as an optional accessory.

New and existing customers can also use the FLIR Si-series plugin for FLIR Thermal Studio, empowering operators to import acoustic images from the camera to the FLIR Thermal Studio suite to easily edit and analyze acoustic imagery alongside their thermal camera

imagery to create extensive, advanced reports as part of a comprehensive predictive maintenance or condition monitoring program.

The FLIR Si124 industrial acoustic imaging cameras sense, display, and record sound waves by producing a precise acoustic image derived from the 124-microphone array. The acoustic image is overlaid onto a visible camera image within an easy-to-use, ergonomic, one-handed camera solution. Compared to traditional inspection methods including soap-bubble and single microphone acoustic inspection, the Si124 can help locate issues up to 10 times faster for common mechanical, electrical, vacuum, and compressor systems.

The entire Teledyne FLIR Si124 family of devices, including the tethered and cordless battery options of Si124, Si124-PD, and Si124-LD, are available for purchase globally from Teledyne FLIR.

Teledyne FLIR Extends Si-Series Acoustic Imaging Camera Family with Expanded Frequency Range and Integrated Battery.

Visit https://www.flir.com/instruments/condition-monitoring-solutions/choose-si124 for regional pricing and availability.

About Teledyne FLIR

Teledyne FLIR, a Teledyne Technologies company, is a world leader in intelligent sensing solutions for defense and industrial applications with approximately 4,000 employees worldwide. Founded in 1978, the company creates advanced technologies to help professionals make better, faster decisions that save lives and livelihoods. For more information, please visit www.teledyneflir.com.

Atlanta Compressor Named to Best Workplaces List

Leading compressed air distribution company Atlanta Compressor has been named to Inc. Magazine's annual Best Workplaces list. Atlanta Compressor is among the top American companies creating exceptional workplaces and company culture. Inc's Best Places to Work celebrates a workplace where team members willingly go above and beyond in their work, advocate for their company and have low turnover rates.

Atlanta Compressor is a purpose-driven company that provides peace of mind to manufacturing and other industrial companies by supplying and maintaining production critical equipment. The Atlanta Compressor team's work has had a substantial impact, providing more US manufacturers with increased production efficiency when it's needed most. This work attracts intelligent,

Compressed Air Technology & Industry News

compassionate and dedicated team members who will change the compressed air industry for the better. Since 2015, the company saw impressive growth of more than 560% in revenue, increasing their market share by a factor of 17, and expanding into three new states (Nashville Compressor, Charlotte Compressor, and Greenville Compressor).

"We're honored to receive this recognition from Inc. Magazine for the incredible team and culture we've built at Atlanta Compressor," said Morty Hodge, CEO and Founder of Atlanta Compressor. "Our purpose is to provide peace of mind, which also applies to our team members. It is our leadership's responsibility to inspire personal growth in our team, a job we take very seriously. We want all our team members to become the best versions of themselves. Our culture makes Atlanta Compressor a unique place to work and build your career."

About Atlanta Compressor

Atlanta Compressor provides compressed air systems and other critical equipment to some of the world's largest manufacturing and other industrial companies. For more information, visit www.atlantaaircompressor.com.

Chicago Pneumatic Hires Northeast Regional Sales Manager

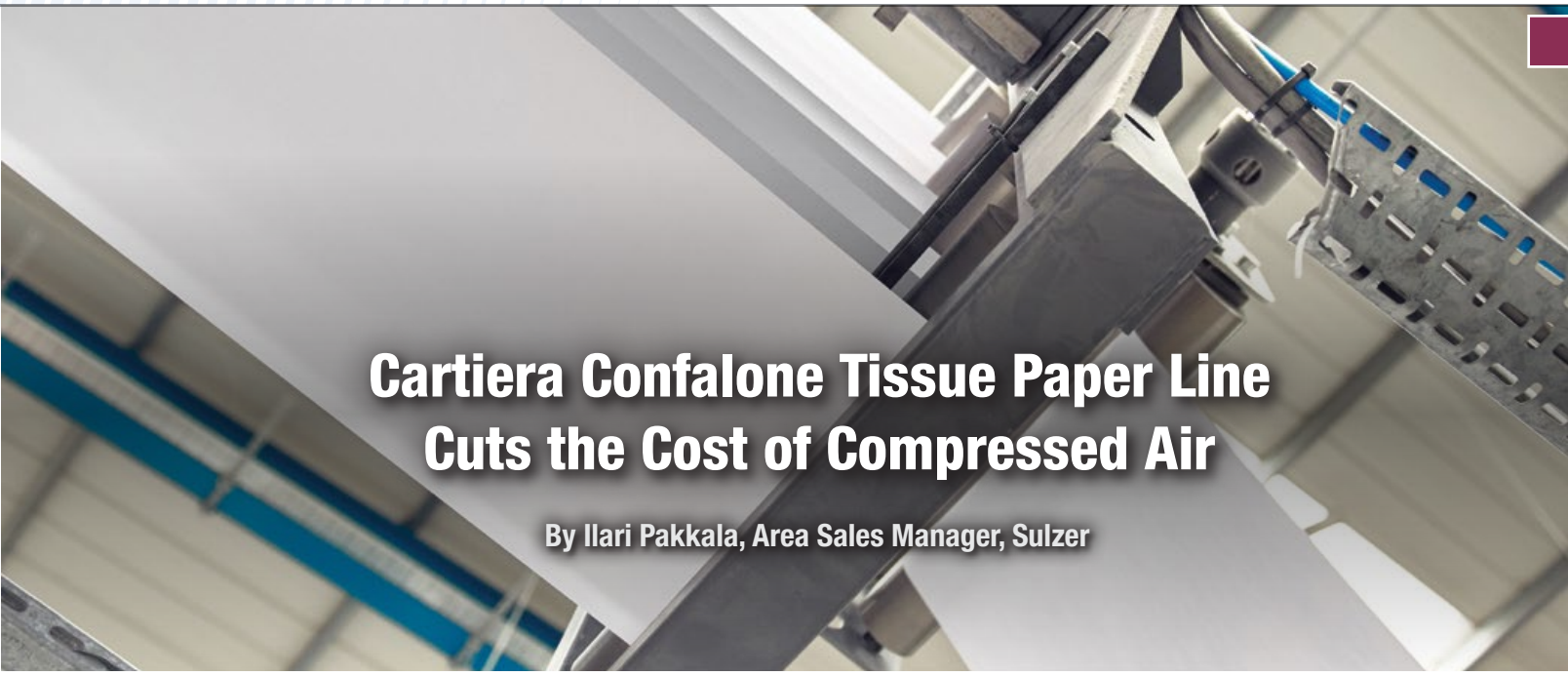
Chicago Pneumatic Compressors, the Rock Hill, SC based compressor manufacturer, has hired Raymond Batkay as the Northeast Regional Sales Manager. Raymond is responsible for managing and developing accounts in ME, NH, VT, RI, MA, NY, CT, PA, NJ, DE, MD and Northern VA.

Raymond Batkay, Northeast Regional Sales Manager, Chicago Pneumatic Compressors.

Raymond earned his MBA in Organizational Management from the College of Mount Saint Vincent and his BA in English and History from Eastern Connecticut State University. After serving 10 years as Administrative and Personnel Officer in the United States Navy, Submarine Force, Raymond became the Sales Director of a large Northeastern air compressor distributor, and then worked as a Channel Partner Manager for an air compressor manufacturer. Raymond brings with him a great deal of industry knowledge and experience and is a great addition to the Chicago Pneumatic team.

About Chicago Pneumatic

Since 1901, Chicago Pneumatic has delivered reliability with a deep understanding of customer needs. We are a global manufacturer of high-performance air compressors, compressed air dryers and compressed air treatment products for professional and industrial applications. Our products are engineered for performance and lasting customer value. People. Passion. Performance. This is our promise. To contact us, visit www.cpcompressors.com, email cp.sales@cp.com or call 877-861-2722.



Cartiera Confalone Tissue Paper Line Cuts the Cost of Compressed Air

By Ilari Pakkala, Area Sales Manager, Sulzer

The pulp and paper industry depends on reliable sources of energy, water and compressed air; maintaining cost-effective supplies of these utilities is important to every successful business. Within paper making processes, a clean, oil-free air supply is essential for the reliable operation of pneumatic equipment and a high-quality end product. For one manufacturer in Italy, the selection of an oil-free turbocompressor enabled both operational and maintenance costs to be reduced.

Paper manufacturing is, like all industries, affected by rising energy costs and raw materials. Individual manufacturers are looking to expand production, not only to keep up with rising demand, but also to benefit from economies of scale. Any project that can optimize energy costs and reduce maintenance spending can improve the competitive edge of a company.

Air Compressor Choices

The compressed air system is one area where significant improvements can be made. It is vital to a wide range of pneumatic equipment used throughout the paper making process, so reliability and efficiency are key. Yet, despite the air compressor being at the heart of this system, it is often over-looked when a plant or new production line is being designed. This can lead to opportunities to save energy being missed.

Typically, mill owners have a choice of three designs of air compressor: oil-injected screw compressor, an oil-free screw compressor or a turbo compressor. For any system that uses oil for lubrication, it is essential to have an oil separator adjacent to the air compressor to ensure any trace of oil is removed before the air is made available to the manufacturing equipment and tools.

Oil separation equipment needs to be properly maintained and any problems with performance can result in contamination of the compressed air supply. One way to avoid this scenario is to opt for a 100% oil-free air compressor, which means no oil is used anywhere in the operation of the equipment, including any gearboxes.

Annual Maintenance Costs

In the paper industry, energy costs are a major factor and gaining a few efficiency percentage points with the choice of air compressor will

The new tissue line at Cartiera Confalone S.p.A. in Italy benefits from completely oil-free compressed air.

Cartiera Confalone Tissue Paper Line Cuts the Cost of Compressed Air

improve the overall energy bill. However, the area that will have the most significant impact in terms of annual costs is maintenance and servicing.

Traditional designs of air compressors suffer from increased levels of wear over the years, and with five-figure bills commonly attributed to annual maintenance, a performance review of the compressed air system could yield significant savings. For example, Sulzer's development of the HSR oil-free turbocompressor product line uses active magnetic bearing technology, eliminating any lubricated bearings or seals and offers a near maintenance-free machine.

This also provides a 100% oil-free air supply, preventing the potential for contamination and helping to ensure high-quality products are delivered to customers.

Proven Technology

The turbocompressor uses high-speed rotor technology proven with over two decades of operation in challenging industrial environments and magnetic bearing technology which means there is never any contact between static and rotating parts, even during starts and stops. As a result, there is no mechanical wear, no performance degradation over time and an absolute minimal requirement for scheduled maintenance.

Such attributes are now keenly sought by several industries, especially manufacturing, automotive, textiles, medical as well as the food and beverage sector. The low-pressure, high-volume turbo blowers that use the same technology have been supporting the wastewater industry and saving considerable costs for energy and maintenance for many years.

In addition, modern air compressor designs now allow waste heat to be recovered (up to 93% of the total power consumption) and used elsewhere in the plant, which can reduce expenditure on water heating. These two compelling arguments led the owner of an Italian paper mill to select Sulzer's HSR air compressor for two separate sites.

Round-the-Clock Production at Cartiera Confalone

Cartiera Confalone S.p.A. had commissioned a brand-new, high-quality tissue paper line but the installation did not include an air compressor as part of the turnkey package. At the same time, the company wanted to replace the existing air compressor on the converting line. With so much pneumatic equipment on the lines, it was essential to find the best solution that would be capable of operating round-the-clock to match the production schedules.

However, in the past, the company had experienced significant maintenance issues with their air compressors and the oil separator equipment. For a business that is renowned for high-quality products, the risk of any oil contamination needed to be avoided. Furthermore, the annual running costs of the air compressor equipment were a concern going forward.

Sulzer's agent in Italy, Adrien Frediani, explains: "When Mr. Confalone spoke to us about new air compressors, he was certain that he wanted 100% oil-free technology, as well as improved reliability. The additional

benefits of much lower maintenance costs and the heat recovery system certainly played in Sulzer's favor."

Flexible Operation

Having researched the benefits of the turbocompressor, the customer invited Sulzer to assess each potential installation and develop a best air compressor specification for the production lines. Generally, the tissue line is operating round-the-clock, seven days a week, whereas the converting line has to alter its working hours to reflect demand. The flexibility of the turbocompressor means that both routines can be achieved with equal levels of efficiency and reliability.

The turbocompressor was specified to be capable of delivering the normal air consumption of the production line, allowing a legacy compressor to be held as a backup. It is expected to run continuously while the manufacturing line is operating, making reliability and efficiency high priority features.

The converting line was the first to be equipped with a 3-stage turbocompressor that delivered 8-9 bar pressure. The unit was fitted with intercoolers and an aftercooler, which optimize the pressurization process as well as capturing heat energy that can be used elsewhere in the factory.

Responsive Performance

The turbocompressor supplies an air storage vessel which acts as a buffer to ensure a consistent pressurized air supply. This is important to cater for larger pieces of equipment as they start and stop operations, allowing all other machinery to continue at the same time.

The first HSR turbocompressor was in operation for several months before the new tissue line was constructed. In that time the production

Cartiera Confalone Tissue Paper Line Cuts the Cost of Compressed Air

team on the converting line found the compressor to work immaculately. Moreover, it was able to respond to increased demand much quicker than the legacy unit and this enabled the line pressure to be reduced from 9 bar (130 psi) to 7 bar (101 psi).

The Sulzer HSR oil-free turbocompressor installation supports the new tissue line of Cartiera Confalone S.p.A. in Italy.

Since installation, the compressor has completed over six months in service and there have been no issues or maintenance costs. In fact, the negligible requirements for maintenance will have a significant impact on the annual budget with an expected reduction of around 75% for servicing.

Ongoing Savings

The most significant saving has come from the heat energy that has been recovered from the turbocompressor cooling system. The hot water has been used to heat all the water required in the washrooms of the converter plant, effectively making the gas boiler redundant. This alone will result in a EUR 10,000 (Euro) savings over 12 months.

In the meantime, the second turbocompressor unit was installed on the new tissue line. Sulzer has remained in contact with the maintenance team at the paper mill to ensure on-going satisfaction with the compressor. The feedback has been very positive and production has been progressing well. The team was pleasantly surprised by the minimal time required to start the compressor and inquired about running the machine at idle for short periods. Sulzer was able to remotely make some minor modifications to the compressors control structure that optimized the operation of the machine for the application.

Fabio Confalone, plant manager, explains: "We need to produce the highest quality paper products for our customers and that means we must invest in the best equipment. A completely oil-free compressor was essential for both of our expansion projects and the HSR has proven to be a great success." BP

About the Author

Ilari Pakkala is an Area Sales Manager at Sulzer in Finland. He holds a Bachelor of Science degree in Engineering. Since 2010, he has been responsible for export sales of industrial process pump, mixer and compressor solutions among others to Italy. To contact email: ilari.pakkala@sulzer.com

About Sulzer

Sulzer is a global leader in fluid engineering. We specialize in pumping, agitation, mixing, separation and application technologies for fluids of all types. Our customers benefit from our commitment to innovation, performance and quality and from our responsive network of 180 world-class production facilities and service centers across the globe. Sulzer has been headquartered in Winterthur, Switzerland, since 1834. In 2021, our 13'800 employees delivered revenues of CHF 3.2 billion. Our shares are traded on the SIX Swiss Exchange (SIX: SUN). www.sulzer.com

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Sustainable Stellantis Energy Center Halves HVAC Chilled Water Energy Costs

By Ryan Cowan, Engineering Manager, tekWorx

The Sterling Heights Transformation

The Sterling Heights Assembly Plant (SHAP) first opened in 1953 as a missile plant, producing jet engines for the U.S. Army. More than 30 years after its 1980 conversion to an automobile plant, millions of vehicles have rolled off the line at SHAP.

The Sterling Heights facility has undergone extensive overhauls and re-tooling in the last decade. In 2010, Stellantis (formerly FCA) announced it would invest nearly $850 million in a new state-of-the-art paint shop at the SHAP Site, as well as the installation of new machinery, tooling and material-handling equipment. The following year, the company added another $165 million to the investment to build a one million-square-foot body shop.

In 2016, it was announced that the auto giant would invest $1.48 billion to again retool the SHAP site to build the next generation Ram 1500 and support the future growth of the Ram brand. The overhaul included an upgrade of the South paint shop and its Energy Center, which houses chillers, hot water generators, pumps, purified water equipment, non-potable water supplies and associated equipment. Production at the retooled plant launched in March 2018.

A Push for Sustainability

At the onset of construction for the SHAP South Energy Center, Stellantis management was focused on efficiency and sustainability, seeking to create an environmentally friendly structure that would utilize technology to decrease operational costs. Stellantis tasked tekWorx, an engineering and technology firm specializing in real-time optimization of chilled water systems, to assist in designing and implementing energy saving HVAC solutions at the new Energy Center site.

Figure 1: Sterling Heights Assembly Plant

Equipping the Energy Center

Focusing on energy at the onset of the project meant that attention was placed on optimizing the system in the design phase, rather than retroactively optimizing an existing plant that had the potential to be over-engineered to meet design day-load conditions. The early involvement of tekWorx and partner Johnson Controls (JCI) ensured equipment was properly sized for the various load conditions, while still providing additional capacity for future loads. More importantly, tekWorx and JCI worked with Stellantis to select HVAC equipment based on efficiency ratings for the shoulder months and low-load conditions that would also operate the complete system most efficiently during design days.

Paint and body operations at the SHAP South site are cooled with 6 x 1,000-ton York chillers. The Energy Center also has a 1,000-ton heat exchanger and 6 x 1,000-ton variable speed Marley cooling towers. All chilled water plant equipment is controlled by the tekWorx Xpress® system.

Optimizing Energy Consumption

Hydronics

While the Variable Primary pumping concept was first implemented back in 1995, many modern designs still utilize the Primary/Secondary pumping concept. Primary/Secondary systems often suffer from "low ΔT syndrome", a condition wherein cold water from the chiller and warm water from the load mix before returning to the chillers. This low ΔT reduces chiller capacity and places the chiller on a less than desirable point on its efficiency curve. tekWorx designed the SHAP South Energy Center with a Variable Primary chilled water pumping configuration to eliminate the mixing and raise the ΔT to design levels. Chiller energy is saved by continuously providing exactly the amount of cooling demanded by the load.

Additionally, the condenser water loop was designed to be variable flow. The same principle applies on the condenser side: over-flowing the loop results in low condenser water ΔT. Varying the flow through the condenser water loop as the load conditions vary saves pump energy while maintaining the safe operation of the chiller.

Reverse osmosis (RO) was also utilized at the Energy Center to reduce city water usage and therefore, reduce utility costs. The RO reject gets treated and used as tower water makeup, thus reducing water usage.

Control & Optimization

In addition to this efficient hydronic configuration, tekWorx also installed its Xpress® solution, a combination of adaptive control algorithms and Tridium Niagara® N_4 hardware for the real-time control and optimization of the chilled water system. With trucks rolling off the line every minute, the decision was made to implement tekWorx Xpress® solution on an industrial Allen-Bradley ControlLogix PLC. Known for high reliability, this option is well suited for industrial environments with a wide range of ambient temperatures and humidity. The front-end graphics, trends and alarms resided on Tridium's Niagara N_4 software platform. This architecture ensured maximum operating reliability and efficiency while providing an interface with a detailed and holistic view of the plant and its equipment.

tekWorx Xpress® optimization algorithms continuously adjust equipment sequences and key setpoints based on parameters related

Sustainable Stellantis Energy Center Halves HVAC Chilled Water Energy Costs

to process requirements and outdoor air temperature. This ensures maximum system efficiency in real-time while maintaining cooling requirements at the lowest total kW per ton.

The following tekWorx sequencing and control algorithms were implemented at the SHAP South Energy Center:

- Selective sequencing of the chillers to operate the most efficient combination of chillers while satisfying the dynamic load.
- Adaptive sequencing of the primary chilled water and condenser water pumps to reduce the overall pump group energy across the entire operating range of chilled water and condenser water loop flows.
- Adaptive cooling tower fan sequencing to maximize cooling surface area while meeting the flow requirements of the towers to reduce the overall cooling tower fan energy.
- Resetting the condenser flow setpoint to leverage the pump affinity laws for pump energy savings while simultaneously providing relief to the chiller compressor for additional energy savings.

Equipment Optimization

All chillers were supplied with variable frequency drives (VFD). Because the South Energy Center serves critical processes, the entire chiller plant is engineered for a fully loaded, design day condition which occurs about 1% of the time. The other 99% of the time, the VFDs ensure that the plant can operate more effectively at part load conditions. In addition to the VFDs, the chillers utilize a variable orifice which allows the chiller control panel to adjust refrigerant flow to the evaporator and maintain the proper refrigerant levels in both shells. This tighter control of refrigerant flow allows for more efficient part-load operation.

YORK® YMC² magnetic bearing centrifugal chillers, supplied by Johnson Controls, were selected for the project for a variety of efficiency reasons.

They can utilize colder tower water than other types of chillers, thereby eliminating the need to incorporate head pressure control. The magnetic bearing chillers operate with even colder tower water than a standard oil-lubricated machine because they utilize magnetic bearings and don't have to account for oil return or oil slugging.

The chillers, ASHRAE 90.1-2004, 2007 and 2010 compliant, also were equipped with York's proprietary QuickStart feature. This feature is designed for critical cooling installations where the goal is to re-establish cooling as fast as possible after a power failure. The QuickStart feature minimizes the time to restart and load the chiller to rapidly achieve the specified leaving chilled water temperature. This feature also includes an

Figure 2: YORK® YMC² chillers reduce energy consumption and increase efficiency via advanced design and active magnetic-bearing technology.

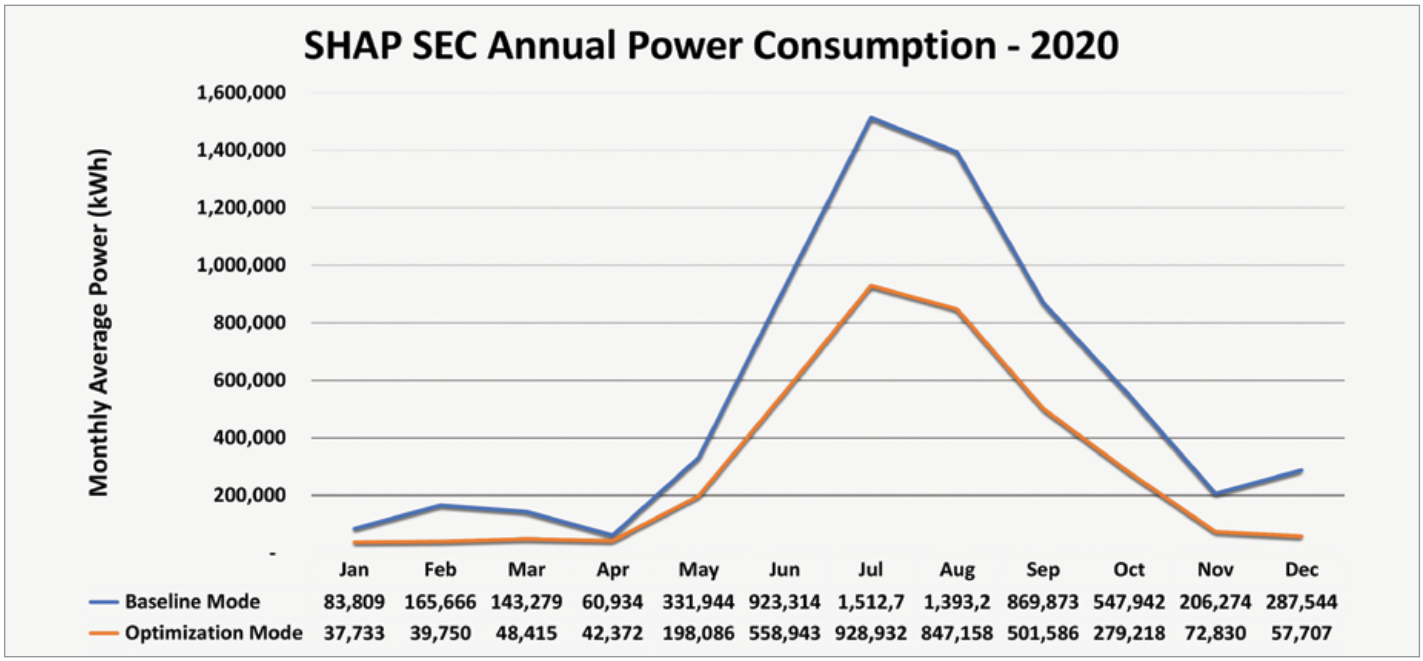

Figure 3: SHAP South Energy Center annual power consumption by monthly averages, baseline vs. Xpress® optimization mode.

Sustainable Stellantis Energy Center Halves HVAC Chilled Water Energy Costs

Uninterruptible Power Supply (UPS), which keeps power flowing to the chiller's control panel as well as the required portions of the VSD control circuit. In a process load scenario like that of SHAP, avoiding downtime is critical. This feature allows the Energy Center to get to 100% load conditions within three and a half minutes after a power failure.

QuickStart also ensures the site can automatically transition between Mechanical and Free Cooling without fear of losing supply temperature to the load. Systems that take too long see too high of a spike in the supply temperature and cannot remain in free cooling mode for as long.

Energy Savings

The Xpress® control and optimization solution implemented at SHAP for the chilled water system leverages several key algorithms to continuously operate the Energy Center equipment as efficiently as possible. According to ASHRAE, any chilled water system with an annual average plant efficiency of 0.70 kW/ton or less receives a rating of excellent. The net result of the algorithms being implemented and the equipment utilized at SHAP South Energy Center have resulted in an average annual total system efficiency of 0.42 kW/ton over the last three years.

Xpress® optimization mode has saved nearly 3,000,000 kWh annually and reduced annual energy expenses by approximately $175,000.

Continuous Monitoring and Verification

In addition to the hydronic, control and equipment implementation, the other major factor in this efficiency project was the implementation of the System Performance Dashboard. This interface views Key Performance Indicators (KPIs) such as kW and kW/ton performance for each piece of major equipment as well as those of the total chilled water system. The intuitive user interface includes a baseline vs. projected vs. actual graph showing real-time energy performance relative to historical data and trending capabilities to provide an instant look at the long-term view of system performance. The system equips the site operations team with real-time energy data for all chilled water equipment to quickly identify energy waste and equipment problems, as

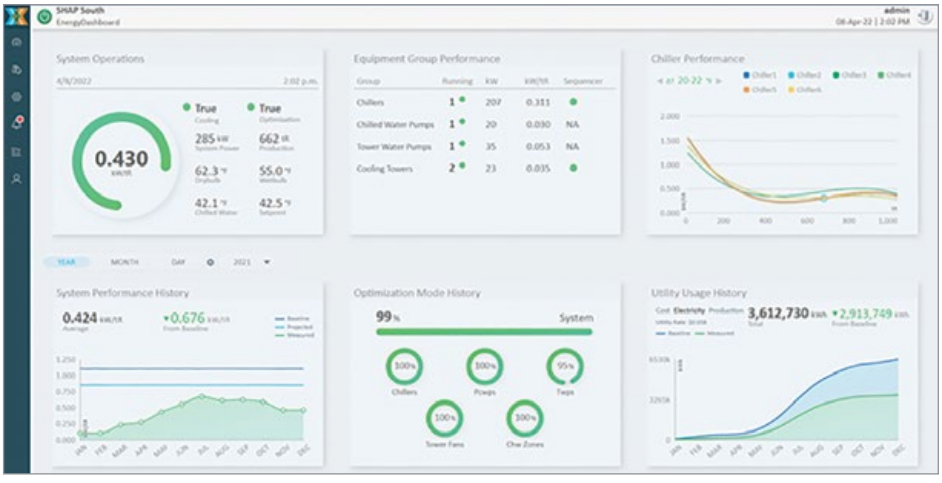

Figure 4: SHAP South System Performance Dashboard provides a window into the system with real-time and historical efficiency KPIs for troubleshooting performance-related issues and maintaining maximum system efficiency.

well as overcharges and errors on energy bills. The operations team also benefits from the alarming functionality of Xpress® which sends emails or texts to facilities staff when equipment such as a fan, pump or chiller is operating outside expected parameters.

Long Term Savings Go Beyond Dollars

In addition to significantly reducing energy use and expenses, the design and optimization of the SHAP South Energy Center has resulted in a LEED Gold certification, the U.S. Green Building Council's second highest designation. The SHAP South optimization project demonstrates how effective technology can simultaneously benefit operations and the environment. BP

About the Author

Ryan Cowan, Engineering Manager at tekWorx, was involved in the SHAP project from start to finish. A graduate of the University of Cincinnati, he specializes in complex automotive and pharmaceutical controls and optimization projects.

About tekWorx

tekWorx is the leader in chilled water plant optimization. Using proven adaptive control algorithms, tekWorx solutions ensure the most efficient combination of plant equipment is operating at its most efficient point. tekWorx cuts cooling and operating costs 20-50%, often eliminating any need for new equipment or plant expansions. For more information, contact info@tekworx.us or visit www.tekWorx.us

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Moisture: the Assassin in Compressed Air Installations

By Pascal van Putten, CEO, VPInstruments and
Frank Moskowitz, Instructor, Compressed Air Challenge

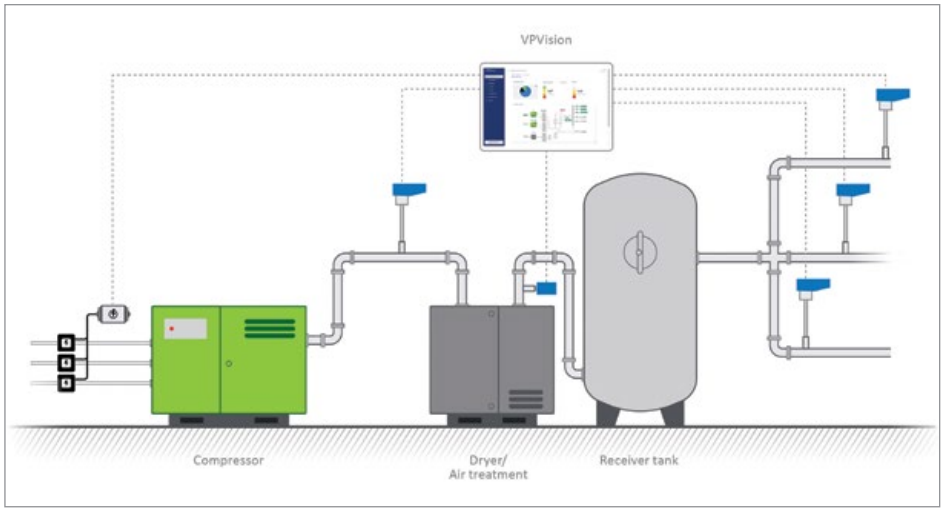
➤Dew Point Monitoring Prevents Production Downtime and Product Rejection

Compressed air users often assume the air flowing from the pipe system is clean and dry. However, this is rarely the case and besides dust and dirt particles, moisture in particular is the most underestimated threat. This not only applicable for the correct functioning and service life of the compressed air installation itself, but also for the processes and components controlled by compressed air. Correct control and accurate monitoring of the moisture content with dew point sensors is therefore more important than many people think!

Moisture can freeze in compressed air systems and cause rust and pitting in pipes and components. It can also flush out the lubricant resulting in accelerated tool wear and damage to valves and cylinders. Moist air is also a rewarding breeding ground for bacteria, which especially in the food and pharmaceutical industries can lead to product rejection and costly production downtime. It is therefore strange that many companies limit themselves to measuring only basic quantities such as pressure, flow and (absorbed) power. Because it is precisely dew point measurements that can prevent a lot of problems and (unnecessary) costs.

Moisture Content and Dew Point

The dew point is expressed in degrees Fahrenheit and is a measure of the amount of water vapor in (compressed) air or in a gas. We explicitly refer to pressure dew point for compressed air because the dew point temperature is measured at a pressure that is usually a factor 6 to 8 higher than the atmospheric pressure. This is important because changing the pressure of a gas also changes the dew point temperature. The lower the pressure, the lower the dew point. For example, if atmospheric air with a relative humidity of 30 to 50% is compressed to a pressure of 100 psig, that air becomes 100% saturated. The current compressed air temperature (which is higher than the ambient temperature) is the actual pressure dew point. As soon as the temperature drops, the moisture in the compressed air will condense, allowing many liters of water per week to enter the system.



VPVision processes all results of flow, pressure, dew point, temperature, and energy use with which the system behavior of compressed air systems can be continuously monitored and analyzed.

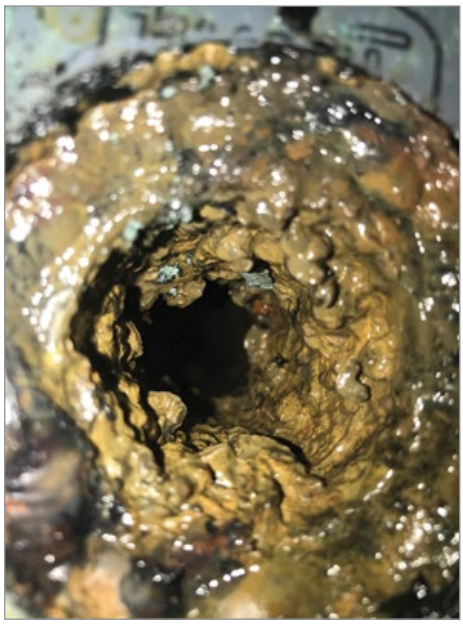
Causes of Moisture Problems

Moisture problems can have various causes. A common occurrence is the flooding of water separators or combined oil/water separators behind the compressor due to mechanical problems such as a stuck float. If this stays unnoticed, water flows unobstructed into the compressed air system and can collect in a buffer tank. Investing in a float drain, a timer drain, or an electronic condensate drain system is therefore not a superfluous luxury. Clogged cooling elements of aftercoolers and oil coolers, but also ignorance about the operation of refrigerated dryers in relation to the ambient temperature are other causes of moisture problems. For example, if a refrigerated dryer after the (wet) buffer tank cools the air to a pressure dew point of (actually) 50°F and in winter and on cool evenings the ambient temperature of the pipe network drops to 40°F, this is often ignored. But that 10-degree temperature drop alone, creates about 1.45 gallons of condensation water in the pipe system during a 40-hour working week and with 24/7 production even 6 gallons! With dew point measurement behind the cooler, this can be discovered very quickly, and measures can be taken on time. So, when choosing a dryer and the pressure dew point that is achieved, the average ambient temperature must be taken into account in addition to the requirements that the process places on the compressed air!

Installing Dew Point Meters

Mirror, capacitive metal oxide and polymer sensors are the three best-known instruments for measuring the dew point. Capacitive polymer sensors are, however, the best protected against dust and dirt, insensitive to condensation, have good long-term stability and have an attractive price/performance ratio. With these sensors, a change in capacitance is translated into the dew point temperature, displayed in degrees Celsius or Fahrenheit. VP Dew Point Sensors in particular have a unique internal heating system which allows them to recover very quickly after exposure to a lot of moisture. This can be easily the case, for example, if dryers, water separators and/or drains do not function properly.

The big question is of course, how many dew point sensors should be installed in a compressed air system and where they should be placed in order to realize reliable measurements. The simplest (starting) solution is to install a dew point sensor just after the dryer and in front of the dry tank. In this way, the dryer is monitored for correct operation. It is also possible to place the sensor after the dry tank, but then take into account a delay in the measurement signal. If there are two or more dryers in parallel, it is recommended to install a dew point sensor after each dryer.



Years of too much moisture in the compressed air results in this specter. It causes rusting, pitting corrosion and can even clog entire pipes.

BEST PRACTICES
2022 EXPO OCTOBER 4-6 ATLANTA, GA
COMPRESSED AIR / VACUUM / COOLING

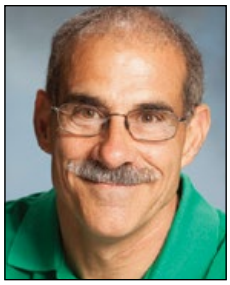
Sustainable, Safe & Reliable
ON-SITE UTILITIES
Powering Automation

PROUDLY PRESENTING THE CONFERENCE SCHEDULE

Opening Session Tuesday, October 4, 10:15AM – 12:00PM

CAGI Remarks
Chad Larrabee, Education Committee Chair, Compressed Air & Gas Institute

Reliable Compressed Air Quality & Verification
John Bilsky, Facilities Specialist for Compressed Air, Purified Water and N2 Systems, Gentex Corporation



Aligning Our Incentives
Michael Younis, Director of Energy and Sustainability CoE, Georgia-Pacific

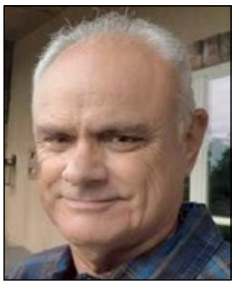
Efficiency, Connectivity, Reliability of Compressed Air Treatment Systems – 10 Easy Tips
Tilo Fruth, President, BEKO Technologies

Plenary Session Wednesday, October 5, 10:15AM – 12:00PM

Welcome!
Roderick Smith, Publisher, Best Practices Magazines & EXPO

Market Trend Towards Air-Over-the-Fence Systems
Steve Briscoe, Director of Sales, Pattons Inc.

Managing Operational Energy at Intertape Polymer Group
Dr. Michael B. Jones, Director of Corporate Energy, Intertape Polymer Group



Multi-Factory Remote Control & Monitoring of Chilled Water and Compressed Air System Performance
Dean Smith, Manager of Auditing & System Design, iZ Systems

Conference Schedule

MONDAY, OCTOBER 3, 2022

6:00PM–8:00PM	Welcome Reception at Renaissance Waverly – *Sponsored by Mikropor*

TUESDAY, OCTOBER 4, 2022

8:00AM–10:00AM	Conference Session #1
10:15AM–12:00PM	Opening Session
1:30PM–6:30PM	**EXPO HALL OPEN**
2:00PM–5:30PM	New Technology EXPO Classroom
5:30PM–6:30PM	Show Floor Reception
6:00PM	Daily EXPO $1,000 Energy Treasure Hunt RAFFLE!
7:00PM–10:00PM	Networking Event at LIVE! AT THE BATTERY – *Sponsored by BEKO TECHNOLOGIES and Kaeser Compressor*

WEDNESDAY, OCTOBER 5, 2022

8:00AM–10:00AM	Conference Session #2
10:15AM–12:00PM	Plenary Session
1:30PM–6:30PM	**EXPO HALL OPEN**
2:00PM–5:30PM	New Technology EXPO Classroom
5:30PM–6:30PM	Show Floor Reception
6:00PM	Daily EXPO $1,000 Energy Treasure Hunt RAFFLE!

THURSDAY, OCTOBER 6, 2022

8:00AM–10:00AM	Conference Session #3
10:15AM–12:15PM	Conference Session #4

New Technology EXPO Classroom

TUESDAY, OCTOBER 4 2:00 PM – 5:30 PM *(SHOW FLOOR)*

2:00-2:25 Another Energy Solution from Hertz
Bob Groendyke, VP & General Manager, Hertz Kompressoren USA

2:30-2:55 Point of Use Oil-Free Air with Catalytic Conversion
Nitin Shanbhag, President, Mikropor America

3:00-3:25 Distributed Production of N2 | O2 | H2 - Benefits & Applications
Yulia Burt, Sales & Business Development Director - Industrial Division, Xebec Adsorption

3:30-3:55 Point-Of-Use Compressed Air Drying Solutions for Moisture Sensitive Applications
Jim DiMaiolo, Industrial Market Manager, Altec AIR

4:00-4:25 Compressed Air Dryer Refrigerant and Environmental Sustainability
Pam Tetterton, Area Sales Manager, BOGE America

4:30-4:55 ABC Compressors New Range & Technology
Nacho Urbistando, Sales Area Manager, ABC Compressors USA

5:00-5:25 Importance of Oil Free Compressed Air in Food and Beverage Safety
Gershom Joel, Product and Support Manager, ELGi North America

WEDNESDAY, OCTOBER 5 2:00 PM – 5:30 PM *(SHOW FLOOR)*

2:00-2:25 FS-Connect a New Way to View Your Compressor from FS-Elliot
David Sleeman, Aftermarket Sales Manager, FS-Elliot

2:30-2:55 High Pressure Air & Gas Applications to Meet and Exceed Your Customer's Needs
Josh Peter, Atlantic Regional Sales Manager, Sauer Compressors USA

3:00-3:25 Compressed Air Piping, The Good, The Bad, The Future
Bill Kirkpatrick, Regional Sales Director, Applied System Technologies

3:30-3:55 AMS (Air Management System): Beyond Traditional Air Prep Systems
Nathan Eisel, National Product Development Manager, SMC Corporation of America

4:00-4:25 Is Control Gap a Problem for Oil-Free Rotary Screw Air Compressors?
Jeff Yarnall, Auditor, Rogers Machinery Company

4:30-4:55 Why Thermal Mass Flow is a Great Technology for Insights into Your Compressed Air Savings
Pascal van Putten, CEO VPInstruments

5:00-5:25 Leak Lifecycle Management
Colin Sewell, CEO & Founder, Prosaris

TRACK 1: On-Site Utility Sustainability: Energy & Cooling Water Conservation *(Room 104)*

Receive actionable project ideas on how to reduce the water and energy consumption of your plant. Learn the latest system assessment techniques from world-class auditors. Meet experts who can answer questions regarding system automation, measurement and monitoring to verify energy savings. **Receive 8 PDH credits.**

Track Chair: *Jon Jensen, Energy Conservation Group Manager, SMC Corp. of America*

TRACK 2: On-Site Utility Reliability, Safety and Quality *(Room 105)*

Learn techniques to improve production up-time with high-quality and reliable on-site utilities. Discuss the establishment of compressed air specifications and compliance verification for the safe production of food, beverage and drug products – and to reduce production spoilage/ reject rates. Receive maintenance check-lists and training to maintain required pressures and flows. **Receive 8 PDH credits.**

Track Chair: *Tom Taranto, Principal, Data Power Services*

TUESDAY, OCTOBER 4 8:00 AM – 10:00 AM SESSION #1

CAGI SEMINAR – CASE STUDIES IN COMPRESSED AIR EFFICIENCY

Chair: *Chad Larrabee, Global Product Management Leader, Ingersoll Rand*

Evaluation of Supply & Demand to Improve Compressed Air System Efficiency Case Studies
Brian Mann, Air Systems Manager, Sullair Corporation

How System Assessments can Reduce Maintenance & Repair Costs on Aging Equipment
Chris Knuffman, Business Line Manager – Reciprocating and Rotary Screw Compressors, Quincy Compressors

Strategies for Improving Compressed Air System Efficiencies Through Innovative Solutions
Neil Mehltretter, Technical Director, Kaeser Compressors

Maximizing Efficiency With Large Demand Fluctuations
Mark Krisa, Global Technology Manager – Air Systems and Digital Solutions, Ingersoll Rand

COMPRESSED AIR COMPLIANCE WITH QUALITY/SAFETY MANAGEMENT SYSTEMS

Chair: *Tom Taranto, Principal, Data Power Services*

Compressed Air as a Quality/Safety Manufacturing Process Variable – Compliance Verification Tips
Tom Taranto, Principal, Data Power Services

Verifying Compressed Air Dryer/Filter/Drain Performance for Quality Reporting Systems
Nitin G. Shanbhag, President, Mikropor America

Avoiding Quality-Related Production Downtime: Realtime ISO 8573-1 Compressed Air Quality Monitoring and Audits
Simon Gleissner, General Manager, SUTO iTEC

From Air Compressors to Purification: Compressed Air Asset Management
Gorazd Bregar, CEO, CALMS Air

TUESDAY, OCTOBER 4 10:15 AM – 12:00 PM OPENING SESSION *(BALLROOM C/D)*

WEDNESDAY, OCTOBER 5 8:00 AM – 10:00 AM SESSION #2

IMPROVING INDUSTRIAL ENERGY AND COOLING WATER EFFICIENCY

Chair: *Doug Barndt, Utilities Engineering Manager, Danone North America*

Improving Industrial Energy and Cooling Water Efficiency-Lessons Learned Over 16 Years
Doug Barndt, Utilities Engineering Manager, Danone North America

Low-cost / No-Cost Flow Reduction: Demand Side Projects for Energy Efficiency
Jon Jensen, Energy Conservation Group Manager, SMC Corp. of America

Critical Insights for Cooling Systems: Off-Design Turndown, Thermal Balancing, and Nominal Ratings
Clayton Penhallegon Jr., Managing Member, Integrated Services Group

Greener Compressed Air Systems – Reducing the Environmental Impact of Air Systems
Paul Edwards, Principal, Compressed Air Consultants

RELIABLE NITROGEN, COOLING WATER AND COMPRESSED AIR SYSTEM DESIGN

Chair: *Bert Wesley, Senior Principal, Woodard + Curran*

Oil-Free, Water-Cooled Air Compressor System Designs
Tim Dugan, President, Compression Engineering Corporation

Cooling System Designs for Water-Cooled Air Compressors
Bert Wesley, Senior Principal, Woodard & Curran

Nitrogen System Designs for Food Industry Applications
Mike Flowe, Nitrogen Generation Specialist, Flowe Nitrogen Systems

Reducing Energy Consumption For Temporary Air Compressor & Blower Needs
Matt Piedmonte, Director, Aerzen Rental

WEDNESDAY, OCTOBER 5 10:15 AM – 12:00 PM PLENARY SESSION *(BALLROOM C/D)*

THURSDAY, OCTOBER 6 8:00 AM – 10:00 AM SESSION #3

VACUUM SYSTEM ENERGY & WATER CONSERVATION PROJECTS

Chair: *Eddie Ostervold, President, E.W. Klein & Co.*

Sizing Vacuum Pumps for Reliability and Efficiency
Dayne Crowley, Product Manager, Gardner Denver Nash

Optimized Maintenance and Water Usage of Liquid Ring Vacuum Pumps in Paper Industry
Dan Barnette, Vice President, E.W. Klein & Co.

How to Save 90% of Water Consumption on a Liquid Ring Vacuum Pump
Eddie Ostervold, President, E.W. Klein & Co.

System Design: Dry vs. Wet Vacuum Pumps in Plastics
Tie Duan, Solutions Engineer, E.W. Klein & Co.

PIPING DESIGN FOR RELIABLE COMPRESSED AIR & VACUUM SYSTEMS

Chair: *Josh Wamser, Principal, Industrial Compressor Solutions*

Compressed Air & Vacuum Piping Analysis
Tim Dugan, President, Compression Engineering Corporation

Use of Sonic Nozzles for Compressed Air Balancing and Distribution
Mustafa Uslu, CEO, Revindus

Compressed Air Distribution Piping and Pressure Drop
Scott Folsom, Director of Channel Development, FS-Curtis

Design Compressed Air Distribution like an Electrical Grid
Josh Wamser, Principal, Industrial Compressor Solutions

THURSDAY, OCTOBER 6 10:15 AM – 12:00 PM SESSION #4

MEASURING & MONITORING EFFICIENCY KEY PERFORMANCE INDICATORS (KPIS)

Chair: *Clayton Penhallegon Jr., Managing Member, Integrated Services Group*

Can Compressed Air Audits be Automated with Auto-Analyzers?
Rok Trelc, Compressed Air Consultant, HPE

Your Fundamental KPI with Air Compressors: Efficiency!
Pascal van Putten, CEO, VPInstruments,

Driving Success with VFDs in Cooling Systems
Clayton Penhallegon Jr., Managing Member, Integrated Services Group

DOE's MEASUR Tool – Compressed Air Module Overview
Alex Botts, R&D Research Assistant, Oak Ridge National Laboratories

UTILITY ENERGY INCENTIVES AND FOOD PROCESSING BEST PRACTICE GUIDES FOR ONSITE UTILITIES

Chair: *Roderick Smith, Publisher, Best Practices Magazine & Expo*

Food Processing Best Practice On-Site Utility Guides for Cooling Water, Nitrogen, Compressed Air & Vacuum
Roderick Smith, Publisher, Best Practices Magazine & Expo

Roundtable Discussion: Dairy (Milk & Cheese) Best Practice Guide Working Group Creation, Content Structure
Frank Melch, Vice President, Zorn Compressor & Equipment

Energy Incentive Program Administrator Minimum Data/Reporting Needs for Compressed Air System Assessments
Christopher Sullivan-Trainor, Consortium for Energy Efficiency

Roundtable Discussion: Vacuum Audit Case Study and Need for Energy Incentives Targeting Vacuum Systems?
Ron Marshall, Chief Auditor, Marshall Compressed Air Consultants

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To Register Visit: https://cabpexpo.com/registration/

Moisture: the Assassin in Compressed Air Installations

The operation of the VP Dew Point transmitter is based on a so-called capacitive polymer sensor that is resistant to dust and dirt, is insensitive to condensation and has good long-term stability.

After all, if only one sensor is used in the central pipe to the buffer tank, it will not immediately be possible to determine which dryer is causing problems in the event of a deviating measurement. It is also wise to install an extra dew point sensor in the supply line of critical processes. If something goes wrong with the dew point, timely action can be taken and costly production downtime can be avoided.

The Power of Combined Measurements

To determine the causes of a deviating dew point quickly and in a targeted manner, it is necessary to perform additional measurements. By installing a 3-in-1 VPFlowScope sensor after the dryer, mass flow, pressure and temperature are also measured. As soon as the dew point rises, it will then be possible to quickly see what is causing this, for example, a rising refrigeration dryer inlet temperature and/or a high airflow. A decrease in flow and/or pressure can also be an indication that the dryer is contaminated internally, while flow measurements can also be used to monitor the leakage level. This is important because, apart from the energy loss, condensation can flow back into the pipe network via leaks, which risk increases with lower dew point applications.

Additional measurements can also be used to visualize the pressure loss across the dryer and filter installation, so that the moment of filter replacement can be predicted precisely. By also measuring the power, in combination with the other measurements, the efficiency of the dryer can be calculated and compared with that of other dryers. This can then be used to optimize maintenance, for example, and also to see afterwards whether the right choices have been made when purchasing the dryer(s).

Dryer Selection

In the context of energy savings, it is important to take a critical look at the pressure dew point

actually required and/or the need to cool all air centrally. Decentralized drying, only for the processes that require it, is also an option. Often people choose "out of safety" for air that is too dry, with a pressure dew point that is too low. However, this will cost an unnecessary amount of energy. A good guideline for determining the correct dew point is the ISO 8573-1:2010 standard. Here the dew point values are divided into seven classes: Class 0 to Class 6. Class 0 (Defined as anything better than Class 1) is the highest category that only applies in rare cases, for example when compressed air is needed in the highest category cleanrooms. Class 1 has a pressure dew point of -94 °F, Class 6 of +50 °F.

Properly analyzing what is really needed can save a lot of money both when investing in the dryer installation and during subsequent operation. To illustrate, the energy consumption of a refrigerated dryer is roughly 0.8 kW/100 CFM, while an adsorption dryer requires about five times as much energy, i.e. about 3 to 4 kW/100 CFM!

Wet and Dry Storage Tanks

It is recommended to install a wet tank downstream of the air compressor and upstream of the compressed air dryer. It is also recommended to install a separate "dry air storage tank" downstream of the dryer. This protects the dryer against overload and also makes it possible to size the dryer based on the average flow instead of on a (short-term) peak demand. As a result, a smaller dryer can generally be chosen. In addition, the extra tank helps to achieve a more stable system pressure and can even have a beneficial effect on compressor sizing and control.

System Optimization

The base for a healthy and optimally profitable compressed air installation is permanent monitoring, in which dew point measurements are combined with flow, pressure, temperature and power measurements. By displaying everything clearly in a monitoring system specifically developed for this purpose, such as VPVision, the system behavior can be monitored and analyzed 24/7, 365 days a year.

Fluctuations in demand, in dew point, a compressor temperature that is too high; everything is visualized in good time and an alarm is issued if things get out of line. It also provides extremely valuable information for maintenance optimization, to make the right investment decisions for future expansion and for optimization of the total compressed air system. Permanent monitoring extends equipment life, reduces maintenance and energy costs, and prevents product loss and production downtime. BP

For more information visit www.vpinstruments.com

This article was created in collaboration with Compressed Air Challenge Instructor Frank Moskowitz and Pascal van Putten, CEO of VPInstruments from Delft, Netherlands.

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Compressed Air System Design for Dust Collectors

By Hank van Ormer, Technical Director, AP Energy

➤ Basic Operating Theory of a Pulse Jet Dust Collector

The dust is collected on the bag or fingers, and when the cake of dust is of appropriate thickness and structure, a pulse or pulses of compressed air hits or shocks the bag and knocks the cake off. This pulse may sometimes be accompanied by physical shaking and even reverse air flows, depending on design.

When the cake is removed correctly from the dust collector, the system removes dust from its assigned environment and has a normal bag life. When the cake is not removed efficiently, the dust collector does not remove dust effectively from its assigned environment and the bag life can be significantly shortened.

Dust collection system designs specify the compressed air inlet pressure to the manifold and pulse valves necessary for effective dust removal. The pulse valve sends a given volume or weight of air to the bag at a predetermined velocity to strike and clear the cake. The actual amount of weight of air is dependent upon the pulse nozzle being fed compressed air at a pre-determined and steady pressure. The dust collector must receive the correct pressure (or close to it) and a steady repeatable pressure level for each pulse, particularly if timers are used to control the pulses. The operator may experiment to find the "right timing sequence" at a desired compressed air inlet pressure. However, if this pressure varies, then performance will not be consistent or satisfactory.

Dust Collector Reverse Flow Filter Pulse Cleaning

The reverse flow filter dust collector utilizes cartridge elements which are cleaned by "back flushing" with compressed air. This momentary air flow reversal is induced by a short burst of compressed air similar to pulse jet sock or bag filter. The compressed air is released from the storage receiver by a fast-acting high flow diaphragm valve. This "pulse" of air dislodges the accumulated dust from the element. The dust then dumps into the "hopper" or collector drawers.

Each pulse cleans a series of filter elements leaving the remaining cartridges available to continue filtering the air. Each diaphragm valve typically operates one pulse jet blow pipe. Each pulse jet blow pipe contains a nozzle for each cartridge – usually up to three cartridge filters per pipe. As the pulse of air reaches the nozzle it is accelerated through the smaller diameter creating a low pressure center, or Venturi, pulling in surrounding air through the filter in a counter-flow direction.

The rated flow of compressed air per pulse is often 3 to 6 cubic feet (this may vary at any site and the proper data will be needed), with normal pulse duration of 0.15 to 0.5 second,

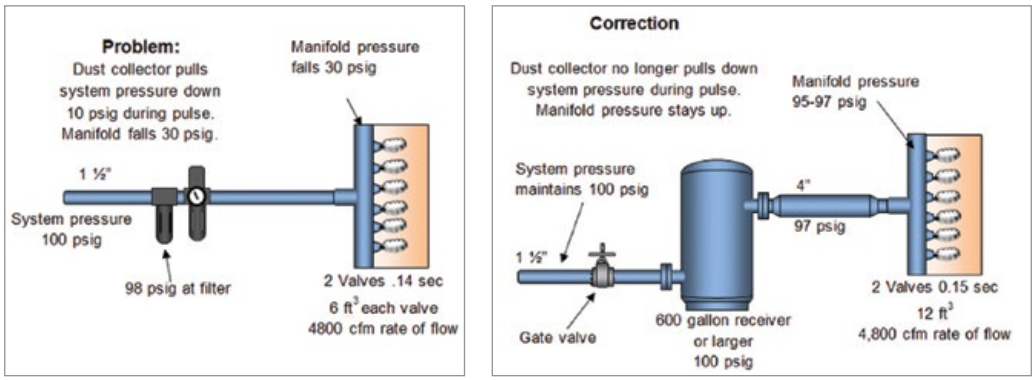


Figure 1. How to Correct for Pressure Drop

and one valve opening every 15 seconds. Obviously there are other designs with different specifications. Most of the time there will be only one valve opening every 15 seconds but sometimes there could be two or more pulses simultaneously.

Installation Considerations for Proper Compressed Air Supply

Short bag life usually comes from the pulsers hitting the bag when the cake is not ready to flake off or the cake has gone too long between pulsing and has grown too thick and heavy to clean effectively. This causes not only short bag life, but also very poor performance. There are several possible causes for this, including:

- Incorrect timer settings for the operating conditions. The actual requirement for the optimum timer setting may well change as various product runs change, or this may change seasonally. These settings have to be set carefully during initial installation and then monitored regularly
- Lack of sufficient compressed air storage near the inlet manifold to supply the required pulse air without collapsing the inlet pressure. With too low an inlet pressure, the mass weight of the air pulse is too low, which then becomes ineffective in removing the cake
- Too small a feed line to the dust collector entry will have the same effect as lack of air supply
- Too small or an incorrect regulator, which is unable to handle the required rate of flow required by the dust collectors
- Figure 1 illustrates a common installation or system situation that causes restricted compressed air flow. Prior to the installation or operational change, the proper rate of flow was not identified for the dust collector cleaning action. Feed line sizing, regulator sizing, and air supply all require an identified rate of flow. Using average flow rate instead of the rate of flow can be misleading and typically results in misapplications. This is true for both Pulse Jet and Reverse Flow.

Compressed Air System Design for Dust Collectors

Improper compressed air delivery and supply may create an ineffective pulse. This can be addressed by:

- Using proper line size to handle rate of flow without high pressure loss
- Using storage to supply air without pulling down feed to the receiver/collector
- Monitoring inlet pressure and drop at pulse
- Monitoring flow

Rate of Flow

Flow rate is the average flow of compressed air in cubic feet per minute either required by a process or delivered to the system. Rate of flow is the actual rate of flow of compressed air demand expressed in cubic feet per minute regardless of duration. Even relatively small air demands in cubic feet can have a very high rate of flow, if they occur over a very short time period. Dust collectors normally have this characteristic.

Sequence controllers can have a very significant impact on the required rate of flow. For example, the following table illustrates a dust collector system which has six pulsing valves that use 3.5 ft^3 over ½ second for each pulse. When this is a problem, appropriate storage and piping can be an effective correction when properly implemented.

The impact of two different rates of flow shows similar differences in regulator sizing if they are used on the feed line flow. The high flow velocities entering the manifold and controls for the pulse valves will create extra pressure loss through the nozzle, affecting the performance of the pulse cleaner. The same effect would show up in air receiver sizing to minimize both system and feed line pressure drops, if that is a question.

Table 2 provides an example of how to calculate storage size. The following figure illustrates how to apply this storage to lower the rate of flow.

Additional Dust Collector Installation Guidelines

It is recommended that every feed line have a quality pressure gauge installed near the dust collector entry. Observe the pressure gauge when the pulser hits. If the pressure drop is too high (over 10 20 psig), start looking for the cause. Record the specifications on the dust collector (scfm per pulse, feed line pressure, time per pulse, cycle time between pulses). Calculate the rate of flow and check line size and storage. If additional storage is required, it can be calculated by using the formulas presented in the "Example of Calculating Storage Size" shown in Table 2.

The sequence and pulse jet nozzle size depend on the number of bags, type of bags, length of the bags, and the materials being trapped. These will vary by make and model. Some rules of thumb that often apply:

TABLE 1. EXAMPLE RATE OF FLOW CALCULATION

Typical sizing (each valve uses 3.5 scfm/pulse – 6 valves on collector)	
Rate of flow and sizing with one valve hitting every 7 seconds	**Rate of flow and sizing with six valves opening at once every 7 seconds**
Rate of Flow = (1) × (3.5) = 3.5 × 60 ÷ 0.5 = 420 scfm	Rate of Flow = (6) × (3.5) = 21 × 60 ÷ 0.5 = 2,520 scfm
The line size recommendation from the air supply to the dust collector – 90 psig line pressure = 2" to 3"	The line size recommendation from the air supply to the dust collector – 90 psig line pressure = 4" to 6"
A 2" feed line will handle the 420 scfm flow at 90 psig line pressure with a velocity of 43 fps, which is about as high as it should go	A 6" feed line will handle the 2,520 scfm flow at 90 psig line pressure with a velocity of about 30 fps, which is conservative in this application
A 3" feed line will handle the 420 scfm flow at 90 psig with a velocity of about 19 fps – very conservative	A 2" line at 2,520 scfm would have a minimum pressure loss of 30-50 psid, depending on timing and turbulence. This would be completely unacceptable
A 2" line would have a pressure loss of about 1 psid every 100' at 420 scfm flow, which may be acceptable depending on feed line design and length	A 4" line would have a pressure loss of about 1.1 to 1.2 psid per 100' at 90 psig, and combined with moderate velocity, should be acceptable depending on the length and design of the feed line
A 3" line would have pressure loss of less than 0.10 psid per 100' at 420 scfm flow, which should be very acceptable	A 6" line would have a minimum pressure loss of 0.15 to 0.20 psid at 90 psig with very low velocities and should be acceptable with "normal" installations

TABLE 2. EXAMPLE OF CALCULATING STORAGE SIZE

Pulse rate of flow to dust collectors

Objective: Size storage to allow pulse of 21 ft^3 in 0.5 seconds to only drop 4 psig

6 valves × 3.5 ft3 = 21 ft^3
21 ft^3 × 60 sec ÷ 0.5 sec = 2,520 scfm rate of flow

Calculating storage size

T = Time (seconds)
V = Volume storage (ft^3)
C = Capacity scfm (2,520) rate of flow
Pa = Psia (14.5)
P1 = Initial receiver pressure (100)
P2 = Final receiver pressure (96)

$\frac{V}{T} = \frac{(C)\,(Pa)}{(P1 - P2)(60\ \text{seconds})}$

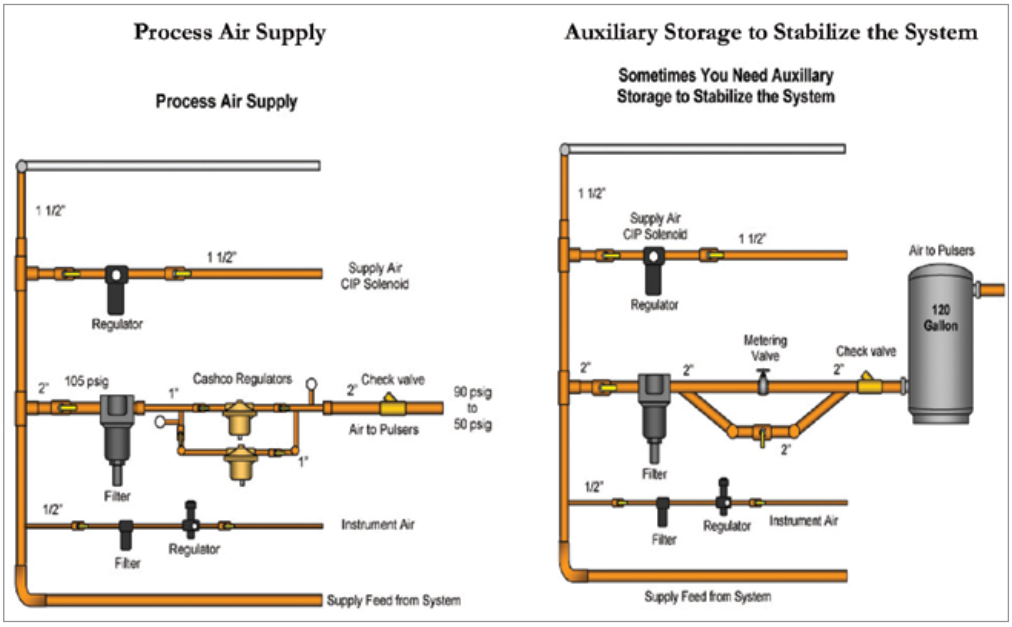
$\frac{V}{0.5} = \frac{(2{,}520)\,(14.5)}{(100 - 96)\,(60\ \text{seconds})}$

$\frac{V}{0.5} = \frac{36{,}540}{240}$

V = 76 ft^3
76 ft^3 × 7.48 gallons/ft^3 = 568 gallons or more receiver size required

Calculating 7-second refill rate of flow:
Time allowed = 6 sec
21 ft^3 × 60 sec ÷ 6 sec = 2,109 scfm rate of flow
Effect on header: Negligible

- ½ second is commonly used for the pulse duration.
- Air flow per pulse jet is very often from 3.5 ft^3 to 10 ft^3.
- Dust collector capacity is often increased first by lengthening the bags and/or increasing the number of bags in the housing.
- As the bag length increases, the pulse jet air demand increases. In one example, increasing from 18" length bags to 84" length bags increases the pulse demand about 25% incrementally.



Storage to Decrease the Rate of Flow

Compressed Air System Design for Dust Collectors

- As the number of bags of the same design increases, the pulse air required increases by about the same percentage.

The number of pulse jets, sequence, and air demand need to be known to install any dust collector correctly to ensure an adequate flow of compressed air at the proper pressure.

With the variety of filters of modern high-performance materials available today, many operations are modifying their older dust collectors; however, too often the effect on compressed air requirements is not considered.

Compressed Air Leaks in Dust Collectors

Pulse jet dust collectors are a continuing source of leaks, particularly when pulse jet diaphragms fail which can create a very large compressed air leak. An open 3/4" diaphragm pulse valve can leak up to 200 250 scfm, equivalent to 50 to 60 hp worth of compressed air, and costing about $24,000 /year.

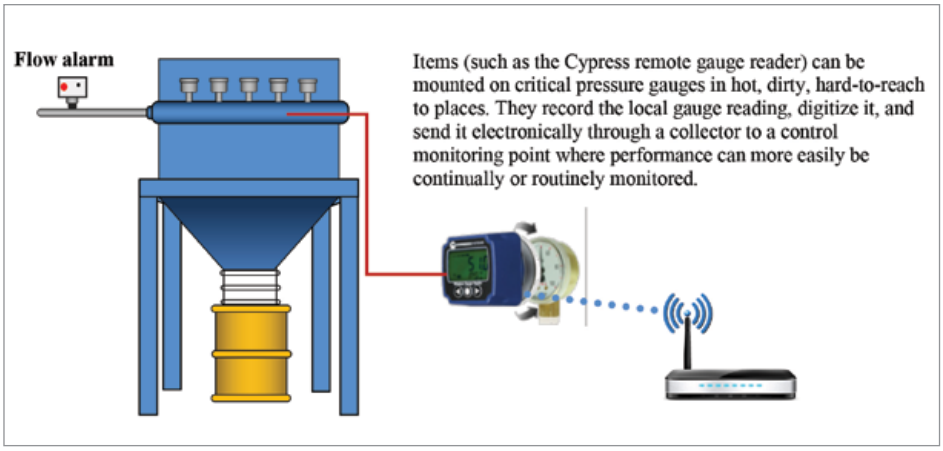
Often, these failures/leaks are hard to hear and sometimes, when first heard, are ignored in the hope that someone else will notice and repair it. After all, it is a hot, or cold, dusty, noisy job, often high above ground level. There are some excellent electronic monitoring systems available which will identify leaks from failed solenoid pulse jet valves. These can also monitor filter performance and condition and monitor the system's capability to stay in compliance.

For these monitoring systems to perform as designed, the compressed air supply should deliver solid, consistent pressure at the point-of-use. A paddle switch visual alarm can easily be installed on the air supply pipeline. Whenever the paddle sensor sees compressed air flow, the light turns on. When the pulse jet hits, the light turns on and then turns off when it closes. If the light stays on, there is continuous flow – a leak!

Automatic Pressure Differential Pulse Controllers

A demand-side controller is always suggested for properly installed applications. This senses the filter condition and only pulses the bag at the right time. There are some excellent electronic control systems available which can be very economical and will usually improve bag life and reduce air usage.

Projects, which are very effective in optimizing compressed air usage, are always recommended; however, the storage and piping has to be correct for proper operation. When not installed properly, there can be a significant negative impact.



Remote Monitor Gauge Reading

Valve Size	Standard Pulse with Demand Control		Continuous 356 pulse/hour	
	$ / Year	Avg. scfm	$ / Year	Avg. scfm
3/4"	$1,007	10.7	$3,205	32.05
1 1/8"	$2,040	20.4	$6,109	61.09
1 1/2"	$3,550	35.5	$10,610	106.61
2"	$4,890	48.9	$14,663	146.63

Table 3. Compressed Air Use for a 10-row Dust Collector. (supplied by FilterSense)

Table 3 indicates estimated compressed air savings based on valve size for a 10 row pulse jet dust collector with either a pressure differential control or timer control set at 356 pulses /hour.

When a plant or operation with significant dust collecting is reviewed, it is very rare to find an operator who is aware of what the dust collector's operating specifications are and how or why the pipe sizes were selected. Typically, when returning conditions to the originally manufactured specifications, the unit will run as intended.

Dust Collector Troubleshooting and Maintenance Tips

All dust collectors need routine maintenance of clearing plugged tubes, in addition to:

- Continuous diaphragm/valve repair
- Cleaning and checking magnehelic gauges and other critical sensors
- Reset timers, if required

When pulse valve diaphragms become worn and do not seal, filter cleaning becomes ineffective

and often the operators adjust the timers to a more frequent cycle, which offsets the lack of performance. This is a poor practice.

Generally speaking, all diaphragms should be replaced within a 3 to 5 year period. Ideally, when replacing one, replace them all. Obviously, different operating condition and controls will yield varying results.

Proper operating valves and diaphragms will allow better filter cleaning, reduce particle emission and use less compressed air:

- A 3/4" ASCO-manufactured pulse valve diaphragm kit retails for about $20 to $25 each
- A 3/4" pulse valve leak may well be as high as 200 scfm. The 1 ½" and 2" valves can and do leak up to 1,000 scfm
- Monitor all control sensors (Δ pressures, time delays, cycle times and cleaning times) per manufacturer specifications
- If pulse cleaning never stops when it should, then:
  - Check if the pressure tubing is disconnected
  - Check electrical connections
  - Check high and low pressure points

Diaphragm and valve maintenance is often overlooked in many plants until losses grow to the magnitude where there is not enough air to feed the hungry leaks, at which time a crisis arises, possibly leading to the purchase of additional compressed air. It is obvious that poorly operating, and even more so leaking, valves and diaphragms can use significant volumes of very expensive compressed air. It behooves any plant that operates pulse jet dust collectors to know them well and maintain them properly.

Conclusion

The preceding information is designed to help create clear operating guidelines for all plants to not only effectively use compressed air, a plant's most expensive utility, but to also enhance continuing productivity and quality of overall plant performance. BP

For more information contact Hank van Ormer, Technical Director, or Don van Ormer, Senior Auditor, AP Energy (formerly Air Power USA) at tel: 740.862.4112, Visit https://apenergy.com

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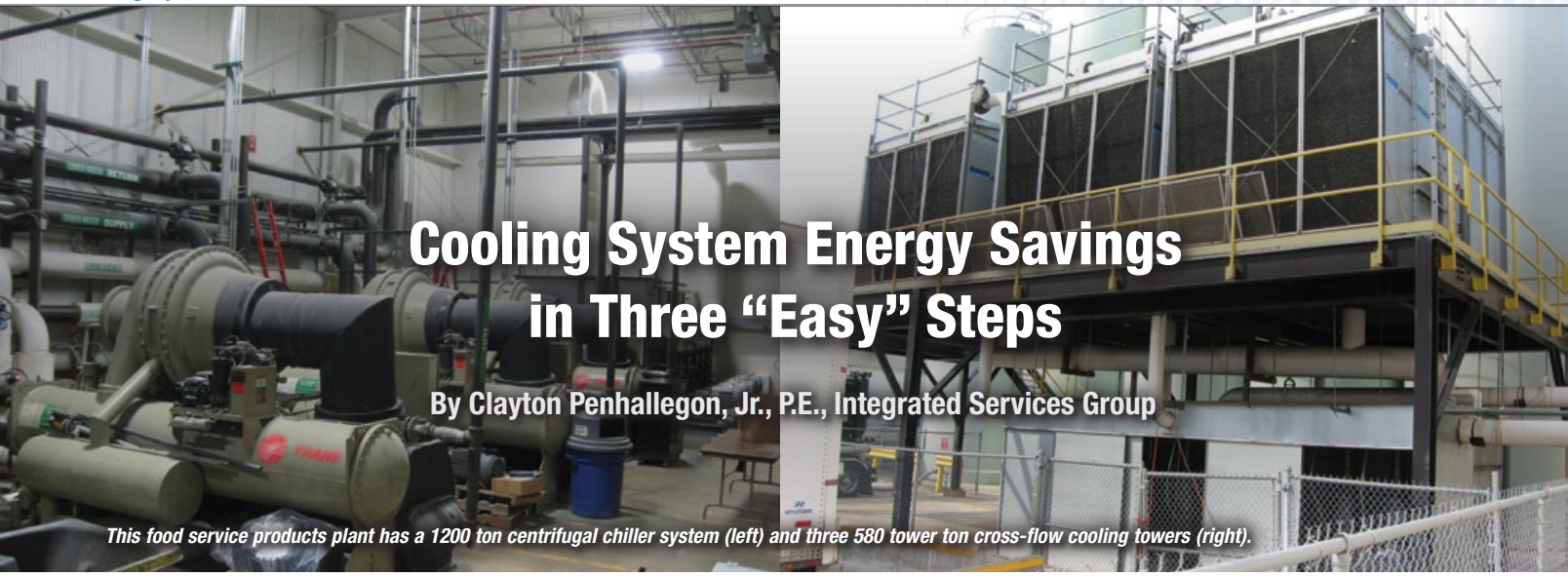


Cooling System Energy Savings in Three "Easy" Steps

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

This food service products plant has a 1200 ton centrifugal chiller system (left) and three 580 tower ton cross-flow cooling towers (right).

An Illinois food service products manufacturer now saves nearly 60% of their base annual cooling energy costs through improvements made in three phases over several years. The plant, which has a 1200 ton chilled water plant, implemented upgrades including pump and tower fan VFDs and enhanced function controls, free cooling, and chiller compressor drive retrofits. The revisions built through successive phases to capture further benefits from more complete utilization of the preceding steps' capabilities.

Each step had to meet corporate payback criteria however the thresholds were loosened as the successes became apparent. The initial upgrades were performed under a 2.0 year energy-only simple payback (SPB) cut-off while the subsequent phases were allowed to meet a 2.5 year SPB. As with many projects of this nature, the plant also realized lower maintenance labor and equipment capital replacement costs coincident with improved process stability and reliability; however, as is also common with many projects like this, the only benefits actually counted for the financial justification were the energy savings due to their clearly discernable nature.

Plant Details and Cooling System Design

The main products of the plant, which operates around 8600 hours per year, are injection molded plates and flatware for the food service industry. Tower water is used to provide cooling for injection molding machine hydraulics, air compressors, and chiller condensers. Chilled water is used for mold cooling and room humidity control to mitigate condensation on the molds.

As a purpose-built system, the cooling equipment was generally well matched to the overall plant loads. Both the tower water and chilled water are open tank, recirculation and process loop design systems with hot well / cold well tanks connected by flow-equalization piping. The tanks are sufficiently large that they don't have the excessive turbulence and air induction that characterizes so many systems that have grown to multiples of their original size[1]; nevertheless, this system was found to have the same inherent flow issues common with tank-based systems.

Three gear-drive, cross-flow cooling towers provide tower loop heat rejection totaling roughly 1750 tower tons. Tower water flows through a hot well tank, is pumped by four 30 HP recirculation pumps to the towers, drains to a cold well tank, and is then pumped by four 75 HP process pumps into the plant.

Chilled water (CHW) is provided by three 400 tonR centrifugal chillers. CHW is pumped from a hot well tank to the chillers by three 20 HP recirc pumps; while nominally installed as one per chiller, the recirc pumps share a common header arrangement so any pump can flow to any chiller. The process CHW is pumped from the cold well tank to the plant by five 75 HP process pumps, and a separate 25 HP pump circulates CHW to the humidity control AHUs.

When initially studied, operation and control of the system was rudimentary. Pumps in each loop were controlled to their amp ratings by partially closed discharge valves, and any flow or efficiency considerations were second to the electrical operation of the pumps. The tower water setpoint was maintained by staging the three single-speed tower fans off and on. There were no other automatic controls – plant operators manually turned pumps and chillers on and off as needed to meet the perceived loads. Due to the generally stable operation of the plant, this provided adequate cooling and the system operation was considered satisfactory by the plant staff and management.

Initial Conditions

The plant cooling load averaged around 620 tons with summer peaks to near 800 tons, and the plant normally operated two of the three chillers in a rotation. Given the pumps and tower fans in the system multi-loop design, the average plant efficiency ran around 1.375 kW per ton. With the high operating hours in the plant, the total annual cooling cost was roughly $570,000[2].

Challenging Injection Molding Cooling Requirements

One characteristic detail of injection molding plants is high flow / low delta T process cooling to the injection molds to provide near uniform cooling across the molds. The target temperature change across molds is typically around 2°F – this means the CHW flow for the actual cooling provided is around 12 GPM per ton vs. the standard 2.4 GPM per ton with a 10°F DT common in cooling water applications.

In practice, the 2°F mold delta T ends up being more like a 4 to 4.5°F DT at the chiller plant with flows between 5 and 6 GPM per ton (inverse change in flow to the DT). This is due to the blending with the mold cooling return water of return CHW from air handling units, machine hydraulics (if all on one system), and other uses (some lines use local circulating pump temperature control units [TCUs] to provide higher mold flow rates at higher supply temperatures).

Because the chillers were selected for typical 10°F evaporator delta Ts and the recirc pumps and piping were designed to meet this criterion, the chillers have to be run at temperatures below the target CHW supply temperature. In this plant, the chillers normally have to be run at a 45°F set point to have around 50°F water supplied to the plant floor.

Opportunities Identified

ISG was contracted to study the systems for potential efficiency improvements and possible qualification for local utility efficiency rebates. The review consisted of a detailed audit which included recording system operating conditions and gathering detailed data to support an eventual local utility rebate application. ISG documented the system equipment and configuration (e.g. hot well / cold well tanks, recirc loops, etc.), noted operating status such as on / off and balancing device states, and also logged 1 minute trend data of power and water conditions including flows, temperatures, and pressures. Cooling water uses in the plant were reviewed so the application considerations could be included in the analysis.

While the cooling systems were built intentionally for the anticipated loads (unlike many plant systems that grow incrementally over time as the cooling needs increase), the systems showed many hallmarks of typical cooling systems:

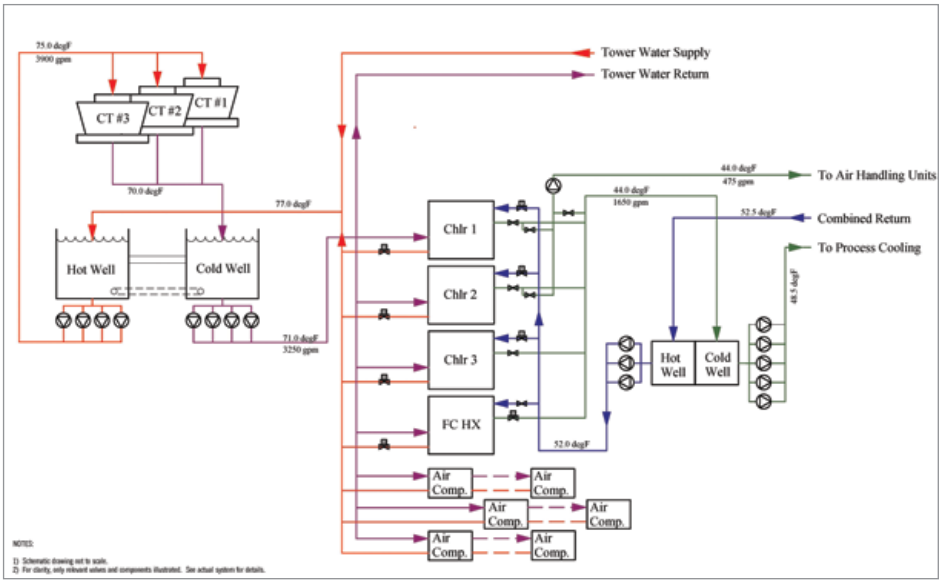
- Constantly varying "sawtooth" tower water supply temperature due to fan cycling, along with excess fan drive mechanical wear from frequent across-the-line starts
- 100% tower fan operation and energy waste seasonally (~June to Sept.) when wet bulb conditions made the fixed set point unattainable regardless of the load on the towers
- Discharge valves partially closed on many pumps to avoid over-amping the motors
- Imbalanced and excessive flows on recirc loops
- Pressure variations on process loops as machine loads varied
- More pumps than necessary operating much of the time due to operators needing on-line redundancy in case of "2:00 AM" failures

ISG presented the manufacturer with recommended improvements that spanned a range of Tier 1 and Tier 2 upgrades (see sidebar) which in aggregate would qualify for local utility incentives as a Custom Project

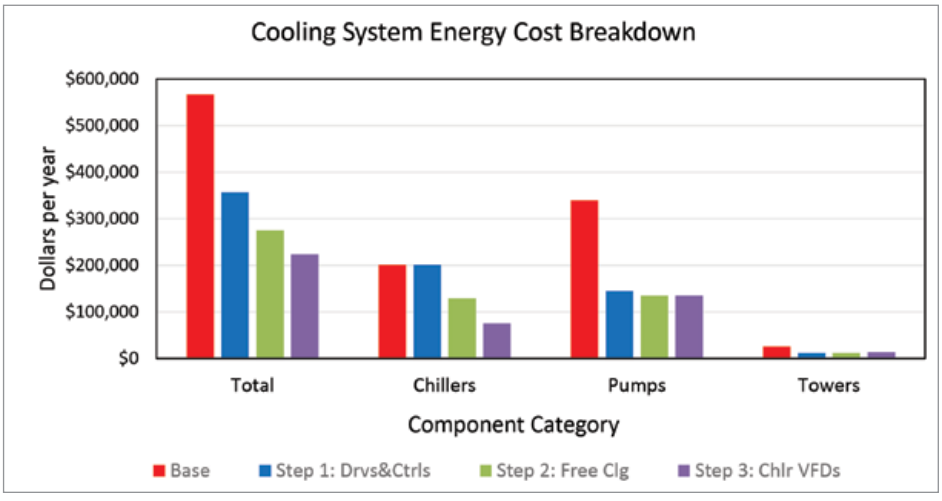
Cooling System Energy Savings in Three "Easy" Steps

application. The suggested measures included (Tier level in [X] brackets):

- Add VFDs to the tower fans (three total) [T1]
- Control towers to run in parallel vs. staged On / Off to reach set point [T1]
- Implement wet bulb reset control on the tower water supply set point [T2]
- Calibrate tower set point reset selection to chiller efficiency beneficial range [T2]
- Add VFDs to tower water and CHW recirc and process pumps (16 total) [T1]
- Open all partially closed pump discharge valves and tower inflow valves [T1]
- Install process differential pressure sensors on the tower water and CHW piping [T1]
- Control recirc loop flows continuously to more closely balance with process loops [T2]



Cooling system flow diagram



Step 1 – Upgrades and Results

The manufacturer approved the recommended upgrades and a utility rebate application was filed for the current program year. In addition to 19 VFDs for the pumps and tower fans, the project also included cooling system controls and adding network communication cards to the chillers. The drives were also networked for intelligent bus control, and the entire cooling system could be supervised remotely through the plant LAN.

All the specific efficiency measures listed above were implemented along with system operation functions including overall on / off control, chiller rotation selection, chiller fault and system high load response, and other fault alarming. Controls data trending facilitated the required utility rebate M&V documentation as well as supporting troubleshooting and performance monitoring, and includes drive frequency and real power (kW), major chiller data points (power, temperatures, refrigerant and oil conditions, etc.), and numerous system parameters such as loop temperatures, pump header pressures, loop differential pressures, and key water flows.

The effects of the changes were impressive: Annual savings were just under $210,000 and total energy savings were 37% of the base with the peak summer demand being reduced by over 20%. The overall plant kW per ton was reduced nearly 32% from 1.374 to 0.935. Finally, the project received an efficiency incentive of nearly $90,000 which was capped due to aggressive cost control and unusual installation circumstances (more internal labor than is typical); under more typical project costs, the incentive could have been around $230,000.

Step 1 – Savings Details

Perhaps surprisingly to someone unfamiliar with these systems, virtually all of the savings came from pump application improvements.

Only 7% of the savings were from tower fans and while there were chiller efficiency improvements from the more capable tower setpoint control, this was essentially ignored due to the requirement to document the savings over an extended period for rebate purposes which were already capped.

The eight CHW pumps, with one exception, all had their discharge valves choked to limit the motor amps. These valves were all opened fully, balance valves on the CHW recirc loop (the chillers) were opened, and active flow control was added to all of these (differential pressure to the floor on the process loop, process-linked flow to the recirc loop).

The tower pumps had open valves initially but very often had significant excess flows. Process loop tower water differential pressure sensing was added in two locations, one in the headers serving the chillers and air compressors, and the other in the plant floor loop serving the injection machine hydraulics (coincidentally also adjacent to the CHW DP sensor). The initial expectation was that the controls would look at both sensors and conduct pump speed control based on separate DP setpoints for the two locations, but in practice the chiller header pressure was found to control the application leaving the process floor loop sensor informational only.

Further tower water pump savings were realized by aggressively resetting the tower water supply temperature seasonally. The northern Illinois climate has many hours each year when the towers could supply water cooler than the originally found 72°F setpoint. In addition to floating the setpoint up when the wet bulb temperature was higher than ≈ 66° (the threshold where the towers could not meet the 72° water temperature target), the setpoint was allowed to come down when economically possible to as low as 57° on the tower recirc loop. This allowed the recirc loop flow to be lower than the process loop flow while still meeting the target supply temperature to the chillers and plant floor by mixing warm process return water. The entire system is allowed to float within a band that meets the summer peak design conditions on the high end but also minimizes chiller and pumping power when possible on the low end.

Partially closed chilled water pump discharge valves.

Cooling System Energy Savings in Three "Easy" Steps

Step 2 – Free Cooling

Once the initial project results were validated, the manufacturer was receptive to opportunities for further savings. The tower water setpoint control capability described above set the stage for the plant to implement so-called free cooling[3] for several thousand hours per year in the northern Illinois climate. The utility approved another efficiency incentive application for the measure based on baseline data provided from the cooling controls trend data with expected annual energy savings of around $53,000; the plant would further see reduced runtime and wear on the chillers and commensurate maintenance savings.

Once in operation, the system saved more than projected as the operating hours were greater than the conservative initial estimates (nearly 4000 hours in the first year vs. 3050 estimated) with free cooling running into May on cool nights; this was offset somewhat by lower running loads due to production changes. Actual energy savings were calculated at $71,000 per year and earned a $57,000 rebate. Annualized total plant kW per ton decreased further to 0.668, over 50% less than the initial figure; total yearly savings were nearly $300,000 when this was complete.

As often happens when system operations are changed, several minor problems were uncovered when the chillers were shut down

ISG Efficiency Measure Tier System

ISG uses a ranking system to describe potential efficiency improvements for cooling systems. The categories include the degree of energy savings impact but also include related benefits such as reduced equipment wear and other integral cost reductions or operational benefits.

The categories, or Tiers in our terminology, broadly describe the complexity or degree of change from the initial conditions. While the Tiers generally correlate to total savings, investment, and / or payback period, this is not the basis of the rankings; rather the Tier category indicates the sequence location of a potential measure in an upgrade process with lower Tier measures preceding higher Tier measures as generally necessary precursors.

Tier 1: Basic Efficiency Improvements – 1st step measures that save energy and position systems for higher Tier measure applications.

- VFDs for tower fans and system pumps
- Control of tower fan to current set point with speed adjustment instead of cycling
- Opening of pump discharge valves choked for amp control by reducing pump speed
- Opening of balance valves and circuit setters for further pump speed reduction
- Flow control improvements such as balancing of nominal flows between recirc and process loops or reducing excess primary chiller CHW loops
- Implementation of process-driven pump speed control such as differential pressure

Tier 2: Advanced Efficiency Improvements – 2nd step measures that leverage the Tier 1 changes to enable deeper energy savings.

- Wet bulb reset control of tower water supply temperature
- Tower water pump control using colder TW to enable reduced flows when available
- Linking of recirc loop flows to process loop flows for dynamic pump control
- Tailoring TW setpoint control to chiller type for best chiller efficiency improvements
- Limited piping changes to enhance system operation and further leverage control capabilities

Tier 3: Capital Efficiency Improvements – 3rd step measures that require Tier 1 and Tier 2 measures for most effective utilization.

- Chiller compressor VFD retrofits and / or high efficiency chiller replacement
- "Free cooling" plate heat exchanger systems for seasonal CHW supply
- Conversion of CHW cooled equipment to closed loop "Process Water" systems, essentially year-round free cooling but at temperatures supported by towers only
- Major piping and equipment upgrades (e.g. pump changes, tower rebuilds / replacements) to enable system consolidations or seasonal shutdowns

Tier 4: Complete System Efficiency Improvements – comprehensive system upgrade measures superseding the three lower tiers and incorporating those features by initial design.

- Replacement of original systems with newly installed, high efficiency cooling plants
- Major rebuilding of existing systems with major component replacements (chillers, towers) and conversion from open systems with bulk water tanks to closed systems with pressure control and thermal expansion tanks (bladder or otherwise)

Most cooling systems have opportunities to employ several of the measures across different tiers. For example, a common sequence would be adding drives to tower fans and pumps (Tier 1), reducing the tower water temperature seasonally though wet bulb control (Tier 2), and retrofitting VFDs on chiller compressors to leverage the colder TW (Tier 3).

completely with the plant still running. These included leaking shut off valves, chiller oil heater issues, and chiller start-up transition sensitivities with cold tower water. While these were frustrating, solving them ultimately served to help improve the overall cooling plant operations; in particular, implementing chiller-based head pressure control of the chiller condenser valves dramatically improved the start-up reliability when transitioning back out of free cooling or when doing a cold start after a winter shutdown.

Additional benefits from the free cooling were achieved by designing the plate heat exchanger for lower pressure drop and higher flows than the chillers themselves. Combined with the reduced total process CHW flow from not requiring humidity control AHUs to run, the CHW supply temperature to the floor is closer to the recirc loop return temperature from the plate HX. The closer the recirc temperature is to the required plant supply temperature, the more hours the system can operate.

Free cooling plate heat exchanger.

Cooling System Energy Savings in Three "Easy" Steps

A 400 ton centrifugal chiller with VFD retrofit.

Step 3 – Chiller Compressor VFD Retrofits

After the success of the first two cooling system upgrade projects, the plant wanted to pursue the last practical efficiency opportunity remaining – adding VFDs to the centrifugal chiller compressors. The chiller manufacturer offers factory-designed drive retrofits that include the drive, complete installation, and control integration on the chiller.

These retrofits were submitted and qualified for custom incentives under the rebate program because installing the drives enabled further control settings tuning and greater savings in the pumps and the chillers themselves than would have been possible with a standard fixed setpoint tower control system. Had the application not been made under the Custom program, for example as a straight prescriptive $ per VFD HP rebate, the payment to the plant would have been significantly lower.

Savings from the chiller VFDs are offsetting to the free cooling, as more of one indicates less of the other; however together they give the plant the lowest overall chilling energy for whatever the weather throws at the plant.

In the first year, during which the free cooling was allowed to run reduced hours to validate the drive benefits, the upgrades saved over $75,000 from the chillers and an additional $10,000 from incremental pump savings (harvesting lower tower water temps when available instead of limiting the turndown due to chiller inability to use the colder water). The project cost was around $260,000 but a rebate of nearly $124,000 was available due to special program year incentives that made the payback just over 1 year. Even under normal incentives and with typical free cooling operation reducing the chiller hours, the project would have paid back under in roughly 2.8 years.

Following the last step, the annual average plant efficiency was 0.542 kW per ton with total bill savings of over $340,000 – in aggregate the efficiency measures are saving nearly 60% of the original energy usage while also providing multiple other benefits to the plant.

Conclusion

This plant was able to realize dramatic efficiency increases and energy cost savings through a multi-step program. Each step improved the overall system performance while also leveraging further improvements from the earlier measures. Other facility operators who would like to achieve similar results should consider how similar incremental measures can be applied in their plants; and aggressive use of utility efficiency incentives should be factored during the planning process as part of the justification – in this case the utility rebates facilitated notably more extensive upgrades than the manufacturer would have been able to fund independently, yielding much deeper energy savings than would have otherwise been possible. BP

For more information about Integrated Services Group visit https://www.isg-energy.com, email: info@isg-energy.com, tel: 770.823.8235

Endnotes

1. Very many plants outgrow their initial tank systems such that the flow rate through the tanks exceeds the tank size, e.g. a 1500 gal. tank with a 1200 gal. usable storage capacity will be flowing 1800+ GPM; not only does this hurt the temperature segregation of the hot and cold wells, it also creates significant aeration issues in the piping system.
2. All costs and efficiency figures are normalized to the per kWh and load figures from the beginning of the work. The power cost and load has increased modestly since the original evaluation, increasing the absolute benefits, but the units were kept consistent for comparability across the changes.
3. Free cooling, or water-side economizing, is cooling the tower water below the chilled water temperature to enable heat exchanger-only cooling. The chillers are turned off yielding significant savings with only modest incremental tower fan power required.

To read similar ***Chilled Water System Assessment*** articles visit https://coolingbestpractices.com/system-assessments

Visit our Webinar Archives to listen to expert presentations on ***Chiller Technology*** at https://coolingbestpractices.com/magazine/webinars

Chiller & Cooling System Technology & Industry News

Carrier Adds Heat Recovery and Free Cooling Options to R-32 Scroll Chiller in Europe

Carrier has introduced high-performance heat recovery and free cooling options to its AquaSnap 30RBP air-cooled scroll chiller range on lower GWP R-32 refrigerant, providing even greater energy savings and further reducing operating costs for end users. Carrier is part of Carrier Global Corporation, the leading global provider of healthy, safe, sustainable and intelligent building and cold chain solutions.

Carrier was the first European manufacturer to introduce a fully optimized scroll chiller range on R-32. AquaSnap units also have an outstanding seasonal energy performance ratio for cooling of up to 6.62, reducing indirect GHG emissions resulting from energy use. The latest heat recovery and free cooling options extend energy savings, further reducing GHG emissions.

The heat recovery system enables chillers to produce domestic hot water up to 80°C, while continuing to provide cooling, useful for applications requiring hot water. The free cooling option makes use of favorable ambient and load conditions, harnessing free cooling from the environment to augment or replace mechanical cooling.

Two versions of free cooling are available. Partial free cooling is designed for applications with a variable primary cooling load, such as offices and healthcare, which may also have a constant residual cooling need. Examples include computer suites or scanner facilities. The total free cooling option is designed for applications with a constant cooling need throughout the year, such as industrial processes and data centers.

"Heat recovery and free cooling can deliver significant energy savings for most applications," said Eric Pollet, Marketing Product Manager, Chillers and Heat Pumps, Carrier HVAC. "Free-cooling is particularly valuable in higher latitudes, where cooler climates offer the greatest opportunities for harnessing natural ambient conditions rather than relying on mechanical cooling. Under these conditions, it is possible for free cooling to meet most of an application's cooling needs, delivering huge potential savings for the end user."

Carrier's hydronic-based free-cooling system automatically activates when the outdoor air temperature drops 1°C below the chiller's return water temperature, harnessing the full free cooling opportunity and maximizing energy savings. For example in Berlin, the hydronic free cooling potential is 50 to 95% of annual chiller run-time, depending on the application. In more northern locations, the potential free cooling opportunity is even greater.

If free cooling is not sufficient to meet requirements, a mixed mode – using both free cooling and mechanical cooling – is automatically activated, ensuring the cooling needs of mission critical applications are always met.

Energy efficient solutions like the AquaSnap scroll chiller with heat recovery and free cooling support Carrier's 2030 ESG Goal of reducing its customers' carbon footprint by more than 1 gigaton.

Carrier AquaSnap 30RBP air-cooled scroll chiller range on R-32 refrigerant.

For more information, visit www.carrier.com.

Trane Premieres Ascend Model ACX, Air-to-Water Heat Pump and Redesigns Precedent Rooftop Units

Trane has released the Ascend Air-to-Water Heat Pump Model ACX, the first air-to-water pump solution in its portfolio that provides both electric heating and cooling, giving building owners an avenue to pursue decarbonization via electrification. Trane also announced it is bringing a new generation of Precedent rooftop units to market, consolidating the legacy Precedent and Voyager 2 offerings. The first models in the redesigned series, the Precedent standard efficiency 6- to 25-ton units, are available now.

Trane's Ascend air-to-water heat pump model ACX combines chiller and heat pump technology to both heat and cool a building using electricity. In cooling mode, the model ACX moves heat from inside the building to the outside. In heating mode, a reversing valve changes the flow of energy to bring heat from outside of the building to the inside. The heat pump moves heat using a compressor, rather than simply generating heat. This technique can make heat pumps up to three times more energy-efficient than other forms of electric heating.

"Over 180 cities, more than ten counties, and eight states across the U.S. have goals to power their communities with 100% clean, renewable energy. As the grid gets greener, the need for full electric heating and cooling is growing," said Dave Molin, VP of Trane Product Management, Equipment, Controls and Digital.

As a result of its boiler-free heating, the model ACX achieves high energy efficiency for cooling and heating. The unit's heating

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efficiency exceeds ASHRAE standard 90.1-2019: 2.77 COP for heating and a cooling requirement of 9.215 EER.

The Ascend model ACX can help builders and operators meet current HVAC regulations, attain certifications, or achieve a net-zero energy building with its all-electric functionality and other energy-efficient features:

- AHRI compliant
- Variable speed fans, variable speed permanent magnet motors, intermediate discharge valves on the compressor, and braze plate evaporators enhance efficiency.
- Dual expansion refrigerant flow valves optimized for heating and cooling modes enable system reliability.
- The heat pump generates hot water temperatures up to 140°F and operation down to 0°F ambient.
- The Symbio 800 unit controller comes factory-mounted and pre-programmed with algorithms that respond to building conditions and maintain efficient chiller plant operations.
- A scroll compressor makes electrification more affordable and practical without compromising efficiency or sound.
- The fin and tube coil support a smaller footprint, and the transverse "V" condenser coils are easy to access for service.

The new Precedent portfolio will include capacities from 3-25 tons, a full range of tonnages and heating types, and improved efficiency levels. The new single-product family of light commercial unitary rooftops will be released in phases now through 2024.

Available immediately, the Precedent standard efficiency 6- to 25-ton cooling and gas units feature various upgrades, including part-load efficiency ratings that comply with new industry requirements.

About Trane

Trane creates comfortable, energy-efficient indoor environments for commercial and residential applications. For more information, visit www.trane.com.

Modine Launches U.S. Chiller Production with Corscale Data Centers

Modine Manufacturing Company announced it commenced full scale production of chillers for the data center market at their new production facility in Rockbridge, Virginia, and further confirmed a significant order with data center giant, Corscale.

Airedale by Modine is Modine's data center cooling brand, providing energy and water efficient cooling solutions for a data center market that is expanding to meet the demands of a planet increasingly reliant on data.

With Airedale by Modine cooling solutions set to be installed at Corscale's Gainesville Crossing Data Campus, the Company has secured a pipeline for its OptiChill free-cooling chillers, AireWall fan walls and SmartCool ONE computer room AHUs.

Corscale, the exclusive data center platform of Patrinely Group, is focused on delivering sustainability at scale for hyperscale operators and enterprise clients. Following a period of consultation, Corscale appointed Modine for its history of free-cooling technology paired with in-depth knowledge of the data center industry.

Modine developed the data center chiller based on its OptiChill range, working closely with Corscale engineers to deliver a cooling solution operating at higher water temperatures and fluid temperature differentials than traditional offerings. The chiller is designed to meet North American safety standards, using American materials.

The new Corscale chiller operates using twin screw compressors and has a number of special features, included to enhance efficiency and performance, including:

- High-capacity twin-screw compressors with staged capacity control
- Enhanced controls including fast-start, input power limiting and intelligent

Ascend Air-to-Water Heat Pump Model ACX, and Precedent Enabled by Symbio 700 units from Trane (left to right).

management of compressors, refrigerant and pumps

- An on-board variable speed pump to precisely match cooling demand, reducing waste energy expenditure while maintaining water-side temperature differential and saving on space and electrical distribution requirements
- 100% contained Glycol loop to isolate the economizer from the cooling loop and increase efficiency of the AireWall units
- Enhanced controls platform including redundancy back-up and fast-start mode, to minimize the risk of disruption in the event of mechanical breakdown
- On-board active harmonic filtration, ensuring a clean power supply to the data center, while saving on external plant requirements.

"We selected to work with Airedale by Modine because we wanted something that mirrors our dedication to deliver sustainability at scale," said Nic Bustamante, Senior VP, Development at Corscale.

About Modine

At Modine, we are engineering a cleaner, healthier world. Building on more than 100 years of excellence in thermal management, we provide trusted systems and solutions that improve air quality and conserve natural resources. For more information, visit www.modine.com.

Emerson Marks 200 Million Copeland Scroll Compressor Installations

Emerson announced it achieved 200 million Copeland compressor installations worldwide, a milestone that comes as the company concludes its 100th-anniversary celebration of the Copeland brand and as more industry regulatory deadlines continue to drive product innovations.

Recent additions to Emerson's compressor portfolio to help meet efficiency and lower GWP refrigerant requirements include the Copeland ZPK7 and ZPKZ scroll compressors for residential and commercial air conditioning. Other recent additions include the ZPSK7 two-stage scroll compressor for residential and light commercial air conditioning applications; an expanding CO_2 compressor product line for commercial refrigeration applications; advancements in R-290 compressor technology; and A2L-qualified compressors, condensing units and components.

100 years of Copeland technology innovation continues to advance efficiency gains and lower GWP refrigerant adoption.

"Lower GWP options, a heightened focus on sustainable solutions and higher efficiency requirements continue to drive product development," said John Schneider, President, HVACR Technologies Americas, Emerson.

The Copeland brand's legacy of reliability and inventiveness continues to serve as the foundation for regulation-ready, next-generation compression technology. The new ZPKZ, ZPK7 and ZPSK7 scroll compressor platforms are Emerson's most efficient fixed-speed and two-stage compressors to date, developed to help meet the upcoming 2023 DOE higher-efficiency minimums. They are currently available with R-410A refrigerant compatibility and will have versions optimized for the next generation of lower GWP A2L refrigerants.

Nearing the end of its 100th-anniversary celebration of the Copeland brand, Emerson extends its focus on rigorous product testing and extensive research. The company continues to offer reliable, high-efficiency and lower-GWP refrigerant solutions to support manufacturers' needs to redesign their systems to meet efficiency and refrigerant regulations.

About Emerson

Emerson, headquartered in St. Louis, Missouri, is a global technology and engineering company providing innovative solutions for customers in industrial, commercial and residential markets. For more information, visit www.emerson.com.

Danfoss Announces Science Based Targets for Climate Change

The Science Based Targets initiative has validated that the corporate GHG emissions reduction targets submitted by Danfoss are in conformance with the SBTi Criteria and Recommendations version 4.2. The science-based target provides a clearly defined pathway for companies to reduce GHG emissions in line with the goals of the Paris Agreement and help to prevent the worst impacts of climate change.

The SBTi's Target Validation Team determined that Danfoss' scope 1 and 2 target ambition is in line with limiting warming to 1.5°C. As part of the science-based target, Danfoss will reduce absolute scope 1 and 2 GHG emissions by at least 46.2% by 2030 from a 2019 base year. In addition, Danfoss has committed to being carbon neutral in scope 1 and 2 emissions by 2030. Danfoss will reduce absolute scope 3 GHG emissions by 15% in the same time frame.

"We have built a strong foundation to achieve our science-based target, an important pillar of Danfoss' new 2030 ESG ambition," said Kim Fausing, President & CEO, Danfoss. "Our

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science-based target expands our GHG emissions reduction goals beyond our own business, across the entire value chain. It reflects our continued dedication to acting on climate change and becoming the preferred decarbonization partner to our suppliers and customers."

Danfoss announced in March 2022 it reached its 2030 target of doubling the energy productivity in its factories globally – nine years ahead of time. Energy productivity improved by 104% in 2021 from the baseline year 2007, and energy intensity was halved between 2007 and 2021. Danfoss produced twice the output in 2021 as in 2007, with the same energy consumption. Subsequently, Danfoss said it would put sustainability at the center of its Core & Clear 2025 strategy and has the ambition to take leading positions within Decarbonization, Circularity, and Diversity & Inclusion.

Martin Rossen, SVP, Head of Group Communication & Sustainability has been responsible for developing Danfoss' ESG strategy and setting the ambition for reducing emissions across the business. He added:

"The validation of our science-based target confirms that Danfoss' climate ambitions are in line with science and the goals of the Paris Agreement. But it's more than order in our own house. Customers, employees, and the public increasingly demand transparency and reward action on ESG. For good reasons. Companies can't simply get away with saying that they act, they need to document it. The science-based target provides a level playing field. It gives a competitive edge to the companies that truly care and take action."

About Danfoss

Danfoss engineers solutions that increase machine productivity, reduce emissions, lower energy consumption, and enable electrification. Our innovative engineering dates back to 1933. Danfoss is family-owned, employing more than 40,000 people, serving customers in more than 100 countries through a global footprint of 95 factories. For more information, visit www.danfoss.com.

Ashraf Abdalla Named CEO of Smardt Chiller Group

Following the recent announcement of TICA's 100% ownership of Smardt, Mr. Jiang Li, Chairman of the TICA Group and Smardt's Board of Directors, announced Ashraf Abdalla as the new CEO of Smardt succeeding Vince Canino.

"As we look forward to propelling Smardt upward to the next level and utilizing improved business models for the group, I am pleased to announce Ashraf Abdalla as the new CEO of Smardt," said Mr. Jiang. "Ashraf will head the transformation of Smardt, ensuring the achievement of our long-term goals and will report directly to the board."

Ashraf Abdalla joined the Smardt Chiller Group in August 2020 as Global Chief Operating Officer. Mr. Abdalla previously served York International and Johnson Controls as VP of Chiller Solutions Global Line of Business, VP and GM of the Middle East and Africa region, and VP and GM of the Global Applied Commercial Business Unit. Vince Canino will lead a new business unit within Smardt that will accelerate the introduction of TICA's products and develop new business models for green solutions for the North American market.

Ashraf Abdalla, CEO, Smardt Chiller Group.

About Smardt Chiller Group

Smardt, the Canadian-based global leader in oil-free chillers founded in 2005 by Roger Richmond-Smith. For more information, visit www.smardt.com.

Daikin Applied Takes Majority Position in CM3 Building Solutions

Daikin Applied Americas announced it has taken a majority interest in CM3 Building Solutions, Inc., a service and solutions provider offering building automation and technology, energy services, security and fire protection, and HVAC support throughout Pennsylvania, Delaware and New Jersey.

This new relationship expands Daikin Applied's ability to serve customers across the entire lifecycle of their building systems and operation. Daikin Applied, a division of Daikin Industries, Ltd., the world's number one air-conditioning company, has a legacy of designing and delivering innovative HVAC solutions that not only provide superior comfort, but address larger societal concerns like improving indoor air quality and cutting carbon emissions. Its offerings include equipment, services and controls for commercial and industrial facilities.

"With CM3's solutions expertise, Daikin Applied will network its HVAC technologies with other building systems, such as security, life safety, retro-commissioning and energy services," said Nick Brazis, VP of Corporate Development. "The connectivity effectively modernizes facilities and building portfolios to maximize performance. Customers will have an enterprise-wide view and command of their

entire operation, as well as comprehensive data and analytics to reduce carbon emissions without reducing occupant comfort."

"Today, when buildings use 75% of the country's power and 40% of its energy, we need to help customers manage their entire environment to achieve the next level of efficiency and sustainability," said Jeff Drees, Executive VP. "We can maximize HVAC performance when we can fully assess and support the building envelope. Our relationship with CM3 opens new opportunities to improve our customers' effectiveness."

CM3 will continue to operate under its current name and leadership including Bruce Michelson, John Hollister and Tom Monahan.

"CM3 strives to provide best-in-class service and technologies to our customers, including exceptional quality and service with every customer interaction," said Michelson. "We share Daikin Applied's commitment to creating unrivalled customer experiences, and are excited that together CM3 and Daikin Applied will deliver fully-integrated, comprehensive building solutions that help our customers take the next step in energy efficiency and building modernization."

About Daikin Applied Americas

Daikin Applied, a member of Daikin Industries, designs and manufactures advanced commercial and industrial HVAC systems for customers around the world. For more information, visit www.daikinapplied.com.

ASHRAE Welcomes 2022-23 President, Officers and Directors

ASHRAE introduced its 2022-23 Society president, executive committee officers and directors.

Farooq Mehboob, Fellow Life Member ASHRAE, will serve as the 2022-23 Society president. During his inaugural presidential address, Mehboob introduced the theme for the 2022-23 Society Year, *"Securing Our Future."* The theme examines how the crucial personal and professional events of the past can help us leverage relationships, knowledge and change, as the formula for making an impact and embracing our diverse world.

"What a heritage we possess. ASHRAE should be proud. We all should be proud," said Mehboob. "It's imperative that we continue to hunger for, and seek information about our market, our changing world, and our technological advances. Breaking down silos and embracing change will infuse a new dynamism in our society at all levels, bringing to our members new knowledge, technology and tools in a timely fashion - helping them to successfully navigate the rapidly changing world." Mehboob is a principal consultant for S. Mehboob & Company Consulting Engineers in Karachi, Pakistan.

Elected officers who will serve one-year terms are as follows:

- President-Elect: *Ginger Scoggins, P.E., Fellow ASHRAE,* Principal, Engineered Designs Inc., Cary, NC
- Treasurer: D*ennis Knight, P.E., Fellow ASHRAE,* Principal, Whole Building Systems, LLC., Mount Pleasant, SC
- Vice President: *Billy Austin, P.E., BCxP, BEAP, BEMP, HBDP, HFDP, OPMP, Member ASHRAE,* Principal, Shultz Engineering Group, Charlotte, NC
- Vice President: *Dunstan Macauley III, Member ASHRAE,* Director of Mechanical Engineering, Setty & Associates, Rockdale, MD
- Vice President: *Sarah Maston P.E., BCxP, Member ASHRAE,* Director, Commissioning & Energy Services, Colliers Project Leaders, Hudson, MA
- Vice President: *Ashish Rakheja, Member ASHRAE,* Director/Chief Operating Officer, Aeon, Noida, India.

ASHRAE introduced its newest Directors and Regional Chairs who will serve three-year terms from 2022–25:

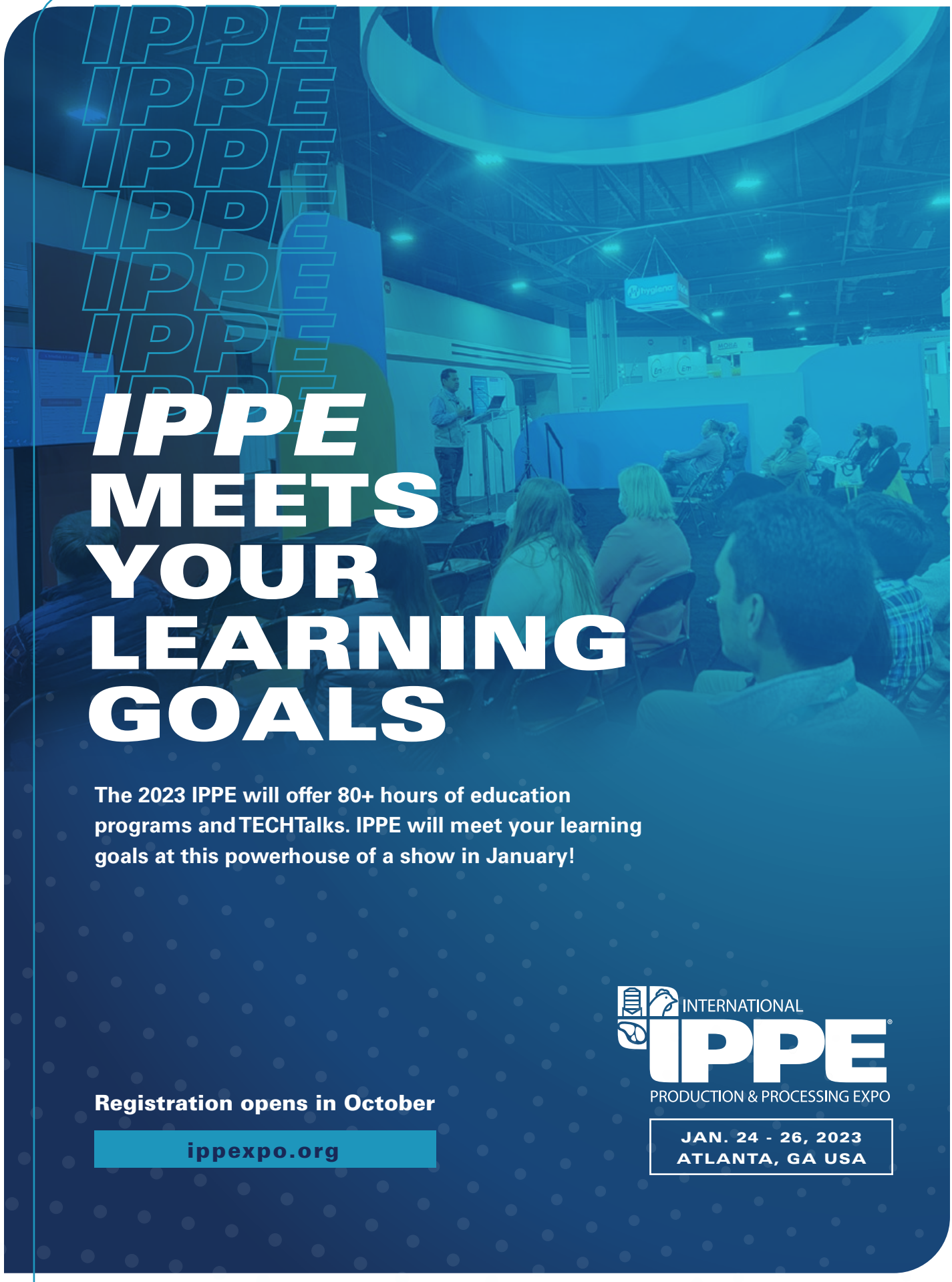
- Region IV Director and Regional Chair: *Bryan Holcomb, Member ASHRAE,* Vice President Sales & Preconstruction, Environmental Air Systems, Oak Ridge, NC
- Region V Director and Regional Chair: *James Arnold, P.E., Member ASHRAE,* engineer, Gutridge, Dublin, OH
- Region VI Director and Regional Chair: *Susanna Hanson, Member ASHRAE,* Application Engineer, Trane, La Crosse, WI
- Region XII Director and Regional Chair: *John Constantinide, P.E., Member ASHRAE,* Energy Manager, Cape Canaveral Space Force Station, Merritt Island, FL
- Region XIII Director and Regional Chair: *Cheng Wee Leong, P.E., Member ASHRAE,* Director, Method Engineering Pte. Ltd., Singapore.

ASHRAE also introduced its newest Directors-at-Large:

- *Blake Ellis, P.E., Fellow ASHRAE,* Principal, Burns & McDonnell, Overland Park, KS
- *Luke Leung, P.E., Member ASHRAE,* Sustainable Engineering Practice Leader, Skidmore Owings & Merrill, Clarendon Hills, IL
- *Wei Sun, P.E., Member ASHRAE,* President, Engsysco, Ann Arbor, MI

About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating ventilation, air conditioning, refrigeration and their allied fields. For more information, visit www.ashrae.org.



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- Measurement Technology

TST - Day 2
- Site Evaluation and Understanding
- Capabilities and Support

1:30 PM-6:30 PM
Best Practices EXPO

7:00 PM-10:00 PM
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