WAGD Systems NFPA 99 Medical Air Hospital Audit

July 2010

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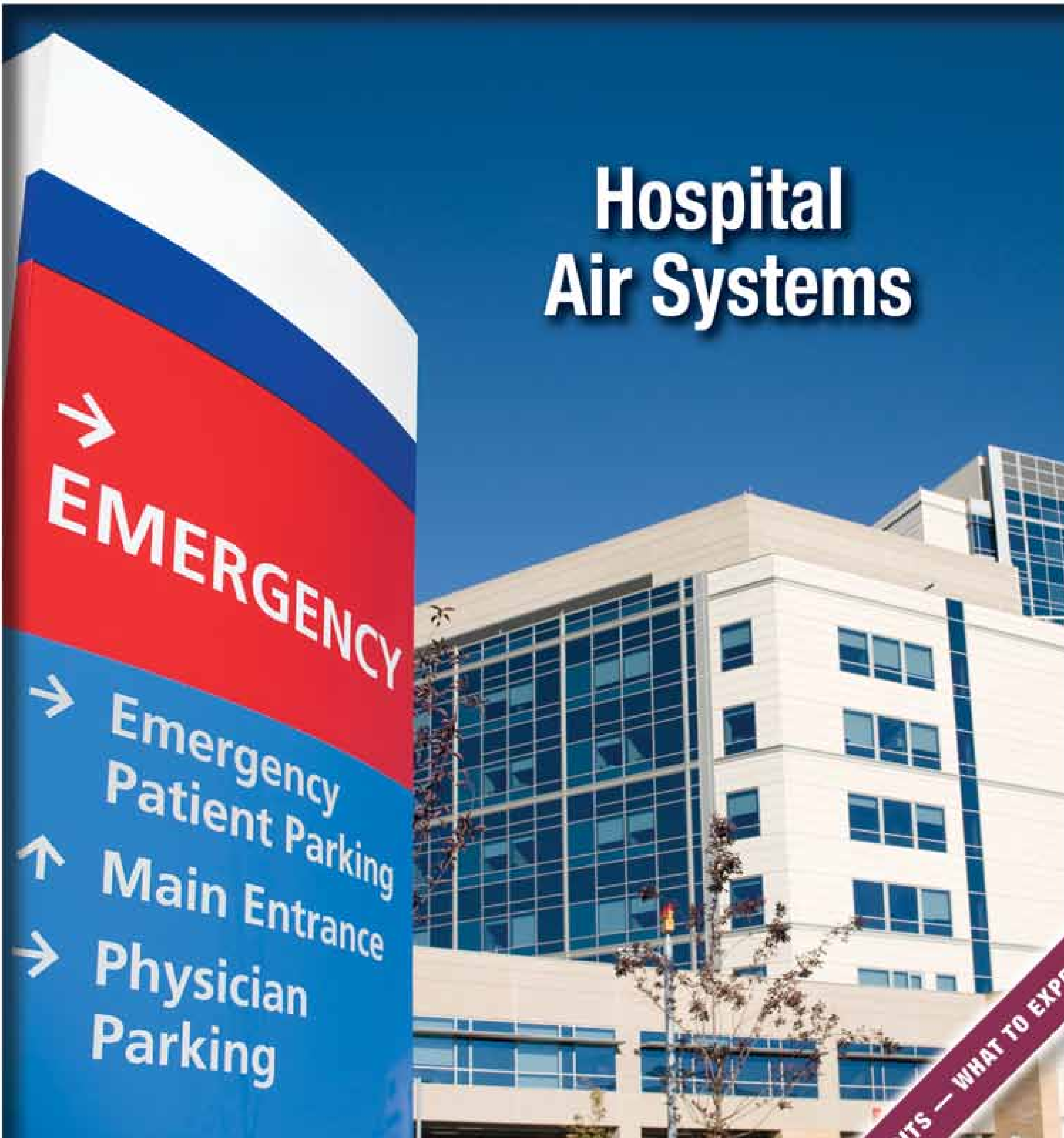

Hospital Air Systems

AUDITS — WHAT TO EXPECT

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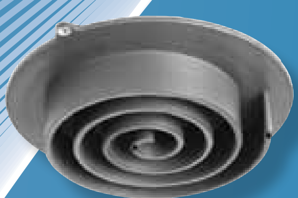

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HITACHI
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SUSTAINABLE MANUFACTURING FEATURES

COLUMNS

FROM THE EDITOR

Hospital Air Systems

Compressed air and vacuum systems for hospitals have always had one, and only one, consideration in mind — patient safety. Rightly so, their systems have built-in redundancy and are seriously over-sized in order to protect a hospital's ability to perform under any circumstances.

There is a growing interest and trend towards improving the energy efficiency in hospitals. The Consortium for Energy Efficiency (CEE) has focused on energy use in hospitals, and this has led to an increase in lighting and HVAC energy projects. A 2005 document prepared by the CEE called, "Healthcare Facilities Sector Fact Sheet," estimates the following breakdown of energy use in hospitals (Source: www.cee1.org).

PROCESS	ENERGY USE
Water Heating	27%
HVAC	26%
Lighting	15%
Cooking	11%
Office Equip.	6%
Misc.	15%

Major hospitals are also formalizing sustainability strategies and recognizing energy efficiency as an important component. This year, for example, New York Presbyterian Hospital was recognized as an EPA ENERGY STAR Partner of the Year for Sustained Excellence in Energy Management. NYP also has a seat on the steering committee of the U.S. DOE Hospital Energy Alliance, whose objective is to accelerate change in the hospital sector towards a greater focus on energy efficiency for the sector.

In this edition, we have a hospital audit story to share, furnished to us by Ron Marshall on behalf of the Compressed Air Challenge®. The other two hospital-related articles in the magazine focus on WAGD systems and medical air dew point.

We also have an interesting article from Scot Foss titled "What to Expect from a Compressed Air Audit." It raises some very interesting points on this expert's opinion on how to correctly conduct an audit.

We hope you enjoy this edition, and thank you for your support and for investing in Industrial Energy Savings. BP

ROD SMITH
Editor
rod@airbestpractices.com

SUSTAINABLE MANUFACTURING NEWS

DOE, New York Presbyterian Hospital, SAVE ENERGY NOW Award, Hospital Energy Alliance, and Energy Star

SOURCED FROM THE WEB

"Public-private partnerships with industry are a critical way to accelerate the transition to a strong, competitive, clean energy economy in the United States."

— Steven Chu, Energy Secretary

DOE Announces Awardees for the Industrial Energy Efficiency Grand Challenge

The U.S. Department of Energy (DOE) announced that 48 research and development projects across the country have been selected as award winners of the Industrial Energy Efficiency Grand Challenge. The grantees will receive a total of $13 million to fund the development of transformational industrial processes and technologies that can significantly reduce greenhouse gas emissions throughout the industrial sector. The funding will be matched by more than $5 million in private industry funding to support a total of $18 million in projects that will enhance America's energy security and strengthen our economy.

"Public-private partnerships with industry are a critical way to accelerate the transition to a strong, competitive, clean energy economy in the United States," said Energy Secretary Steven Chu. "These awards allow us to harness the diverse strengths of industry, academia and our national laboratories to advance energy innovations in our factories and plants."

American industry accounts for more than 30% of the energy used nationwide, is responsible for 27% of the country's carbon emissions and supports nearly 13 million core manufacturing jobs. With such a large impact on the nation's economic and environmental interests, the industrial sector remains a major part of the nation's clean energy equation. The funding announced today will promote breakthrough achievements in the development of energy efficient technologies and practices that will lower the energy demand of industry, open up new potential markets and enhance the competitiveness of American business.

Through the Grand Challenge and its Industrial Technologies Program, the department is working to forge partnerships that capitalize on the leadership and commercialization strengths of industrial companies, harness the innovative research and modeling capabilities of universities and use the unique development and testing facilities at National Laboratories.

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The DOE is providing cost-shared funding for concept-definition research and development studies in four main topic areas:

Next Generation Manufacturing Concepts — These manufacturing concepts address the goal of reducing the energy intensity or greenhouse gas emissions of industrial systems by a minimum of 25%

Energy Intensive Processes — These projects address specific technology areas that are expected to generate large energy-saving benefits across a variety of industries and transform the way major manufacturing processes use energy. The following specific technology areas are included: Reactions and Separations, High-Temperature Processing, Waste Heat Minimization and Recovery and Sustainable Manufacturing

Advanced Materials — These projects focus on Thermal and Degradation Resistant Materials and Materials for Energy Systems

Industrial Greenhouse Gas Emissions Reduction — These projects address transformational technologies that offer not only carbon intensity reductions, but also absolute carbon reductions

Source: www1.eere.energy.gov/industry

SUSTAINABLE MANUFACTURING NEWS

DOE, New York Presbyterian Hospital, SAVE ENERGY NOW Award, Hospital Energy Alliance, and Energy Star

NewYork-Presbyterian

EPA ENERGY STAR Award Goes to New York Presbyterian Hospital

Recognizing its leadership in efforts to reduce greenhouse gas emissions through energy efficiency, the U.S. Environmental Protection Agency (EPA) has honored New York Presbyterian Hospital with an ENERGY STAR Partner of the Year Award for Sustained Excellence in Energy Management, the energy program's highest honor. It is the fifth time the hospital has been honored by the EPA — the most of any hospital in the country.

"At New York Presbyterian we know that supporting a healthy environment is an important part of supporting the health of individuals and the communities they live in," says Dr. Herbert Pardes, president and CEO of New York Presbyterian Hospital. "We are very proud to once again be recognized by the EPA for our work in this area."

As part of the ENERGY STAR program, the hospital pledged to reduce more than 3.5 million pounds of greenhouse gas emissions for 2009, and exceeded this amount by 185% — among the four greatest reductions for a non-profit organization in the nation, according to the EPA.

Examples of the hospital's recent energy and environmental initiatives include the following:

- In 2009, the hospital installed a 7.5-megawatt cogeneration plant that will reduce emissions of CO^2 by more than 27,000 tons each year — equivalent to taking 4,600 cars off the road, while adding millions of dollars in annual cost savings
- Also in 2009, three hospital buildings were recognized by the American Society for Healthcare Engineers' E2C (Energy Efficiency Commitment) program each for reducing energy consumption by more than 10%
- The hospital's new Vivian and Seymour Milstein Family Heart Center is expected to receive Leadership in Energy and Environmental Design (LEED) Silver certification. The building features recycled materials and is estimated to be 30% more energy efficient than a standard structure. In addition, the hospital's Coleman Tower has received LEED-certified status
- New York Presbyterian is participating in PlaNYC, New York City Mayor Michael Bloomberg's sustainability initiative. The hospital has pledged to decrease carbon dioxide emissions 30% by 2018 and share best practices with other local organizations

"New York Presbyterian Hospital's outstanding accomplishments demonstrate that improved energy performance can benefit the bottom line and protect the environment at the same time."

— Jean Lupinacci, EPA

- New York Presbyterian has an active sustainability program called NYPgreen, with a full-time sustainability officer and volunteer "green champions" who encourage environmentally friendly practices throughout the organization. The hospital also initiated "Earth Awareness Day," hosting workshops to educate staff and community on sustainability and energy efficiency

- The hospital has a comprehensive mixed-recycling program and composting program, and has committed itself to using environmentally friendly products. The organization has a fleet of hybrid vehicles and a staff rideshare program. This spring, it will begin hosting a farmer's market

In its congratulatory letter to the hospital, the EPA's Jean Lupinacci wrote, "New York Presbyterian Hospital's outstanding accomplishments demonstrate that improved energy performance can benefit the bottom line and protect the environment at the same time. Your commitment to smart energy management, your ability to measure and track progress and your effort to communicate the importance of energy efficiency to a wide audience distinguishes New York Presbyterian as an industry leader."

Forty-one organizations received awards this year, and 23 of these were for Sustained Excellence. They were selected from a pool of more than 15,000 ENERGY STAR partners.

Previously, New York Presbyterian won Partner of Year awards for Leadership in Energy Management in 2005 and 2006, and Sustained Excellence awards in 2007 and 2008. The hospital has been an ENERGY STAR partner since 2003.

Source: http://nyp.org

SUSTAINABLE MANUFACTURING NEWS

DOE, New York Presbyterian Hospital, SAVE ENERGY NOW Award, Hospital Energy Alliance, and Energy Star

The 2010 SAVE ENERGY NOW Award Recipients

The Industrial Technologies Program (ITP) of the U.S. Department of Energy (DOE) recognizes U.S. manufacturing plants for implementing recommendations identified during the ITP's "SAVE ENERGY NOW" energy assessments and for achieving significant energy savings. At a recent ceremony in Washington D.C., the DOE recognized 140 companies as 2010 Energy Champion Plants and Energy Savers.

2010 Energy Champion Plants

The following companies achieved more than 250,000 MMBtu total energy savings — or more than 15% total energy savings.

COMPANY	PLANT LOCATION
Alco High-Tech Plastic	
American Axle & Manufacturing	Detroit, MI
American Textile	Duquesne, PA
Appleton Papers	West Carrollton, OH
Ashland Hercules Water Tech.	Macon, GA
Bollinger Shipyards	Lockport, LA
Bracalente Manufacturing	
Carlisle Industrial Brake & Friction	Logansport, IN
Century Packing Corp.	
Chatsworth Products	Georgetown, TX
Clos Du Bois	
Daviess County Metal Sales	
Diamond Crystal Brands	Duluth, GA
Dogfish Head Craft Brewery	
EGS Electrical Group	Stephenville, TX
Emerson Power Transmission	Maysville, KY
Endot Industries	Greeneville, TN
ENKEI Florida Inc.	
Fairfield Aluminum Casting	
FUJIFILM Hunt Chemicals USA	Dayton, TN
GE — Arecibo	Puerto Rico
Gerdau Ameristeel	Calvert City, KY
Gerdau Ameristeel	Knoxville, TN
Green Point Nursery	
Hamilton Sundstrand	Miramar, FL
Hart Associates	
Hirsh Industries	Dover, DE
ILC Dover	
Jabil Circuit	St. Petersburg, FL

COMPANY	PLANT LOCATION
Joy Mining Machinery — Franklin Manufacturing Operations	
Kraft Foods	Campbell, NY
Mansfield Industries	
Mid-South Metallurgical	
Morrill Motors	Erwin, TN
Multifilm Packaging	
Nalco Company	Scott, LA
Northern Star Industries — BOSS Snowplow Plant	
Northern Star Industries — Systems Control Plant	
Ohmart/VEGA	
Oldcastle Glass	Albertville, MN
Penn-Union Corp.	
Poland Sand & Gravel	
Polymer Technologies	
Presrite Corp.	
R.C.A. Rubber Co.	
Red Ball Oxygen	
Rio Grande Valley Sugar Growers — WR Crowley Sugar House	
Ryobi Die Casting (USA)	Shelbyville, IN
Sanderson Pipe Corporation	Sanderson, FL
Southern States, LLC	
The Coca-Cola Company	High Springs, FL
Trex Hawaii, LLC	
United Machine and Foundry	
Universal Protective Packaging	Mechanicsburg, PA
vonGal Corporation	
William A. Schmidt & Sons	

Energy Savers

The following companies achieved more than 75,000 MMBtu total energy savings or more than 7.5% total energy savings.

COMPANY	PLANT LOCATION
3M	
Airstream, Inc	Jackson Center
Alexandria Extrusion	
Ampacet Corporation	Heath, OH
Anoplate Corporation	
Baxter BioScience	Thousand Oaks, CA
Bobalee Hydraulics	
Bollinger Shipyards	Amelia, LA
Boyd Technologies	
Brown Corporation	
Caterpillar Inc.	East Peoria, IL
Corn Plus Ethanol	
DeepSea Power & Light	
Dynaburr	
E.F.S., Inc.	Rockmart, GA
EGS Electrical Group	Houston, TX
EGS Electrical Group	Rainsville, AL
E-J Enterprises	
Emerson Power Transmission	Morehead, KY
English American Tailoring Co.	
ESCO Turbine Technologies	Chittenango, NY
FCH Enterprises Inc.	
Flinchbaugh Engineering, Inc.	
Forte Power Systems	
Fresenius	Ogden, UT
Fusite	Cincinnati, OH
General Plug & Manufacturing	Oberlin, OH

COMPANY	PLANT LOCATION
Geyser Peak Winery	
Goodyear Tire & Rubber	Lawton, OK
Goodyear Tire & Rubber	Topeka, KS
Graham Packaging Pet Technologies	Fremont, OH
Graphic Packaging	Solon, OH
Greif	Florence, KY
Greif	LaPorte, TX
Greif	Morgan Hill, CA
Hague Quality Water	
Heidenhain Corporation	Santa Barbara, CA
Hercules Paper	Portland, OR
Hoosier Magnetics, Inc.	
Hormel Foods — Clougherty Packing Company	
Hormel Foods	Rochelle, IL
HPM Building Supply	
IBM Corporation	Poughkeepsie, NY
Ideal Snacks	
Illinois Tool Works	Lake Geneva, WI
Interstate Paper	Riceboro, GA
Jabil Circuit	St. Petersburg, FL
Johnson Controls	Red Oak, IA
Kawneer	
Keller Crescent	Portland, CT
Kent Feeds	Beardstown, IL
Marlite	Dover, OH
Medical Device Technologies	
Mennie Machine	Mark, IL
Michael Foods	Klingerstown, PA
Mid-South Electronics	
Munters	Amesbury, MA
National Cart Company	St. Charles, MO
OMNOVA Solutions	Calhoun, GA
O'Neal Steel	Waterloo, IA
Owens Corning — Roofing	Houston, TX
Parker Hannifin	Holly Springs, MS
PGT Industries	North Venice, FL
Plastic Parts, Inc.	
Plymouth Tube Company	Eupora, MS

COMPANY	PLANT LOCATION
PMRS, Inc.	
Rathbone Precision Metals, Inc.	
Rigid Park Corporation	
Roper Pump Company	
Rudolph Foods Company	Lawrenceville, GA
Rusken Packaging	Cullman, AL
Schindler Elevator	Gettysburg, PA
Schreiber Foods	Carthage, MO
Schreiber Foods	Mount Vernon, MO
Sherwin-Williams Minwax	Flora, IL
Simi Winery	
Snyder Industries	Philippi, WV
Superior Manufacturing & Hydraulics, Inc.	
Temple — Inland	Binghamton, NY
Temple — Inland	Utica, NY

COMPANY	PLANT LOCATION
Tervis Tumbler	
Texon Polymer Group	
The Crowell Corporation	
The Pepsi Bottling Group	Harrisburg, PA
Tronox, Inc.	Hamlinton, MS
United States Steel	
VT Industries	Bryan, TX
Wabash Alloys LLC	
Warren Achievement Center	
Weyerhaeuser (NORPAC)	Longview, WA
WhiteWaves Foods	Jacksonville, FL
Whitmore Group	Annapolis, MD
W.R. Grace	Irondale, AL
ZF Services North America, LLC	

Source: www1.eere.energy.gov/industry

SUSTAINABLE MANUFACTURING NEWS

DOE, New York Presbyterian Hospital, SAVE ENERGY NOW Award, Hospital Energy Alliance, and Energy Star

Hospital Energy Alliance Identifies Priorities

The priorities for accelerating change in the hospital sector as identified by the Hospital Energy Alliance (HEA) Steering Committee are:

- Improved, verified energy-efficient medical equipment
- Database of best practices for hospital design and operation
- Better business case for energy efficiency for all major hospital decision makers
- Training for new and existing hospitals on best energy efficiency operation and design
- Using collective voice to affect the equipment supply chain
- Improved codes, standards, utility rates and legal requirements for energy

Source: www1.eere.energy.gov/buildings

Members of the Hospital Energy Alliance (HEA) Steering Committee are:

- Catholic Healthcare West
- Department of Veterans Affairs
- Gundersen Lutheran Health System
- Hospital Corporation of America
- Kaiser Permanente
- New York Presbyterian Hospital
- Providence Health & Services
- TECO/Texas Medical Center
- University of Pittsburgh Medical Center
- American Society for Healthcare Engineering (ASHE)
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- Global Health and Safety Initiative (GHSI)
- Illuminating Engineering Society of North America (IESNA)

Energy Star Challenge for Industry Recognizes Manufacturing Sites

The U.S. Environmental Protection Agency (EPA) recognized the first group of manufacturing sites that have met the Energy Star Challenge for Industry and reduced their energy intensity by 10% percent within five years or less. The United States manufacturing industry is responsible for nearly 30% of greenhouse gas emissions in the U.S. and spends almost $100 billion annually on energy. Under the umbrella of the Energy Star Challenge for Industry, EPA is working with individual manufacturing sites and their parent companies to fight climate change and save money through improvements in energy efficiency.

The first manufacturing facilities owned by Energy Star partners to meet or exceed the 10% reduction goal within five years or less under the Energy Star Challenge for Industry are:

- Kodak's Manitou site in Rochester, N.Y.: 25% reduction (2007–2009)
- Kodak's GCG Columbus manufacturing site in Columbus, Ga.: 10% reduction (2007–2008)
- Shearer's Foods, Inc.'s Lubbock, Texas plant: 15% reduction (2009–2010)
- Detroit Diesel's Redford Component Manufacturing Center in Detroit, Mich.: 17% reduction (2008–2009)
- John B. Sanfilippo & Son, Inc.'s Elgin Headquarters facility in Elgin, Ill.: 17% reduction (2008–2009)
- John B. Sanfilippo & Son, Inc.'s Selma, Texas facility: 26% reduction (2008–2009)
- John B. Sanfilippo & Son, Inc.'s Garysburg, N.C. facility: 23% reduction (2008–2009)
- FetterGroup's headquarters facility in Louisville, Ky.: 23% reduction (2007–2009)

Total annual energy savings for these companies is equal to the energy needed to power all the homes on the island of Nantucket for a year. Annual carbon dioxide savings are nearly 34,000 metric tons — equal to the emissions from nearly 6,500 cars.

Under the Energy Star Challenge for Industry, manufacturing sites establish an energy intensity baseline, set a 10% reduction goal, implement energy efficiency projects, track energy use and verify their savings. Any U.S. manufacturing site may participate in the Energy Star Challenge for Industry. Trade associations and regional energy efficiency programs can also join with EPA to promote the Energy Star Challenge for Industry. The International Dairy Foods Association, Energy Trust of Oregon and the Connecticut Energy Efficiency Fund have signed up to promote the Energy Star Challenge for Industry to their members and partners.

Manufacturing accounts for 30% of energy use in the United States. If the energy efficiency of industrial facilities improved by 10%, EPA estimates that Americans would save nearly $10 billion and reduce greenhouse gases emissions equal to about 12 million vehicles. Hundreds of industrial companies across nearly a dozen manufacturing industries are working with EPA's Energy Star program to develop strong energy management programs, earn the Energy Star for their facilities and achieve breakthrough improvements in energy efficiency.

Source: www.energystar.gov

HOSPITAL AIR SYSTEM $avings

BY RON MARSHALL CET, CIM, FOR THE COMPRESSED AIR CHALLENGE®
EDITED BY JAN ZUERCHER AND DAVID BOOTH

Large hospitals often use compressed air for important operational-related end uses. The systems that produce this air need to supply clean and dry compressed air with a high level of reliability. These systems are not immune to efficiency problems as is the case for any compressed air system. "For these critical types of systems, it is very important to reliably maintain a certain minimum air pressure. However, there is typically not enough data available to help accurately size the compressors," says Brent Ehrlich, an independent air systems consultant with Air Services and a Compressed Air Challenge® (CAC) Fundamentals instructor. "Usually, without good data," he continues, "the only way to be certain that the demand can be consistently met and pressure reliably supported, is to oversize the equipment, often leading to inefficiency."

"Having worked in hospital maintenance and as a licensed stationary engineer, I know the importance of reliability and air quality. But as we stress in the CAC® training, it does not have to be at the expense of energy efficiency," says Joe Ghislain, manager, Lean Supplier Optimization, with the Powertrain division of Ford and a CAC® advanced instructor. "This can be accomplished through a number of ways," he says, "including proper selection and sizing of compressors and/or after-treatment of the air, including point-of-use filtering." The following case study gives an example of right-sizing and optimizing a hospital air system, and follows some of the principles taught in the CAC® Fundamentals of Compressed Air seminar.

"The only way to be certain that the demand can be consistently met and pressure reliably supported, is to oversize the equipment, often leading to inefficiency."

— Brent Ehrlich, an Independent Air Systems Consultant with Air Services and a Compressed Air Challenge® (CAC) Fundamentals Instructor.

Health Sciences Centre — Central Energy Plant

> "Having worked in hospital maintenance and as a licensed stationary engineer, I know the importance of reliability and air quality. But as we stress in the CAC® training, it does not have to be at the expense of energy efficiency."
>
> — Joe Ghislain, manager, Lean Supplier Optimization, with the Powertrain Division of Ford and a CAC® Advanced Instructor

Health Sciences Centre Case Study

The compressed air system at the Health Sciences Centre (HSC) in Winnipeg Manitoba is critical to the operation of the complex of buildings that make up the largest hospital in Manitoba, Canada. Shortly after arriving and taking his new position as chief operating engineer, Gerry Hebert turned his attention to the compressed air system. He had inherited a lubricant-free system that incorporated a water-cooled 200 horsepower centrifugal compressor and some old reciprocating compressors. This system was used to produce the compressed air required for building HVAC controls, laundry equipment, general labs and maintenance shops at the hospital.

The centrifugal compressor had been purchased by the previous chief operating engineer to renew the aging system — formerly supplied by large reciprocating compressors. This compressor was purchased before lubricant-free screw compressors were deemed economical, or commonly available, and when the availability of large reciprocating compressors was fading.

After attending a utility-sponsored compressed air efficiency course and having some knowledge of the characteristics of centrifugal compressors, Gerry started taking note of the variable load profile tracked by the compressed air flow meter at his site. He decided to investigate the annual operating cost of his compressor and the appropriateness of the compressor type. He also wanted to determine the system efficiency. Unfortunately, there were no energy meters tracking the power consumption of his compressors, so Gerry turned to his local power utility, Manitoba Hydro, for assistance in creating a baseline energy figure.

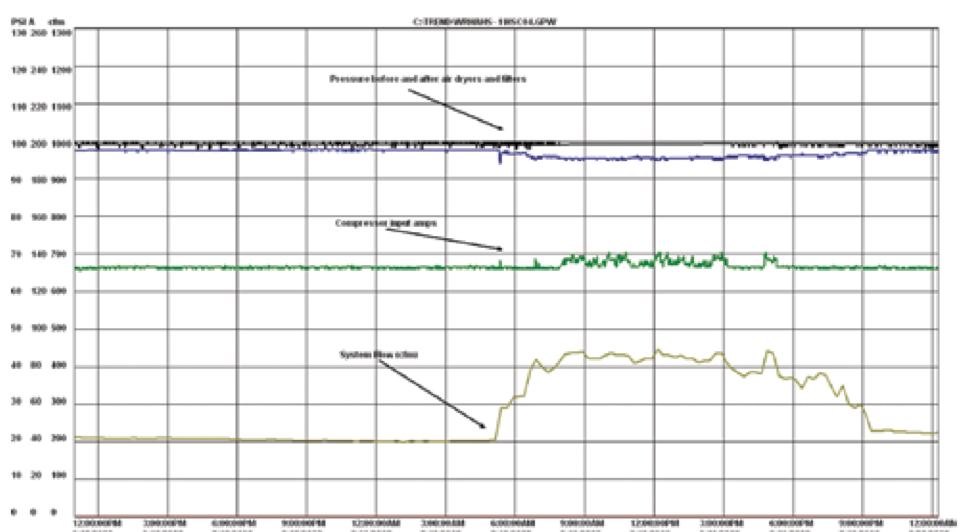
HOSPITAL AIR SYSTEM SAVINGS

An energy audit of the centrifugal compressor showed that while the compressed air demand of the hospital was variable, the power consumption of the compressor was very flat. Calculations showed that the average load was slightly under 300 cfm, yet the energy consumption of the system was topping 1,400,000 kWh — costing $68,500 per year in operating costs. The specific power of the compressor alone was averaging a staggering 49 kW per 100 cfm (more than double what would be expected). The compressor also used chilled water that required additional refrigeration energy to produce, and the system had non-cycling style refrigerated air dryers installed, increasing the system specific power number to 57 kW/100 cfm.

With the assistance of Manitoba Hydro's Performance Optimization Program technical support and financial incentives, the HSC was able to purchase an air-cooled variable speed drive lubricant-free compressor and cycling-style refrigerated air dryers that were better able to track the varying loads of the facility. The more efficient system operation and the removal of the chilled water costs reduced the system-specific power to a more reasonable 18 kW per 100 cfm — saving $39,500 in annual operating costs, or more than half the original costs.

After the initial project was completed, HSC staff noted the close proximity of the boiler intake air to the hot air discharged from the compressor coolers, and decided to put the heat of compression to good use. Using the heated compressor, cooling air is a very effective way of tempering the cold combustion air in winter, and adds additional heat to the boiler combustion in summer, increasing boiler efficiency. Previously, the intake air was pre-conditioned with steam heat on colder days. This heat recovery displaces an estimated 37,500 cubic meters of natural gas, worth about $12,000 per year.

In all, the changes to the HSC compressed air system and the heat recovery saved a total of $51,500 in operating costs. These savings are almost as large as total annual cost to operate the original inefficient system!



Graph 1 – The original compressor consumes almost-constant power due to its poor turndown or part load characteristics. See the middle line on the graph above.

> "A large majority of the input energy used in compressing air is converted to heat, capturing and reclaiming this waste heat yields a great opportunity to improve efficiency and reduce energy cost. Whether you are utilizing it for space heating, air drying or, as in this case, boiler air makeup, heat recovery can be very cost effective and save you money."
>
> — Joe Ghislain

Learn about Selecting Compressor Types

Participants in the Compressed Air Challenge® **Fundamentals of Compressed Air** training learn the differences in the characteristics of various types of compressors. After completing the course, participants will be able to understand why the original compressor in the HSC case study showed very low efficiency and the reason why the turndown capability of the new lubricant-free screw VSD compressor improved the situation. They will learn that centrifugal compressors are an excellent choice for systems with flat constant loading near the top of their capacity curves, but are less appropriate if oversized or used alone on a varying profile, like HSC's. "Centrifugals are a great choice for lubricant-free air, but only if the demand is large enough to warrant it," explains Ghislain. "Typically, these machines can only turn down 20–30%, so any time the base load or even low load goes below this point, the centrifugal will blow off, acting like a large air leak. The longer it stays in this condition, the more energy and dollars wasted."

HOSPITAL AIR SYSTEM SAVINGS

CAC Qualified Instructor Profile

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Joe is currently the Manager, Lean Supplier Optimization, with the Powertrain division at Ford, and has over 30 years' experience with Energy, Compressed Air Systems and Powerhouse operations, starting as a Stationary Engineer in a hospital, then with Ford Motor Company as a Power House Chief Engineer, Corporate Energy Engineer, Manager of Energy Efficiency, and Manufacturing Planning Manager. He received his B.S.E.E.T. from DeVry Institute of Technology and his M.A. in Business Management and Energy from DePaul University. He is a Registered Environmental Manager from NREP and both a Certified Energy Manager and Certified Sustainable Development Professional from AEE. Joe has served on the Compressed Air Challenge® Project Development Committee since its inception, and is an instructor for both Fundamentals and Advanced Compressed Air System Training.

The following is an excerpt about centrifugal compressors taken from the CAC® "**Best Practices for Compressed Air Systems**." This 325-page manual is available at our bookstore and the handout material is distributed at our CAC® **Fundamentals of Compressed Air** course.

Centrifugal Compressors

Centrifugal compressors have a characteristic curve of rising pressure as capacity decreases. A limit is reached where surge can take place, a phenomenon where a flow reversal occurs. The most common method of capacity control is to maintain a constant discharge pressure by progressively closing an inlet valve as demand is reduced and pressure tends to rise. This reduces the mass flow through the compressor and also increases the overall pressure ratio. Capacity can normally be reduced from 100% capacity to about 70–80% capacity, with reasonable reduction in energy consumption. A refinement of this method of capacity control is to replace the inlet valve with inlet guide vanes. While restricting the flow of inlet air, the guide vanes also make the air flow in the direction of rotation of the impeller inlet, providing more efficient part-load operation. In both cases, the reduction in capacity is limited to prevent the possibility of surge.

The compressor may continue to compress at the aforementioned 70–80% minimum allowable capacity. Any excess air is discharged through a blow-off valve, usually to the atmosphere, with no further savings in energy. This mode of operation should be avoided to conserve energy. Alternatively, at the minimum allowable capacity, some compressors may be unloaded, no longer discharging to the system. With the inlet valve closed, these compressors can operate in a load/unload control mode similar to a non-lubricated rotary screw compressor. This is very efficient compared to the use of a blow-off valve, but will require adequate storage capacity to avoid short cycling.

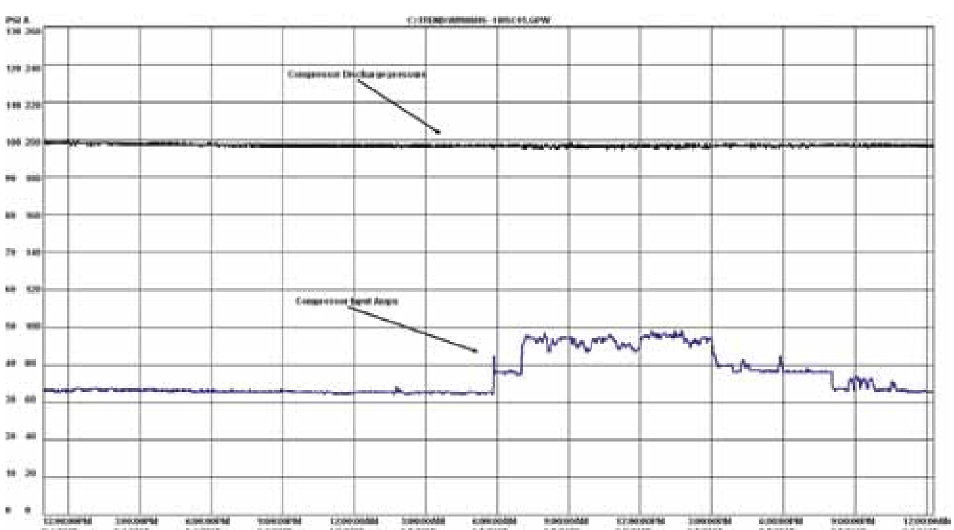

Chart 2 – The new compressor consumes less energy, which now tracks the facility flow profile (flow omitted).

Constant pressure control may be attained by means of an inlet throttling valve or by more efficient inlet guide vanes. The amount of reduction in capacity is limited by the surge line, where a reversal of flow can occur, and should be avoided. The compressor can then be arranged to discharge excess capacity to atmosphere (which is very wasteful), or to unload.

Compressor Selection

Selection of air compressors and controls must take into account the requirements of the different points of use, the air capacity for each when fully loaded and the frequency of these requirements. Demands often are intermittent, but the "worst case scenario" also must be considered. Standby compressor capacity must also be considered, taking into account the essential nature of an application and the cost of downtime compared with the cost of a spare compressor.

The capacity and load swings will be a major factor in determining the type of compressor chosen. A general rule is that compressors with the best full-load efficiency should be used for continuous base-load type of service. Compressors with good part load efficiency are better suited to swings in load. This means that a compressor(s) with good full load efficiency may be sized for the minimum or average demand, while a compressor(s) with good part load efficiency can be sized to handle the swings in load from minimum or average to the peaks. BP

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Brent has been a CAC® instructor since 1999, and is AIRMaster+ certified. He operates a consulting business, Air Services, serving clients nationwide. He has performed system audits and assessments for the US DOE, The Tennessee Valley Authority, Duke Energy, Virginia Power, Enron and directly for numerous industrial facilities.

The instructors featured here are available to lead a Compressed Air Challenge® seminar at your facility. Visit www.compressedairchallenge.org for more information.

THE TECHNOLOGY PROVIDER

An Introduction to WAGD System Implementations

BY MARK ALLEN, DIRECTOR OF MARKETING, BEACONMEDAES

BeaconMedaes AGS System

This article will examine in detail four of the five acceptable WAGD implementations under NFPA 99, along with some alternative ways they may be implemented. This article will not deal with passive implementations.

Dual-Use Medical Vacuum/WAGD Implementations

Dual-use implementations are primarily medical vacuum systems into which the WAGD is introduced, more or less as a "free rider" on the medical vacuum network and pump. Dual-use implementations are high vacuum. The medical vacuum application will always take precedence when setting pump cut-in and cut-out. This means the lowest vacuum a WAGD inlet can see is 12 inHgV (305 mmHgV per NFPA requirements for medical vacuum) and typical vacuums are 15–29 inHgV (380-760 mmHgV). Due to the high vacuum, the networks for these systems must be relatively strong and copper pipe is therefore commonly used. WAGD terminals look very similar to vacuum inlets except for color, and are nearly identical to vacuum inlets internally. Most significantly, this means that the internal porting is limited, and many WAGD inlets (particularly older ones) may have some difficulty with higher flows. Piping is typically sized using the same loss tables as are used for vacuum, and valving and alarming generally follows the vacuum rules. A rare variant on this implementation, is a regulated WAGD line. In these implementations, a regulator is installed in the WAGD line, which reduces the top vacuum level to a medium or low vacuum and thus brings the WAGD pipeline closer to the ideal of an intrinsically safe system. Such an implementation requires separate sizing of the WAGD line at the lower vacuum. Copper pipe would still be the preferred material of construction.

Dedicated WAGD, Using a Pump

Pump-based implementations have in the past generally been run at vacuum levels similar to medical vacuum. Pumps usually selected are designed to run at vacuums of 15 inHgV (380 mmHgV) or higher. However, a variant of this system is a medium to low vacuum system, wherein the systems operate more nearly in line with the ideal of an intrinsically safe system. This is achieved by sizing and setting the pumps to lower vacuum settings (e.g. 5-10 inHgV {127-250 mmHgV}) and sometimes also installing a vacuum regulator in line to reduce the vacuum at the inlet. This variant is appropriate only with technologies that are suited to low vacuum operation (liquid ring, dry vane, rotary lobe).

The networks must be designed to handle the full vacuum of which the pump is capable (even though the pump may in fact operate at a lower vacuum normally). Therefore, the networks for these systems must be relatively strong. Copper pipe is most commonly used. At vacuums

12 inHgV {305 mmHgV} and above, piping would be sized using the same loss tables as are used for medical vacuum, but alternative sizing methods will be required at lower vacuums. WAGD terminals used at the upper end of the vacuum scale (5 inHgV and higher) look very similar to vacuum inlets, except for color, and are nearly identical to vacuum inlets internally. Most significantly, this means that the internal porting is limited, and many WAGD inlets (particularly older ones) may have some difficulty with higher flows. Therefore, at the lower end of the vacuum scale, the terminals may need to be of a different type to ensure adequate flow.

Dedicated WAGD, Using a Blower

These implementations achieve all the objectives desired in a WAGD implementation, but typically are the most complex to design and install. Unlike the two types discussed previously, these systems typically use a regenerative blower as their producer. Whereas a pump is designed to expand the air first (i.e. produce a deep vacuum) and move volume second, a blower is designed to move volume first and produce only a shallow vacuum. In this they more closely resemble a fan than a pump. It is this emphasis on moving lots of air at low vacuums that makes them ideal for WAGD.

As an example, a liquid ring pump with a one horsepower motor will move 396 lpm (14 scfm) at 5 inHgV (if it could be operated there — most will run up to 28 inHgV). A regenerative blower driven with the same one hp motor will move 1,245 lpm (44 cfm) at 40 inH2OV (2.9 inHgV). This low vacuum creates it's own issues. The sizing of the network is immediately different from that used for higher vacuum, and the terminals must be of a different type to pull enough flow at these low vacuums.

However, an important advantage of these low vacuum implementations is that the producer may be located close to the terminals, unlike pumps, which typically must be located remotely. A blower (especially a small one) is sufficiently compact and quiet that it can sometimes be placed near the WAGD terminals (e.g., in a ceiling space, a mop closet, etc.) The network can therefore be minimized. A pump, being typically larger and noisier, must typically be placed at some remove in a mechanical space. The resulting network is longer and potentially more complex (see Figure 2).

At first glance, it may appear to be more expensive to implement and operate a local system possibly composed of multiple blowers vs. a single large pump. In fact, because blowers are less expensive, smaller and internally less complex than pumps of similar capacities, the economics often slant in favor of the local implementation.

Low vacuum systems can be piped in a variety of materials. NFPA requires they be metallic and non-corroding, which rules out plastic or iron pipe. However, copper, stainless and galvanized pipe might be used, as might ductwork and thin-wall galvanized because of the low vacuum (an ideal material would seem to be electrical conduit with liquid tight fittings, but so simple an answer may be too exotic to be acceptable in many local jurisdictions). Copper pipe is the most common material. These systems may require a means to balance the system and are tested in a somewhat different manner to high vacuum systems.

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An Introduction to WAGD System Implementations

WAGD Using Distributed Producers

These implementations are in many ways the simplest, but have not been seen in the North American market and are thus unfamiliar. They tend to be relatively expensive to install, because two separate piping networks are required.

Conceptually, they involve no central producer, but instead use a venturi in each inlet. The venturi is intrinsically capable only of low vacuum. An air line must serve the venturi, and medical air is not permitted for use in this service. Instrument air is ideal, but at this writing relatively few facilities have instrument air systems. Once the venturi is served by an appropriate air source, the exhaust must also be routed to the outside and sized. The exhaust side may be made of pipe suitable to the pressure. Copper would be typical. There are no alarms, which can practically be installed. Each inlet is individually controlled, and must have an operating indicator of its own.

All WAGD implementations, except the distributed producer styles, share the same basic requirements as to the location of terminals, alarms, etc. All WAGD implementations share the same basic requirements as to the discharge from the building. Specific details of how these items operate will vary by implementation. We will consider the universal requirements here, and then deal with the necessary variations under each specific implementation.

WAGD Selection

What factors should be weighed when selecting a WAGD implementation? There are several, and the weighting to be given to each will vary from facility to facility. They include:

1. **Effectiveness.** Will the system do the job of keeping the workspace free of waste gas? Efficacy usually has less to do with the type of system selected than the design and installation of the system, as all the implementations described herein are perfectly capable of being effective if well designed.

2. **Patient safety.** Will the system protect the patient and ensure the anesthesiologist's control of the procedure? Here, the low vacuum implementations are to be preferred over the high vacuum implementations due to the intrinsic safety implied in a lower vacuum.

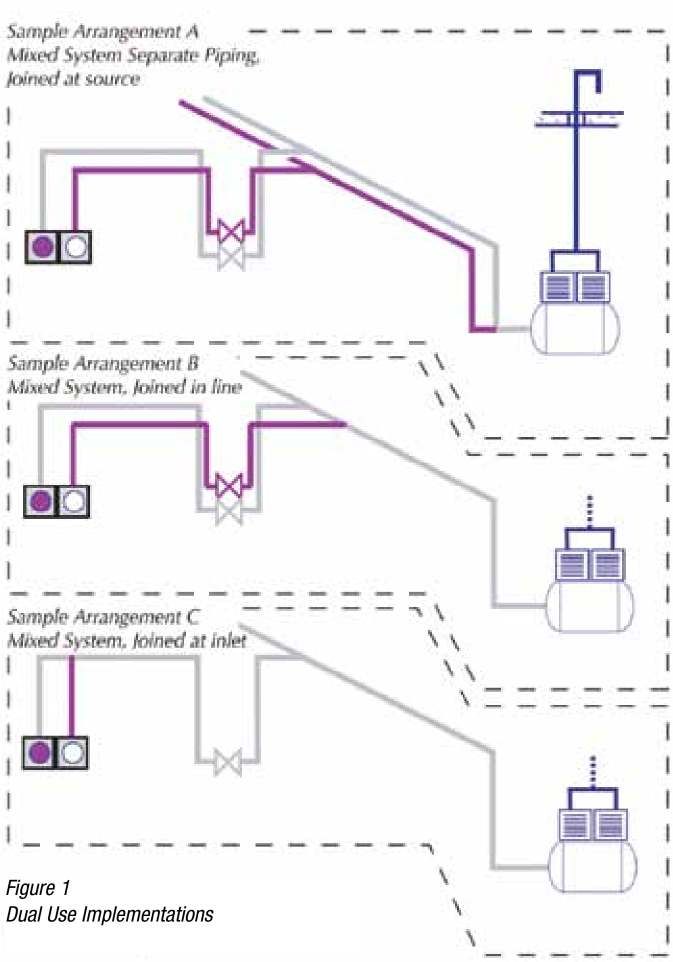

Figure 1
Dual Use Implementations

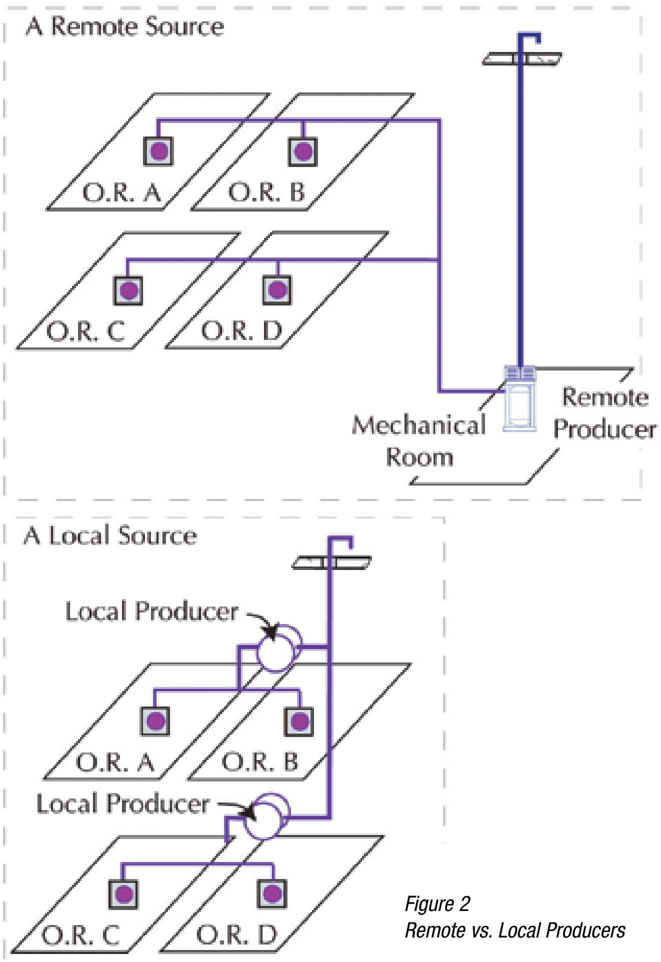

Figure 2
Remote vs. Local Producers

3. **Cost.** Which system is least expensive to implement and operate? Evaluating this is complex and the result varies dramatically between facilities. In general, low vacuum systems are less expensive than are high vacuum systems. Low vacuum systems are also typically lower maintenance than are high vacuum systems.

   However, an assertion often made in favor of dual-use implementations is that WAGD dumped into a medical vacuum system is "free", since the medical vacuum "has to be there anyway". When the average WAGD inlet only flowed 6–9 liters, there were many cases where this was at least in part true. With WAGD flowing at 50 liters (1.8 scfm), it is true far less often. The additional capacity required and the additional operating hours mean that the cost of WAGD produced by a medical vacuum pump is considerably higher than has been assumed.

   A simple rule of thumb test can be applied: Size the medical vacuum system without WAGD and select a pump of appropriate capacity. Add in the WAGD requirement (use at least 1.8 scfm per location). If the pump selected has sufficient capacity to handle the additional volume, an argument can be made that the WAGD produced is "free", or at least low cost. If the pump selected does not have the necessary excess capacity, and thus to accommodate the WAGD a larger pump must be selected, a properly selected dedicated system will almost certainly be less expensive. This is especially true when a low vacuum system is used for comparison. Remember that a horsepower of pump will move approximately 15 scfm, whereas a horsepower of blower will move approximately 44 scfm — a ratio of roughly 3:1.

4. **Technology.** Is the technology otherwise preferred for the medical vacuum source acceptable for WAGD? If not, can another option be equally acceptable? In some cases, a technology otherwise preferred for use with medical vacuum may be oxygen sensitive, and there is not an equally acceptable oxygen-compatible alternative. Naturally, this will restrict the potential for dual use. The same limitation may also render unacceptable pumps otherwise preferred in a dedicated pumped system. In such a case, the limited technology options may be a powerful argument in favor of a low vacuum alternative.

5. **Design complexity.** How difficult is the system to design and what are the chances of problems resulting from bad design? Whatever can be said against a dual-use system, they are undoubtedly among the simplest to design. Correspondingly, low vacuum dedicated systems offer the greatest range of advantages for the user, but are probably the most complex to design and are also outside the experience of most North American designers. Low vacuum dedicated systems are also the most complex to commission.

WAGD Design: General Requirements

(Reference Figure 3)

NFPA 99 states that a unique, dedicated WAGD terminal should be placed wherever nitrous oxide or halogenated anesthetic is intended to be administered (13.3.5.2, 14.3.5.2). This will obviously include any location piped with nitrous oxide. Consideration should also be given to areas that are not traditionally piped with nitrous, but where nitrous oxide mounted on the anesthetizing machine can reasonably be expected to be used. Common examples of these locations include

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An Introduction to WAGD System Implementations

CAT/MRI/PET scan rooms, lithotripsy, exam/treatment rooms, trauma rooms and other locations where patients are routinely sedated or anesthetized. Other areas that should receive consideration might include laboratories where veterinary anesthesia will occur, dental clinics and OB/Labor where nitrous oxide/oxygen self-administration is practiced. WAGD terminals may also need to be placed in areas such as recovery, where exhaled anesthesia from recovering patients must be considered and the staff protected.

All dedicated WAGD producers are required to be duplex, wherein one unit must be sufficient to serve the system, and a second of equal size is ready to operate in the event of any inadequacy in the first. A local alarm indicating Lag WAGD producer in service must be included and relayed to the master alarm. The WAGD producer is required to include a source valve. Exhausts from the producer must exit the building, discharging at least 10 feet from any opening in the building, at a vertical level different from any air intake (preferably at a lower level) and in a location that is open and permits free dispersion of the waste gas.

Electrical power must be from the essential electrical system, equipment branch. Centrally piped WAGD is required to be valved like any other medical gas or vacuum system. Valves may be either ball or butterfly type. Required valves include: source valve, main valve (in a limited number of circumstances), riser valves, service valves and zone valves.

WAGD inlets must be separate from and non-interchangeable with the vacuum inlets (even if they are ultimately piped to the same source). WAGD has it's own color code (white letters on violet).

Many older WAGD or evacuation inlets were "one-way" interchangeable (you could plug vacuum into evacuation, but not evacuation into vacuum). This is no longer permitted and such inlets should be retrofitted to bring them up to standard. The master alarms for a piped WAGD system will include at least an indicator for "Low WAGD" and an indicator for "WAGD Lag Producer Running."

Any area fitted with piped WAGD requires a WAGD area alarm at the nurses' station, just like any other medical gas. It will typically be piped into the line upstream of the anesthetizing location zone valve.

Distributed WAGD may be considered exempt from some of these requirements, but others may need to be fulfilled in unusual ways. As an example, while it is impractical to alarm a venturi, it is appropriate to alarm the drive air so that the facility knows if the WAGD is inoperable. It is necessary to observe intent in these cases and to ensure the essential functions are present even if it is necessary to use different methods to achieve the result. BP

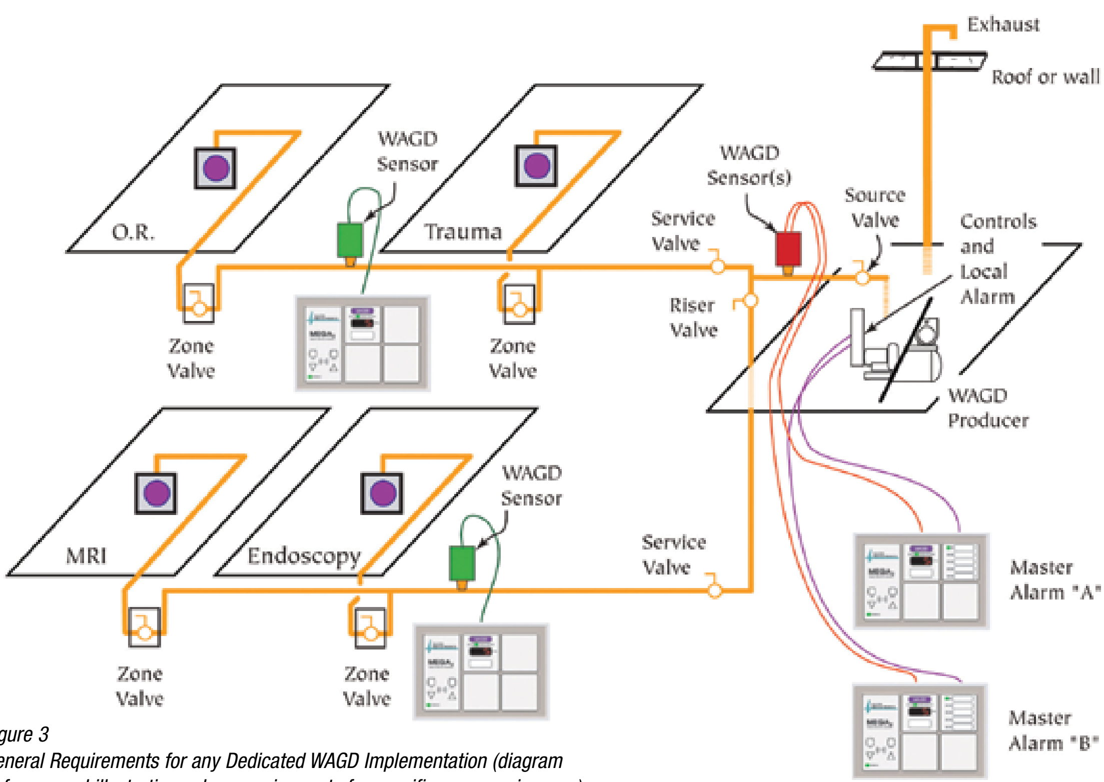


Figure 3
General Requirements for any Dedicated WAGD Implementation (diagram is for general illustration only – requirements for specific occupancies vary)

NFPA 99 Medical Air Dew Point Requirements

BY ROD SMITH, COMPRESSED AIR BEST PRACTICES®

The NFPA 99 (National Fire Protection Agency) Standard for Healthcare Facilities (2005 Edition) is the current code by which healthcare facilities in the United States design their compressed air systems. The NFPA 99 Standard covers many requirements for medical gases, with compressed air being just a component of the standard. To understand the complete scope of the standard, including information on air compressor requirements, it can be purchased at http://www.nfpa.org/catalog.

Healthcare facilities have two separate compressed air systems that fall under the NFPA 99 Code — the Medical Air and Instrumentation Air Systems. They are two completely independent systems that are not allowed, by code, to be connected. Both systems have specific dew point and air quality requirements and are monitored by specific local and master alarm systems. This article discusses the Medical Air System and drying technologies used to meet the standard.

Medical Air Systems

There are two types of Medical Air Systems. The definitions of Level 1 and Level 2 Systems from the NFPA 99 Code are as follows:

> **Level 1:** Medical Piped Gas and Vacuum Systems — systems serving occupancies where interruption of the piped medical gas and vacuum system would place patients in imminent danger of morbidity or mortality
>
> **Level 2:** Medical Piped Gas and Vacuum Systems — systems serving occupancies where interruption of the piped medical gas and vacuum system would place patients at manageable risk of morbidity or mortality

NFPA 99 MEDICAL AIR DEW POINT REQUIREMENTS

Medical air is produced by medical air compressors at 100 psig air pressure. This air is introduced into medical air dryers and filters at this pressure. The air is then pressure regulated down to 55 psig, and distributed to occupancy areas for Level 1 or 2 applications. A pressure drop in the piping distribution is accounted for, and the end use pressure is 50 psig.

Medical Air Dew Point

Both Level 1 and Level 2 Medical Air have the same dew point specification. The NFPA 99 Standard states:

"The medical air dryer shall be designed to provide air at a maximum dew point that is below the frost point (0 ˚C or 32 ˚F) at any level of demand."

The phrase "at any level of demand" is important. The NFPA 99 Standard goes on to state that dryers must be sized to deliver the specified dew point at peak calculated demand. Peak calculated demand, therefore, represents the full load conditions for which a dryer must be sized. This allows dew point quality to be maintained even when a crisis hits a hospital and all air-consuming devices are in use.

The reality in hospitals is that actual demand is typically only 33% of peak-calculated demand. The estimate of 33% is unofficial, yet is agreed upon by many industry experts. This means that the air dryer, which must provide dew point at "any level of demand," must be able to provide a dew point of 32 ˚F at 33% load.

Medical Air Dew Point Alarms

Medical air quality monitoring requirements are very specific in the NFPA 99 Standard. They are outlined as follows:

Medical Air Quality Monitoring — medical air quality shall be monitored downstream of the medical air regulators and upstream of the piping system as follows:

1. Dew point shall be monitored and shall activate a local alarm and all master alarms when the dew point at system pressure exceeds 4 °C (39 °F)

2. Carbon monoxide shall be monitored and shall activate a local alarm when the CO level exceeds 10 ppm [See 5.1.9.5.4(2)]

3. Dew point and carbon monoxide monitors shall activate the individual monitor's signal at all master alarm panels if the monitor loses power

Medical air dew point, therefore, is monitored at both the dryer's control panel (at 100 psig pressure) and downstream after the pressure regulators (at 50–55 psig pressure). Any presence of moisture in the pipelines will trigger the downstream alarms.

Desiccant Air Dryers

The desiccant-type dryer has gained market share in healthcare facilities. Over the past fifteen years, the desiccant air dryer has replaced many refrigerated air dryers. A NFPA 99 committee member, **Mark Allen** of **BeaconMedaes**, estimates that, "Medical air systems use desiccant air dryers 90% of the time." The primary reason for this change was the installation of many refrigerated dryer designs, over the years, which did not have moisture separators effective at 33% load conditions. Mr. Allen commented, "When dew point alarms became mandatory in the NFPA 99 Standard, many hospitals began experiencing daily alarms. In most cases, the alarms would activate overnight when there was very little demand for compressed air. During the day, with higher levels of demand, the alarms would not be activated."

Desiccant air dryer designs are not negatively affected by low-flow conditions. Compressed air passes through a bed of adsorbent material (normally activated alumina), which removes the moisture from the compressed air stream. The traditional design is a twin-tower design with two pressure vessels holding the adsorbent material required to deliver a -40 ˚F (-40 ˚C) dew point — a common specification for industrial applications. The beds are also large enough to provide a -100 ˚F (-73 ˚C) dew point if cycle times are shortened. This design is very effective in providing the required dew point at all flow rates.

Some newer designs of desiccant air dryers have gained popularity in the healthcare industry. These dryers have been designed to provide a 14 ˚F (-10 ˚C) pressure dew point. An example of this is the **BeaconMedaes Lifeline Dryer**. Designing a twin tower desiccant air dryer to meet the NFPA 99 Standard for dew point has reduced the size of the towers and therefore the cost of the unit. These dryers also integrate dew point controls and alarms required by NFPA into the dryer package to further reduce system costs.

Modular-Type Desiccant Air Dryer
(Image Courtesy of Parker domnick hunter)

NFPA 99 MEDICAL AIR DEW POINT REQUIREMENTS

Healthcare facilities have two separate compressed air systems that fall under the NFPA 99 Code — the Medical Air and Instrumentation Air Systems.

Another popular design is the "modular-type" desiccant air dryer. Designed to provide dew points of -4 ˚F, these "modular" desiccant air dryers are very compact and easy to get through doorways and into elevators. This is often a significant issue for healthcare facilities who have their compressed air equipment in difficult-to-access areas.

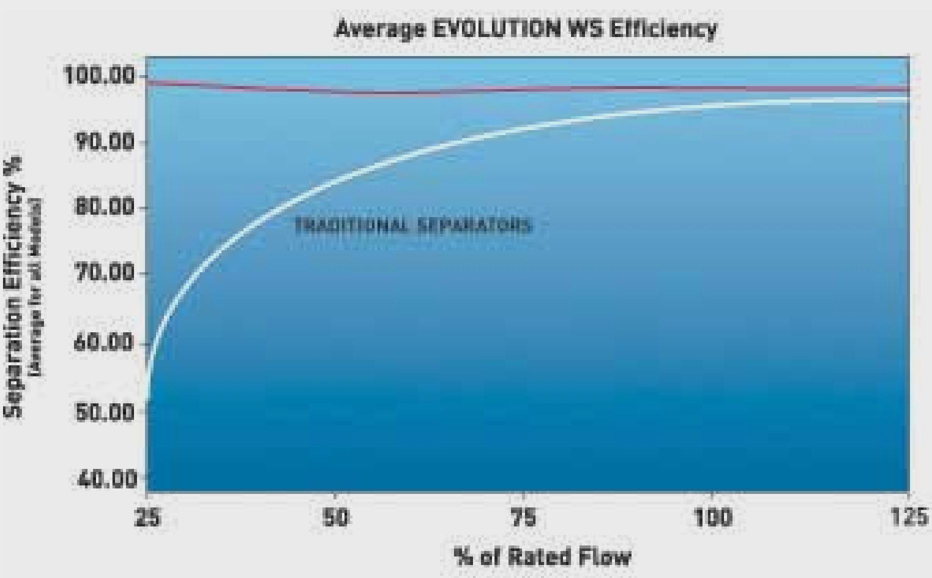
Refrigerated Air Dryers

Refrigerated-type compressed air dryers can provide pressure dew points that comply with the NFPA 99 specification of 32 ˚F (0 ˚C). They will first supply a pressure dew point of 38 ˚F (3 ˚C) at 100 psig pressure. Hankison refrigerated air dryers, a brand owned by SPX Corporation, have long been used for medical air. "When air with a 38 ˚F (at 100 psig) pressure dew point is regulated down, the pressure dew point becomes 25.9 ˚F at 55 psig and 24.1 ˚F at 50 psig," says **Timothy J. Fox**, Manager, Research and Development, **SPX Flow Technology**.

Refrigerated air dryers operate on the principle of using a refrigeration circuit to cool compressed air in a heat exchanger and provoke the condensation of moisture in the air. The condensed moisture is then separated from the compressed air stream by a moisture separator inside of the dryer. The compressed air now leaves the refrigerated air dryer at the design dew point of 38 ˚F (3 ˚C) at 100 psig pressure.

Moisture Separators Can Determine Dew Point at Partial Loads

The moisture separator plays a critical role in the ability of a refrigerated air dryer to meet the dew point specification. A common problem with some refrigerated air dryer designs is that the **moisture separator** only performs to a high degree of effectiveness (90–99+% moisture removal) when experiencing a full 100% load.



Separator Performance Can Vary Significantly (Image Courtesy of Parker domnick hunter)

Moisture separators in refrigerated air dryers have varying designs and degrees of effectiveness — particularly under the partial load conditions of 33% commonly experienced in hospitals. This is why the NFPA 99 Standard specifically says, "the dryer will provide the specified dew point at any level of demand." It is recommended that buyers receive written assurances of dew point performance at any level of demand.

Some separators used in refrigerated air dryers can have a problem with a lack of air velocity at loads of 33%. These "velocity-sensitive" separators receive insufficient air velocity to force the moisture droplets out of the air stream. The moisture droplets are simply re-entrained into the air stream and continue downstream of the dryer. Some heat exchangers inside of refrigerated air dryers have a compartment that acts as a bulk separator of liquids. Effective at full loads, some of these separators have been known to see reduced performance efficiency at reduced loads.

There are some designs of mechanical separators that do create enough turbulence to provide effective separation in low-flow conditions. These "non-velocity sensitive" designs were created with low-flow conditions in mind. Some manufacturers, like **domnick hunter**, a division of **Parker Hannifin**, offer end users a Lloyd's third-party certification of effectiveness at low-flow conditions.

Another effective design is the "filter/separator". This separator design flows the air through a two-stage filter element. The air flows through the element, from the inside to the outside. The first stage is made up of perforated stainless steel, and blocks the larger droplets of moisture. The second stage is made up of coalescing filter media, and this is where the finer droplets are coalesced. This second stage is 99% effective at low-flow conditions, such as those seen in hospitals.

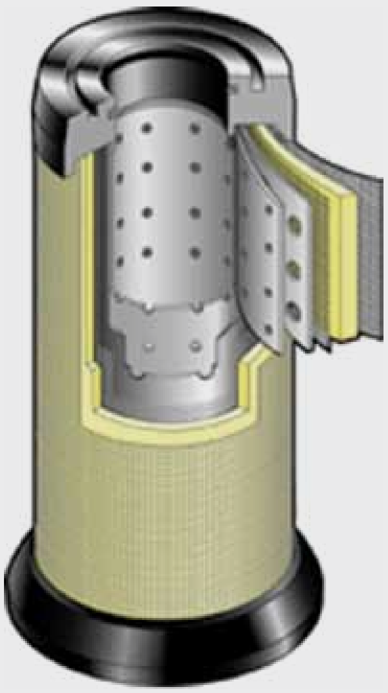
Refrigerated air dryers continue to be a good option for medical air applications, provided they are properly designed to meet the dew point requirements under 33% load conditions.

Medical Air Dew Point Summary

Level 1 and Level 2 Medical Air Systems are required by the NFPA 99 Standard to provide a 32 ˚F pressure dew point at supply pressure of 50–55 psig. Medical air is produced and dried at 100 psig pressure and then regulated down to 55 psig for distribution in the pipelines. Per NFPA 99, both local and master dew point alarms will activate when pressure dew point exceeds 39 ˚F. Refrigerated and desiccant air dryers are both technologies capable of achieving the pressure dew point requirement at the supply pressure of 50–55 psig. The low-flow characteristics of hospitals, normally at 33% load, makes them a challenging application for some refrigerated dryer designs, due to issues with the moisture separators. As a result, the healthcare market has moved towards desiccant air dryers and/or refrigerated dryers which offer assurances of partial-load, low-flow dew point performance. BP

To acquire the NFPA 99 Standard, please visit: http://www.nfpa.org/catalog.

For more information on this article, please contact Rod Smith at Tel: 251-680-9154 or email at rod@airbestpractices.com. More information on Medical Air Systems can be found at www.airbestpractices.com/standards.



Hankison Filter/Separator (Image Courtesy of SPX Flow Technology)

ENERGY INCENTIVES

Industrial Energy Incentives for Minnesota and Wisconsin

BY ROD SMITH, COMPRESSED AIR BEST PRACTICES®

Compressed Air Best Practices® Magazine interviewed Mr. Jake Selseth (Energy Incentive Program Administrator) of Great River Energy (GRE).

Please describe Great River Energy for our readers.

Great River Energy (a Touchstone Energy cooperative) is an energy generation and transmission (G & T) provider owned by 28 electric cooperatives in Minnesota and Wisconsin. We run power plants and the high-voltage transmission lines. We have a variety of power plants, the largest of which is a coal-operated, 1050 MW plant in North Dakota called One Coal Creek Station. We also operate several gas-fired peaking plants in Minnesota. Great River Energy also has 300 MW of wind energy under contract and a refuse-derived fuel power plant in Elk River, Minnesota. We also generate close to 4 MW of power from numerous, smaller anaerobic digesters at dairy farms around the state. GRE serves the 28 electric distribution cooperatives that own and operate us. The cooperatives distribute power to the customers.

Great River Energy Administers a $9.5 million Energy Incentive Program

What market does GRE serve?

The electric cooperatives we serve have 675,000 accounts serving 1.7 million people. Serving many rural areas, we cover two-thirds of the state of Minnesota and the northwest corner of Wisconsin.

The two biggest electric cooperatives we serve are Connexus® Energy (serving the northern half of the Twin Cities) and the Dakota Electric Association (serving the southern half of Minneapolis metro). Lake Country Power, up north, is the biggest electric cooperative we serve in terms of service territory.

The Dakota Electric Association, for example, is a member-owned, not-for-profit electric utility founded by local farmers in 1937 with the help of the Rural Electrification Administration. With more than 100,000 members, Dakota Electric is the second largest electric cooperative in Minnesota and ranks among the 25 largest electric distribution cooperatives in the nation. Dakota Electric purchases wholesale electricity from Great River Energy and distributes electricity to homes, businesses and farms in parts of Dakota, Goodhue, Scott and Rice counties in Minnesota.

Please describe the GRE Energy Rebate Incentive Budget.

GRE administers a $9.5 million dollar energy rebate incentive budget in 2010 for our 28 co-ops. 50% of the budget is designated for residential and 50% targets commercial, industrial and agricultural markets. This is the same budget we had in 2009, and in 2008 our budget was $6.5 million.

Energy incentives are offered because we consider conservation our lowest-cost resource. It's much lower cost than building another power plant. Being a non-profit, we are an expense-driven company.

Our energy rebate incentive programs really got started in 2007 with "The 2007 Next Generation Act" from the State of Minnesota Office of Energy and Security. This Act mandated that utilities save 1.5% of their produced energy per year starting in 2010. This means we have to save 167 million kWh in 2010. Our plans call for commercial, industrial and agricultural customers to generate 60–70 million kWh of savings in 2010. Residential customers will generate 40–50 million kWh of savings, and the balance will come from the supply-side of generation.

AIR BEST PRACTICES™

> "Energy incentives are offered because we consider conservation our lowest-cost resource. It's much lower cost than building another power plant. Being a non-profit, we are an expense-driven company."
>
> — Jake Selseth (Energy Incentive Program Administrator) of Great River Energy (GRE)

ENERGY INCENTIVES

Industrial Energy Incentives for Minnesota and Wisconsin

Paper Mill in Minnesota

What does your Incentive Portfolio look like?

Great River Energy administers a full Energy Incentive Portfolio for commercial, industrial and agricultural markets. Incentives cover projects for most processes, including lighting, motors and drives, compressed air and HVAC systems. Our biggest hitters are lighting, motors and drives (due to VFD) and ground-source (geothermal) heat pumps.

Lighting projects have received the majority of our incentive dollars so far. They are simple and have quick paybacks. Our Motors & Drives Program provides $35 per horsepower for newly installed VFD drives. We are at $20 per horsepower for NEMA premium retrofit motors, and new construction motors are $7.50 per horsepower.

HVAC systems are big in the commercial market. We focus on the electrical side of air conditioning and rooftop units. Our incentives are at $18 per ton. What is significant is that we have an escalator, which for every one point of EER (Energy Efficiency Ratio), we incent another $5.00 per ton.

In hospitals, the proper application of HVAC equipment and lighting is where we focus. Hospitals have a lot of indoor air quality and lighting.

> "We call compressed air "The 4th Utility." We fund companies to perform compressed air system assessments with the objective being to find energy-saving opportunities. We will fund 50% of the system assessment and we provide Custom Grant rebates for the actual projects generated by these system assessments."
>
> — Jake Selseth

How would you rate the success of the incentive programs for compressed air projects?

We call compressed air "The 4th Utility." We fund companies to perform compressed air system assessments with the objective being to find energy-saving opportunities. We will fund 50% of the system assessment and we provide Custom Grant rebates for the actual projects generated by these system assessments.

We are hoping to get more out of compressed air. It's pretty low on the list of dollars received. We are trying to get more people aware of the costs associated with compressed air and are working on an Awareness Campaign. We have a group of programs called Energy Wise. In them, we promote the compressed air studies.

We have some criteria we like to see on the implementation of compressed air projects:

- Air compressor installations should be of 50 horsepower or greater
- A compressed air leak study must be performed. 50% of compressed air leaks identified must be corrected
- The system assessment must cover both the supply and demand side of the compressed air system
- Based upon system assessment recommendations, we then evaluate rebates for equipment upgrades or design fixes

What are the main challenges to getting more energy-reduction projects done?

The main challenges to hitting the energy-reduction goals of our incentive programs are education and communication. It's a challenge to let enough people know about the different rebates and to help them understand how the rebates can benefit them.

Our 28 electric co-ops have energy service reps and key account reps that help educate our accounts. This field service group is very effective in communicating ways to save energy. We therefore invest in the on-going training of these reps on energy-efficiency projects. A few months ago, we completed Compressed Air Challenge® training for 30 of our reps here at our headquarters in Maple Grove. We had excellent feedback from everyone who attended.

Thank you very much for your insights. BP

For more information, please contact Jake Selseth jselseth@greenergy.com or Randy Fordice Rfordice@grenergy.com, Tel: 763-445-5713 or visit www.greatriverenergy.com or www.dakotaelectric.com.

The main challenges to hitting the energy-reduction goals of our incentive programs are education and communication. It's a challenge to let enough people know about the different rebates and to help them understand how the rebates can benefit them."

— Jake Selseth

THE SYSTEM ASSESSMENT

Compressed Air Auditing — What You Should Expect!

BY SCOT FOSS, PLANT AIR TECHNOLOGY

Introduction

With energy costs increasing at 7.5% per annum for the past few years, most facilities managers and maintenance professionals are looking for the best opportunities for excellent return on investment projects, which can drive their operating costs in the opposite direction. Compressed air is an area where significant improvements are readily available.

Unlike traditional utilities users like lighting, chilled water, steam and HVAC, there is very limited knowledge of energy conservation in this venue. Utilities generally operate with a "keep it running" philosophy and are supported by maintenance providers at almost any cost. Fear provokes this approach. Fear can only exist in the absence of knowledge.

Production users in virtually all plants have no accountability for the cost of air or the consequences of their actions. Adding compressed air usage should be considered a business decision when one realizes that an extra 100 scfm costs greater than $13,750.00 per year (at $.07 per kWh, 90 psig, 8500 hours of usage per year). Despite this fact, most plants allow anyone in production to add compressed air usage.

New production equipment is evaluated based on initial cost and workability with little to no interest in utilities requirements or operating cost. Most systems are set up to handle the peak usage with no consideration of diversity or transient event management. Waste, in most systems, amounts to more than 30% of the total usage. 200 scfm is a minimum amount of leaks even in a relatively small system, but since it is a no see-um, it goes unnoticed. 200 scfm equals 1,496 gallons. If the leaks were water, would you walk past them? Would you fix a ground fault in the electric system by jacking up the taps on your sub-station?

These are common issues with compressed air in most plants. We have only looked at the tip of the iceberg. Without quantifying the constituents of demand, you are going to miss between 35–50% of the reduction opportunity. Considering this information, an "air compressor audit" would not provide the best results and would miss the root cause of most of the energy waste and operating cost issues.

Without quantifying the constituents of demand, you are going to miss between 35–50% of the reduction opportunity. Considering this information, an "air compressor audit" would not provide the best results and would miss the root cause of most of the energy waste and operating cost issues.

How Do You Pick an Audit Team?

Audits are offered by hundreds of companies, but most do not evaluate the constituents of demand or approach the root cause of problems with the system. How do you pick an audit team and what should their capabilities be?

1. Do they analyze the entire system, including demand constituents and critical pressures?
2. Have they audited a number of similar systems, designed the implementation, made return on investment and delivered the desired end results?
3. Do they provide thorough financial evaluations or do they only look at electricity?
4. Do they understand compressed air and how it is used on the demand side of the system?

You should always review a couple of audit reports and/or call a few of their clients to find out what happened.

How a System Works

Let's understand how a system works to understand the opportunities. There are five parts to a compressed air system configuration.

1. You must compress the air as efficiently as possible.
2. You need to convert a portion of the kinetic energy to potential energy to flat line the usage and control the rate of change in the system.
3. You must distribute the compressed air efficiently.
4. You must expand the compressed air to take advantage of the energy to operate the users.
5. You must consider the air users, all of which must be applied, installed and operated correctly.

In most systems, only the compression portion is ever considered. You must consider and evaluate all five parts of the system if you hope to approach a reasonable solution and return on investment. Even when this is done, most auditors do not look at or consider signal locations, the impact of differentials on operation of the supply system or the set points or how the controls are set up. These are major issues in determining how the equipment operates. It is necessary to evaluate signals, differentials and set points of all of the compressors to determine what the units are actually displacing and why. When the configuration of equipment is in what the industry calls "compressor trains", the trains need to be carefully evaluated because it is so difficult to get the equipment to work together. A compressor train refers to each compressor being configured with its own filtration and drying equipment piped into a manifold with other trains. Trains offer particularly great opportunities because in most cases, the compressors are significantly part loaded, even when pressure can't be satisfied in the system.

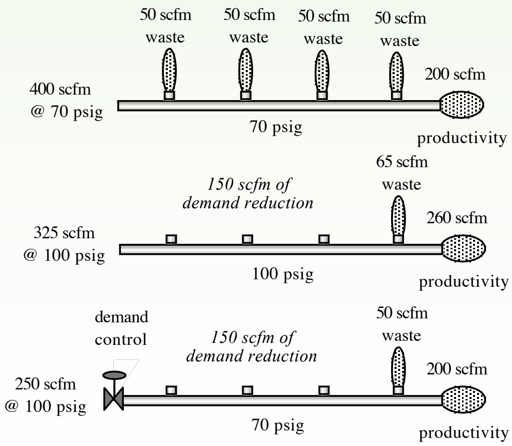
Measurement

Flow meters are often used to determine the air usage totals, but can provide inaccurate information and do not determine what the compressors are doing. The system is in a constant state of dynamic change. There are three states of change: positive rate of change, where supply exceeds demand; negative rate of change, where demand exceeds supply; and neutral rate of change, where supply and demand are both stable.

THE SYSTEM ASSESSMENT

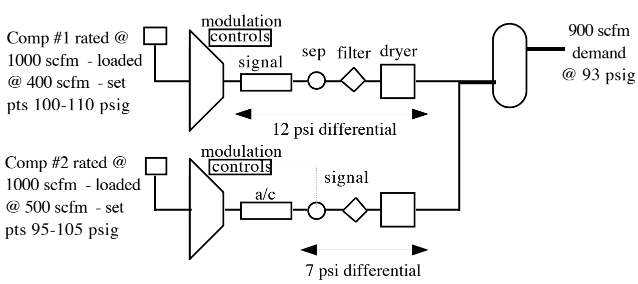
Compressed Air Auditing — What You Should Expect!

Illustration #1



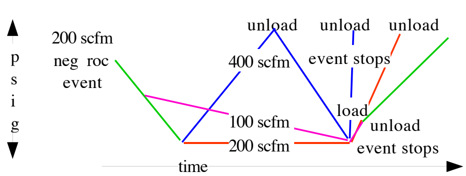
Without controlling demand, fixing leaks can provide less than a linear result

Illustration #2



The two compressor trains have different signal locations. They are both part loaded. When the demand increases the systems psig must drop. The differential increases as the square of the flow increase. A 10% increase will cause the pressure to drop below 85 psig. The common solution is to add another compressor also part loaded.

Illustration #3



When this 200 scfm negative rate of change event (green) begins, the pressure drops. At a lower pressure, you can see what happens when you add either 200 (orange) or 400 (blue) scfm units. The preferred approach would be rate of change, pressure, and time which is 100 scfm (magenta) which controls the ROC. The longer it takes to recover, the less energy the system requires.

You have to be careful not to evaluate usage based on a positive rate of change. This will only indicate the flow when the compressors are reacting to demand. The larger the compressors or the more part-loaded the compressors, the higher the flow will measure. The only true indication of demand is when the system is in a negative rate of change, which coincides with falling pressure. You must measure pressure at the same time that you measure flow to determine the rate of change. Remember that only a portion of the data is useful to determine demand. This is why signals, differentials and set points are so important to evaluate even when you are using flow meters to audit.

Don't forget to measure power on the compressors. Power never lies. If you can make pressure at full load and you are not pulling full load rated power, you are not making flow. The industry rates compressor performance based on free air delivery, psig and brake horsepower at conditions that are different for different types of compressors. In general, this has nothing to do with your site. This information must be converted into mass flow (scfm or lb/mn), psig and kilowatts of energy at site conditions which should include, at a minimum, psia or barometric pressure, temperature, relative humidity and water cooling temperature (if required). The difference between FAD and mass flow can be as much as 18% lower. You will also need to evaluate and correct performance based on extreme conditions to determine if the system will work at other ambient circumstances. A great ROI project that doesn't provide production support on your hottest or most humid summer day will come back to bite you. We would also suggest that you do not use the pressure readings on the compressors or dryers for evaluation purposes, as this information has proven to be as much as plus or minus 4–7% off.

Other Evaluation Points

Many auditors neglect to evaluate the accessory equipment when looking at reduction opportunities. You must consider the inlet filtration, control systems, cooling water or air cooling system, the filtration equipment, dryers and drainage and the inter-relationship of these components to the entire process, including the compressors.

You must evaluate potential energy throughout the system and how it can effect the operation of the system, including the following:

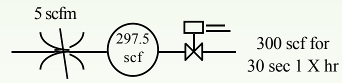
1. Point of use
2. Dedicated storage with checked and/or metered recovery
3. General overhead storage
4. Peak shaving storage
5. Control storage

The scf/psi or storage capacitance can tremendously influence the amount of energy required, the rate of change in the system, what the supply sees as demand, systems reliability, controls integrity and the workability of transient point-of-use applications.

The Piping System

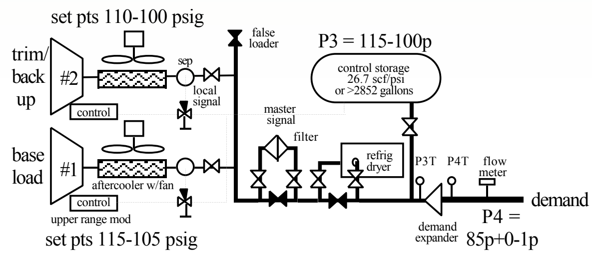
Once you know what the demand in the system is, you need to evaluate the piping system. You should determine if there are pinch points in the system or high differentials. When demand waste is mitigated and transient points of use are flat lined, most piping changes are corrected with no additional actions. This is because differential pressure increases and decreases as the square of the flow change. Therefore, a 5% change in flow will reduce the differential by 25%. In addition, many systems have been designed as a cut-and-paste configuration. By this, we mean that the piping has been sized based on a generous margin above the highest flow, often to store air in the piping. We would recognize this where if the header were one size, the sub-header would be one size, etc.

Illustration #4



By storing 297.5 scf + 5 scfm for 30 seconds, we are able to satisfy the event with 5 scfm continuously instead of requiring a 75 hp or more compressor plus accessory equipment heavily part loaded 95% of the time.

Illustration #5



When the supply system is properly configured, control storage is used to control unit cycling, operating efficiency, and back up reliability. Assuming that the base unit @ 1600 scfm fails. With the back up getting a load signal @ 100 psig and a typical cold start permissive @ 15seconds, the following is the formula to determine the required control storage: 1600 scfm X (15/60) X atm/useful dp (14.3/15) X 7.48gal/scf = control storage.

Illustration #6

Constituents	Current Production	Proposed
Production Good & Bad	359	359
Diaphragm Pumps (6 ea)	430	163
Leaks	745	200
Dryer Purge	208	0
Drainage	186	0
Artificial Demand	96	0
Total scfm	2019	717
System's psig	85	89
Total Systems kw	459	158

These are the constituents of demand from an audit performed in January 2008. Please keep in mind that this is only one of the conditions. Had we not done the demand assessment, we would have guessed at leaks and would have been able to reduce energy by 128 kw.

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These types of configurations create considerable droop in the system. This is where you can have a much higher drop at the point of use than at the supply system. The droop ratio is an important part of evaluation in order to determine the required resolution and control profile in the solutions section of the report.

Expansion

Expansion of the compressed air should be determined based on a number of factors. If it can be done completely at the point of use to minimize the number of leaks in the system, this would produce the best results in terms of efficiency. If there will be any useful storage in the system, the pressure at the expansion point will need to be at a lower pressure than the lowest supply pressure at the discharge of the clean-up equipment. This requires discipline from production management to adjust point-of-use regulators to the lowest required pressure and not jack it up to fix undefined point-of-use problems. If production cannot manage point-of-use discipline, we suggest that you install a central or sector expander(s). We would strongly suggest that you consider isentropic rather than adiabatic expansion. Adiabatic expansion destroys energy in exchange for a lower pressure management. Isentropic expansion expands the gas to a lower density, whereby little if any energy is expended. It is unfortunately commonplace for point-of-use applications to have 15–45 psig of pressure drop between the pipe inlet to a filter regulator and the article inlet pressure to the point of use. At the same time, added compressors are on line or new compressors are being installed to increase the supply pressure by 5 psig. Should you correct the point of use for $100 or add $40,000 worth of supply energy?

Constituents of Demand

To determine a potential solution without reviewing the constituents of demand can miss up to three times the reduction in operating cost. The following are some of the constituents of demand that contribute to the total system demand:

1. Appropriate usage
2. Applications that can be improved upon like:
    - a. Open blowing
    - b. Transient events
    - c. Users that can be significantly reduced in operating pressure
3. Artificial Demand (volume created by operating unregulated users and leaks at higher than necessary pressure)
4. Waste, such as:
    - a. Drainage
    - b. Leaks
    - c. Dryer purge
    - d. Centrifugal blow off

See the "constituents of demand" chart (on the next page) from a recent configuration and financial analysis. Please note that there are numerous footnotes to explain the various constituents and cost basis. Once you have determined the appropriate amount of production usage plus a moderate amount of waste, you can now determine what you need on supply to satisfy the actual demand. You may have different demand requirements for each of three shifts, as well as weekends. Most power is logged based on the average condition. Make sure that you have applied the actual power, including all accessory power to the actual condition. If you are a distribution electrical customer, make sure that you evaluate the demand kilowatts for each condition, as well as the electrical usage. Demand can often amount to 50% of the total energy bill. You will also want to see if there are seasonal or time-based charges for weekdays and weekends. There can be two to twenty four energy bins that are needed to accurately determine the actual and potential energy costs, combined with the conditions of usage.

To properly evaluate the total annual operating cost, you must also evaluate cooling tower pumps and fans and dryer electrical costs. You must look at water cost (if any) including make up, sewer and cooling fans (if any) and treatment chemicals. Don't forget maintenance costs, including inspection, in-house and contract labor and parts and rental (if any), including fuel and maintenance. You should also evaluate current depreciation and miscellaneous costs, such as inventory costs, aging to destruction and supervisory costs as they apply.

Other Factors to Consider

What are the considerations at this point? What is the lowest potential operating cost using the existing system components for each production load condition? Is there a different configuration that would further reduce the cost? After appropriate changes in signals, differentials and set points, what should the new control profile look like? Often, the project may take some time to get approved. In this event, you may want to develop an interim profile so that the system works better until the project is completed. Do you require supplementary cooling to satisfy air quality and air treatment inlet requirements? What air quality is really needed?

COMPRESSED AIR SYSTEM CONSTITUENTS OF DEMAND

CONSTITUENTS OF DEMAND	CURRENT NO LOAD	PROPOSED	CURRENT NORMAL PROD	PROPOSED
Production Good & Bad [1]	0	0	354	354
6 ea 12" Dbl Diaphragm Pump	430	163 [2]	430	163 [2]
Leaks	745	200	745	200
Dryer Purge	208	0 3	208	0 [3]
Drainage	186	0	186	0
Artificial Demand	78	0	96	0
Totals	1647	363	2019	717
Psig @ P4	84	80	85	80
Total Comps & Dryers Kw	395	82.4	459	158.1
Scf/Kw	4.16	4.41	4.40	4.54
$/hr/condition/elect @ $.0855/kwhr	$33.77	$ 7.05	$39.24	$13.52
Hrs/Cnd/Yr	1216	1216	7210	7210
$/Cond/Yr/Elec	$41,067	$8,566	$283,953	$97,462
$/100 scfm/hr/elec	$2.05	$1.94	$1.95	$1.89
CURRENT ELECTRICAL COST = $325,020 VS PROPOSED = $106,028 VARIANCE = $218,992				

[1] Production good and bad represents good applications for compressed air as well as inappropriate applications which we did not feel would provide an adequate return on investment to deal with at this time.

[2] The proposed diaphragm pump category includes regulating 4 of the 10 pumps that are in the system of which you typically operate 6 ea....occasionally 8 each to 65 psig and installing float switches which will create substantial diversity effecting the load on the system. The balance of the pumps will be replaced with electric pumps with float switches.

[3] The existing main dryer is sized for 2600 scfm. It is a heater purge dryer with a purge rate of 208 scfm. The dryer is designed for -40 ˚F pdp. It doesn't work as the desiccant bed is coated with oil from the compressors. This dryer wastes energy and doesn't provide a dry system. It should be replaced.

FINANCIALS

CONSTITUENTS	CURRENT	PROPOSED	VARIANCE
Electricity	325,020	106,028	-218,992 @ $.0855 kwh blended rate for 2008 *
Rental incl Maint [1]	27,917	0	-27,917
Diesel Fuel for Rentals [1]	17,816	0	-17,816
Maintenance - part, labor, supervisor costs [2]	29,860	29,860	0
Depreciation	0	25,958 [3]	+25,958
TOTALS	**$400,613**	**161,846**	**-238,767 PRETAX 148,036 AFTER 38% TAX ON REDUCTION**
TOTAL PROD COST/HR/100 SCFM [4]	**$2.36**	**$2.18**	**25.2 MONTH INTERNAL ROI**

* Found out on the last night before the out briefing that this is the new rate for electricity. It represents a 29% rate increase.

[1] The rental has been in the system for several months and is used to support the frequent systems interruptions when the 100 hp compressor has an electrical overload. This is because the 100 hp is a top of the frame machine set at 100-110 psig with a 33 SAE weight lubricant that pulls approximately 3% more power than a 10 weight fluid. The combination of circumstances pulls more than 1.15 into the service factor of the motor.

[2] Maintenance costs include inside and outside labor, parts, lube, inspection, and supervisory costs @ 5%. The figures are based on a four years average cost. As we do not feel that adequate attention has been given to maintenance. With a reliability centered maintenance program, even a half the loaded power, we feel that you should plan on maintaining the same maintenance budget.

[3] Depreciation is added to establish the return on investment and is calculated based on 12 years straight line method.

[4] Even based on the significant reduction in demand waste and the appreciable improvement in efficiency, the cost for a ¼" open hose blowing at 80 psig for 8426 hrs per year would be >$15,700 per year. This deserves to be treated as a business decision.

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Is there a reasonable case for heat recovery? What is the part load correction factor for the heat source you may be completely or partially reducing? What is the number of degree days required at the site locations? Make sure that the proposed process flow diagram includes both the inlet and the cooling air inlet and face or coolant conditions. Included should be the elevation above sea level, air and coolant temperature and relative humidity. If possible, you will also require the suction pressure on the inlet in psia. Make sure that this data is used to determine the actual capacity of the compressors in lbs/min or scfm. You will, of course, want to check with the National Climatological Center for extreme projected conditions to determine the requirement for power and equipment performance at extreme conditions. Make sure that you use 0% tolerance instead of the typical fudge factors so that you don't miss the systems requirements for the hottest, most humid day.

Conclusion

If the audit team has been vigilant, you have reduced the number of compressors on line. This means that the compressors that are on now represent a larger percentage of the total system's demand. If you had four compressors and reduce the supply to two, you will increase the risk of interruption if you lose a compressor from service. In the current analysis of risk, the loss of a compressor meant less than a 25% negative rate of change. With only two units on line, the negative rate of change will double on a unit loss. You must make provisions for this to maintain the reliability of the system in the new configuration.

Based on how your management group prioritizes maintainability, you should consider the application of HMI management information in lieu of developing expertise to improve the quality of root cause analysis and solutions. In lieu of both an HMI system or expertise, most organizations settle for fixing the symptoms of undefined problems and then waiting for new symptoms to arise later from the same root cause.

Once you have scoped out the most workable solution to meet the desired priorities of your management team at the lowest operating cost, it is time to develop an action plan or project plan to move forward with implementation. The action plan should be detailed and include capital and installation costs, engineering, project management, contingency, shipping and taxes, if any. The plan should be developed in the correct chronological order, as most plans must be executed with minimum disruption to production and be accomplished, as much as possible, during normal working hours. Make sure that you clarify to the potential audit teams that the deliverable that you expect is not a shopping list of things that they sell. Particularly with compressed air, you must apply rather than buy the solution. When done correctly, the scope of work is demanding and difficult.

The last work that needs to be done is to determine the proposed operating financials and the return on investment. It may require adding depreciation for the capital action plan. You may also need to tax the reduction in operating cost, which is typically assessed on a corporate basis, from 37–41% of the annual reduction.

In this lean economy, where the corporate agenda is frequently "Do a Good Job with Less…..or Else," you can't overlook compressed air opportunity expense as a viable area to evaluate. At the same time, you must be mindful of how critical it is to make the ROI once a project is approved. As important as compressed air is to most production plants, it doesn't mean that it should be maintained at any cost.

Mr. Foss has been analyzing and trouble shooting compressed air systems since 1973. He has audited more than 1,500 systems worldwide. He is also the author of "The Compressed Air Systems — Solution Series,*" an 1,100-page instruction manual on the integration and operation of the system. Mr. Foss is semi-retired, and is a Senior Analyst with Plant Air Technology, Tel: 704-844-6666, email:airsagas@aol.com.* BP

For other articles on System Assessments, please visit www.airbestpractices.com/system-assessments.

Association of Independent Compressor Distributors (AICD) Membership Meeting and Exhibition 2010

BY ROD SMITH, COMPRESSED AIR BEST PRACTICES®

Bill Thomas (Belair Technologies) keeps score while Bob Foege (Standard Pneumatic Products) shoots 'em up

The 2010 edition of the AICD was held May 16–18 at the Sawgrass Marriott Resort in Ponte Vedra, Florida. It's a tough job but someone has to do it. Considering the economy, there was an outstanding attendance by both exhibitors and association membership. The conference had an interesting line-up of speakers and featured interesting technologies. Most importantly, the golf outing went very well with just the usual sunburns to report.

25th Anniversary Banquet

This year marked the 25th anniversary for the AICD and a nice banquet was prepared. As an added touch, many past-presidents were in attendance and were given seats of honor. Past-presidents who couldn't make it were also remembered. You know who you are! Those in attendance included:

Peter Scales, Scales Industrial Technologies
Ron Nordby, John Henry Foster Minnesota
Bill Kiker, National Pump & Compressor
Mike Schmeltzer, Rogers Machinery
Charles Pugh, National Pump & Compressor
Jim Bruce, Reapair Compressor
Steve Kollmyer, A.J. Kollmyer & Son

The current President of the AICD, Jim Bruce of Reapair Compressor Services, commented that the AICD organization is stronger than ever and expressed his gratitude for the valuable business relationships the AICD has allowed him to build over the years with fellow members. He encouraged all members to get involved with the association.

In addition, it seems you can't visit Jacksonville anymore without Bill Thomas, of BelAir Technologies, shooting shotguns. In what is becoming a welcome new tradition, a good group of distributors accepted BelAir's invitation to the Jacksonville Skeet & Trap Club to "punch some holes and make some noise." As far as I could tell, every one returned safely.

The Conference

The speaker line-up delivered on President Jim Bruce's promise to be "relevant to any one in the business." The first presentation was titled "The Economy and Small Business" presented by Dr. Carol Dole of Jacksonville University. While the forecast was not exactly rosy, the presentation had many interesting points outlining a business environment with greater government involvement.

2010 ASSOCIATION OF INDEPENDENT COMPRESSOR DISTRIBUTORS (AICD) MEMBERSHIP MEETING AND EXHIBITION

New cycling refrigerated dryer from SPX Hankison

Renee Garza (Burton Compressor) and Bob Foege (Standard Pneumatic Products) discuss compressor controls

MTA's Don Joyce and John Medeiros discussed free-cooling systems

The President of the AICD, Jim Bruce, visits with Rod Smith during the Expo

Bill Scales, from Scales Industrial Technologies, then presented "Position Your Company for Growth When Coming out of a Recession." Always a motivational speaker, Bill provided great insights on how Scales Industrial Technologies has managed in this recession and invested to take advantage of what comes next. He discussed the actions taken in process improvements, cash management, sales management, cost reductions, communication with employees and measurement metrics with "flash points." Future goals like finding new markets, training people and promoting your company were also discussed. My personal favorite quote from Bill is, "We can't find more hours in a day, and we must make every minute count." That quote is up on my wall and is what I know can have the biggest impact on our small business.

Jeff Yarnall, from Rogers Machinery, followed with a (music to my ears) presentation on "How to Market Energy Conservation." He had a fun, experience-built, presentation about how, when he had a territory as a compressor salesman, he couldn't ever create need. He simply had to "hope someone needs an air compressor." This happened year after year! He then discussed how the education of the marketplace on the lifetime cost of an air compressor (76% of the cost is electricity), changed his career. Now, most of his customers need an air compressor in order to reduce their energy costs.

Last but not least, Ken Schiefer of Hycomp made a presentation called "Niche Market Pressure Booster Applications." Several distributors commented to me afterwards that they had learned some new applications that they had not previously thought of.

The Exposition

At the exposition, I normally disappear from my booth and don my "roving reporter" hat. With no intelligent methodology, I wander around and get into interesting, random conversations during the exhibition. Following is a summary...my apologies go to the many booths and firms not mentioned, due to the space limitations of this article.

Compressed air treatment remains a focus of this exposition. Aircel Corporation is making an investment in the business and displayed a comprehensive range of products, including their DigiCel Series cycling refrigerated air dryers. SPX Hankison continues their introduction of their new HES Series refrigerated dryers. SPX Hankison's Ray Brahm said that interest levels were very high for the new thermal mass technology from Hankison.

Air compressors and compressor control products were well represented. Kobelco oil-free rotary screw compressors, Hitachi oil-free compressors and FS Elliott oil-free centrifugal compressors were present for standard plant air applications. Hycomp presented their booster packages and Bauer presented their industrial high-pressure compressor packages. Powerex was also present with their oil-less scroll compressor packages. Standard Pneumatic Products displayed their cost-effective Universal Autodual compressor control packages as well.

Cooling systems continued to catch my eye. Don Joyce and John Medeiros of MTA always get me interested in the "free-cooling" chiller applications they install — to the tune of great energy-savings for their customers! Hydrothrift reported that their heat-recovery projects (using the compressor oil to heat water) continue to increase.

Newcomers to the AICD meeting (at least new to me) were lubricant suppliers I.S.E.L and Strident Corporation. TIGG Corporation (my neighbor in Pittsburgh) presented their line of air storage receivers, and Nano porous systems presented an innovative (patent pending) compressed air drying technology. I have to say that it appears that Mr. Colin Billiet's new venture with nano-porous systems has truly come up with a new dryer technology.

In summary, the AICD exhibition was again well worth the time. I'm already looking forward to the 2011 AICD and another twenty-five years (well, maybe less for me)! BP

RESOURCES FOR ENERGY ENGINEERS

TRAINING CALENDAR

TITLE	SPONSOR(S)	LOCATION	DATE	INFORMATION
Compressed Air Challenge® Fundamentals of Compressed Air Systems	Tate Engineering, Compressed Air Challenge®, Sullair	Baltimore, MD	7/27/1	Tate Engineering Tel: 800-800-8283 x115 www.compressedairchallenge.org
Compressed Air Challenge® Advanced Mgmt of Compressed Air Systems	Tate Engineering, Compressed Air Challenge®, Sullair	Baltimore, MD	7/28–29/10	Tate Engineering Tel: 800-800-8283 x115 www.compressedairchallenge.org
Compressed Air Systems	Association of Energy Engineers	Online Seminar	8/23/10	www.aeeprograms.com
Compressed Air Challenge® Advanced Mgmt of Compressed Air Systems	Efficiency Vermont, Burlington Electric DOE EERE	S. Burlington, VT	8/31–9/1	Peter Wilhovsky Burlington Electric Tel: 888-921-5990 x1328 www.compressedairchallenge.org
Compressed Air Challenge® Fundamentals of Compressed Air Systems	Compressed Air Challenge®	Web-based	9/13/10	Tel: 301-751-0115 www.compressedairchallenge.org info@compressedairchallenge.org
Compressed Air Challenge® AIRMaster+ Specialist Training	Efficiency Vermont, Burlington Electric DOE ITP	S. Burlington, VT	9/27–30/10	Peter Wilhovsky Tel: 888-921-5990 x1328 www.compressedairchallenge.org
Compressed Air Challenge® Fundamentals of Compressed Air Systems	Manitoba Hydro Compressed Air Challenge®	Winnipeg, MB	10/26/10	Veronica Walls Tel: 204-360-7229 email: vwalls@hydro.mb.ca www.compressedairchallenge.org
Compressed Air Challenge® Advanced Mgmt of Compressed Air Systems	Manitoba Hydro Compressed Air Challenge®	Winnipeg, MB	10/27–28/10	Veronica Walls Tel: 204-360-7229 email: vwalls@hydro.mb.ca www.compressedairchallenge.org

Editors' Note: If you conduct compressed air system training and would like to post it in this area, please email your information to rod@airbestpractices.com.

PEOPLE

New President at BOGE America

Gavin Monn has been appointed as the President and CEO of BOGE America, Inc. In his new role, Gavin will be responsible for leading, managing and developing the North American business for BOGE. Gavin has spent nearly two decades working within the compressed air industry for an international manufacturer, and in that time has gained extensive experience on three continents of managing and developing both the sales and aftermarket businesses, working with both the distribution networks and end customers directly. Gavin Monn, president and CEO of BOGE America, Inc., said, "BOGE has already built a great reputation with its existing customers. I am looking forward to building on this and growing our market share in North America going forward."

Boge America
Tel: 770-874-1570
www.boge.com/us

PEOPLE

Kaeser Names New Director of Sales

Kaeser Compressors, Inc. recently announced the hiring of their new director of sales, Ed Smiley. Based out of Kaeser's United States headquarters in Fredericksburg, Virginia, Mr. Smiley will lead the sales teams for all of Kaeser's product divisions.

Frank Mueller, president of Kaeser Compressors, commented, "We welcome Ed to the Kaeser family and look forward to making full use of his talents to serve our customers as well as our distribution network."

With over 17 years of industrial sales and product management experience, Mr. Smiley is uniquely qualified to lead Kaeser's sales efforts in the U.S. by combining his skills in strategic planning, territory management and sales management. For the past nine and a half years, Mr. Smiley was employed by a European-based pump company, where he served in various sales and marketing management roles — most recently serving as the market development manager for the general Industry and machine tool markets.

"I am very excited to join such an enthusiastic and experienced team here at Kaeser," said Smiley. "Together, we will continue providing the right solutions for our customers' compressed air needs with the industry's most efficient equipment and unmatched after sales service and support."

Mr. Smiley received his undergraduate degree from Western Kentucky University and completed his MBA from The University of Kansas in March 2010.

Kaeser Compressors
Tel: 800-777-7873
www.kaeser.com

RESOURCES FOR ENERGY ENGINEERS

PRODUCT PICKS

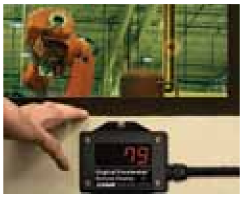
New IQ Blower Package

Gardner Denver (GD) introduces the intelligent IQ Blower Package. This large, 50–100 horsepower, factory-direct blower package is a new addition from GD, the trusted solutions provider to the PD blower and vacuum pump marketplace. The IQ blower package is a blend of proven results and innovation for the future. The IQ blower package range now delivers pressure to 15 psig, vacuum to 16" Hg and air flows from 200–1400 icfm. Some of the key IQ competitive advantages include:

- Intensely quiet design reduces sound levels by as much as 20 dBA
- Intelligent digital monitoring is standard with the AirSmart controller
- Integrated full-voltage starter or optional Variable Frequency Drive (VFD) for premium efficiency
- Innovative removable discharge silencer provides package integrity and end-user flexibility
- Quality blower options — DuroFlow®, Sutorbilt® Legend® DSL and award-winning HeliFlow®

Gardner Denver
Tel: 800.682.9868
www.GardnerDenverProducts.com

Compressed Air Flow Meter Summing Remote Display



EXAIR's new Summing Remote Display for the Digital Flowmeter makes it easy to monitor compressed air consumption from a convenient location. With the push of a button, the display cycles to show the current air consumption, usage for the previous 24 hours and total cumulative usage. Regular monitoring of the air usage of a machine, process or department makes it possible to save thousands of dollars per year in compressed air waste by identifying costly leaks or inefficient air products.

The Digital Flowmeter (sold separately) has a four-digit LED display that directly indicates the scfm (standard cubic feet per minute) of airflow through the pipe it is mounted to. The Summing Remote Display shows that flow measurement, the daily and cumulative usage and is frequently used when the Digital Flowmeter is in an obscure, hard-to-read location. The accuracy of the displayed measurement is within 5% of the reading when the air temperature is 40º–120 ºF (4º–49 ºC) and air pressure is between 30–140 psig. No adjustments or calibration are ever required. It is CE and RoHS compliant.

Two models of the Summing Remote Display are available (Model 9150 that displays scfm and Model 9150-M3 for m3/hr). They are pre-wired with 50' (15.2m) of cable and powered by the Digital Flowmeter. Mounting hardware is included. Price is $235.

EXAIR Corporation
Tel: 800-903-9247
www.exair.com

New Synthetic Food-Grade Lubricants

The Omnilube® family of lubricants from Ultrachem, Inc. is a complete line of premium-quality food-grade synthetic oils and greases for incidental food contact that are specially designed for reduced lubrication intervals, longer equipment life, less downtime and reduced maintenance costs. Omnilube® lubricants are available for compressor, hydraulic, chain, gear and multi-purpose applications, and are well suited for all food, beverage, pharmaceutical and related industries.

Omnilube® food-grade products meet all of the requirements of the USDA and FDA H-1 regulations, 21 CFR 178.3570, and conform to the requirements of NSF. They are also approved by the Orthodox Union for Kosher use.

Ultrachem's Omnilube® fluids are formulated with excellent anti-wear protection and oxidative stability, qualities that have been shown to surpass other food- grade products on the market and outperform many non food-grade lubricants in food processing applications. "With the Omnilube® line of premium food-grade synthetics and white oils," said Bob Whiting, president of Ultrachem, "performance is no longer sacrificed when converting to food-grade products."

Omnilube® fluids are formulated from the highest-quality polyalphaolefin (PAO), polyalkylene glycol (PAG), ester and mineral base oils, depending on application. Ultrachem also offers food-grade grease and multi-purpose oil in convenient 12-ounce aerosol spray cans.

Ultrachem, Inc.
Tel: 302-325-9880
E-mail: info@ultracheminc.com or www.ultracheminc.com.

PRODUCT PICKS

New Inline Vacuum Ejectors

PiINLINE™ is Piab's new range of inline vacuum ejectors based on COAX® technology. The products are well suited for the packaging industry, where vacuum ejectors with good vacuum flows are required to enable reliable gripping, lifting and moving of objects.

"The new range has a high vacuum flow and tolerates fibers and dust, so they work very well in applications for carton board and solid board materials that leak air significantly, which is normal in the packaging industry," says Jan Schieche, global product manager of pumps and accessories.

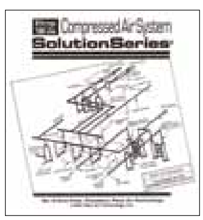
Another important benefit is that piINLINE™ is a more eco-friendly solution than single-stage ejectors.

The smallest model, the Micro, uses on average 50 % less energy than comparable products, which means significantly less energy consumption and lower carbon emissions. Sound levels are also lower, which creates a better working environment.

PIAB
Tel: 800-321-7422
www.piab.com

LITERATURE & SERVICES PICKS

The Compressed Air System Solution Series©



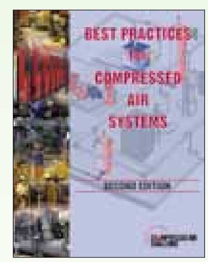
Scot Foss has provided his expertise to many of the world's leading manufacturing and processing corporations by finding solutions to their problems. Foss is one of the world's leading experts in compressed air systems, known for his sometimes-controversial approach to the issues that face plant engineers, maintenance managers and production engineers.

Written in a conversational format, this 1,100-page book with 165 illustrations brings you solutions with a straight on, common sense approach supported by technology. The author focuses on concepts and applications, which are guaranteed to improve production results and energy efficiency. The chapters of the book are as follows:

1. Change Your Way of Thinking about Compressed Air
2. Designing a New System
3. Troubleshooting the System
4. Instrumentation and Information Management
5. Compressed Air Storage and Using Potential Energy
6. Piping and Piping Systems
7. Compressor and System's Controls
8. The Business of Demand
9. Supply Energy
10. Cleaning Up Compressed Air
11. Standards and Specification

The cost of the book is $195.99. To order the book, make a check or PO out to: Air's a Gas, Inc., 3728 Berenstain Drive, St. Augustine, FL 32092, or call 904-940-6940, fax 904-940-6941 or e-mail: airsagas@aol.com. A portion of the proceeds from this book will be donated to selected children's charities.

New Edition of "Best Practices for Compressed Air Systems®" from the Compressed Air Challenge®



The Compressed Air Challenge® has released the Second Edition of their authoritative "Best Practices for Compressed Air Systems®."* The Best Practices manual provides tools needed to reduce operating costs associated with compressed air and to improve the reliability of the entire system. The 325-page manual addresses the improvement opportunities from air entering the compressor inlet filter, through the compressor and to storage, treatment, distribution and end uses, both appropriate and potentially inappropriate. Numerous examples of how to efficiently control existing and new multiple compressor systems are provided in one of the many appendices.

The Best Practices manual created by the Compressed Air Challenge® begins with the considerations for analyzing existing systems or designing new ones. The reader can determine how to use measurements to audit their own system, how to calculate the cost of compressed air and even how interpret electric utility bills. Best practice recommendations for selection, installation, maintenance and operation of all the equipment are included in each section. BP

**The Best Practices for Compressed Air Systems® manual is a product of the Compressed Air Challenge®, co-authored by Bill Scales and David McCulloch and is not associated with Compressed Air Best Practices® Magazine.*

Compressed Air Challenge®
www.compressedairchallenge.org

WALL STREET WATCH

BY COMPRESSED AIR BEST PRACTICES®

The intent of this column is to provide industry watchers with publicly held information, on publicly held companies, involved with the sub-industry of compressed air. It is not the intent of the column to provide any opinions or recommendations related to stock valuations. All information gathered in this column was during the trading day of June 22, 2010.

MAY 3, 2010 PRICE PERFORMANCE	SYMBOL	OPEN PRICE	1 MONTH	6 MONTHS	12 MONTHS	DIVIDEND (ANNUAL YIELD)
Parker-Hannifin	PH	$62.79	$60.45	$54.58	$41.86	1.70%
Ingersoll Rand	IR	$39.03	$35.70	$36.10	$21.36	0.70%
Gardner Denver	GDI	$50.42	$44.69	$42.79	$24.32	0.42%
Atlas Copco ADR	ATLCY	$14.36	$12.11	$12.69	$8.30	n/a
United Technologies	UTX	$67.99	$66.66	$69.38	$53.85	2.45%
Donaldson	DCI	$43.13	$42.77	$42.50	$34.32	1.07%
SPX Corp	SPW	$56.61	$58.01	$55.61	$45.71	1.72%

Gardner Denver Announces 2010 1st Quarter Earnings

Gardner Denver, Inc. (NYSE: GDI) announced that revenues and operating income for the three months ended March 31, 2010 were $422.2 million and $47.5 million, respectively, and net income and DEPS attributable to Gardner Denver were $32.0 million and $0.61, respectively.

Compared to the three-month period of 2009, revenues declined 9%, but orders increased 23%. The improvement in orders occurred in most business units and in all regions. Operating income increased $274.6 million compared to the prior year, which included a preliminary impairment charge of $265 million and expenses related to profit improvement initiatives and non-recurring items totaling $8.1 million.

CEO's Comments Regarding Results

"We were quite pleased by the acceleration in demand for our products," said Barry L. Pennypacker, Gardner Denver's president and chief executive officer. "The improvement was broad-based, providing an indication that the global economy is in the early stages of recovery. Demand for OEM products continued to improve during the quarter, as did requirements for well servicing pumps and aftermarket parts and services. In these businesses, we have benefited from investments in process improvements, which have resulted in improved margins and increased manufacturing velocity, and enabled us to respond to some of the increased demand. We are continuing our transformation into a lean organization, which supports our goal of 14% operating margin in the Industrial Products segment by 2014.

"Cash provided by operating activities was more than $26 million in the three-month period of 2010, allowing the Company to continue to reduce its borrowings and repurchase some of its shares in the open market for the first time since 2008. Debt to total capital was 24.5% as of March 31, 2010, and we continue to expect cash flow from operating activities, less capital expenditures, to exceed net income in 2010, which should position the Company to repurchase shares or make acquisitions, if the appropriate opportunities become available.

"The Company invested approximately $4.8 million in capital expenditures in the three-month period of 2010, compared to $9.0 million in the prior year period. By comparison, depreciation and amortization expense was $15.6 million for the three-month period of 2010 and $16.7 million in the comparable period of 2009. The Company expects capital expenditures to be approximately $35 million to $40 million in 2010. One of the benefits of our application of lean principles is that non-capital solutions are often identified as part of our process improvements, or the projects are less capital intensive.

"In the first quarter of 2010, we shipped a large engineered package for a tar sands application. As expected, segment operating margin (1) for our Engineered Products Group in the first quarter of 2010 was negatively impacted by the unfavorable mix associated with the shipment of this package, which contained a disproportionate amount of purchased components.

"We completed the sale of a foundry that we previously operated in Schopfheim, Germany during the first quarter of 2010 and completed our eighth manufacturing plant closure. We realized significant productivity improvements at our Louisiana operation and began to see reductions in past due backlog, despite the ongoing growth in orders. In general, we are making good progress in broadening our knowledge and use of lean initiatives, and driving our decision-making based on the voice of the customer."

Outlook

Mr. Pennypacker stated, "Based on the economic outlook, our existing backlog and cost reduction plans, we are projecting the second quarter 2010 DEPS attributable to Gardner Denver to be in a range of $0.59 to $0.63. Profit improvement projects and other lean initiatives will continue to be implemented throughout 2010. Accordingly, we may record additional profit improvement charges totaling approximately $1 million or $0.01 DEPS in the second quarter of 2010 related to potential and in-process initiatives. Excluding profit improvement costs, the second quarter 2010 DEPS are expected to be in a range of $0.60 to $0.64.

"The full-year 2010 DEPS are expected to be in the range of $2.72 to $2.82. This projection includes estimated profit improvement costs (primarily consisting of severance expenses) and other items totaling $0.03 per diluted share. Full-year 2010 DEPS, adjusted to exclude profit improvement costs and other items, are expected to be in a range of $2.75 to $2.85. The effective tax rate assumed in the DEPS guidance for the second through fourth quarters of 2010 is 28%."

First Quarter Results

Revenues decreased $40.3 million (9%) to $422.2 million for the three months ended March 31, 2010, compared to the same period of 2009. Industrial Products segment revenues decreased 3% in the first quarter, compared to the same period of 2009. Orders for Industrial Products, however, increased 14% for the three-month period of 2010, compared to the same period of 2009, reflecting an increase in demand on a global basis.

Gross profit decreased $6.8 million (5%) to $133.8 million for the three months ended March 31, 2010, compared to the same period of 2009, primarily as a result of volume reductions and unfavorable product mix, despite the benefit of favorable changes in foreign exchange rates and cost reductions previously completed. Gross margins increased to 31.7% in the three months ended March 31, 2010, from 30.4% in the same period of 2009. The increase in gross margins was due to the benefits of operational improvements and cost reductions, partially offset by the loss of volume leverage and unfavorable mix.

Selling and administrative expenses decreased $6.9 million to $87.7 million in the three-month period ended March 31, 2010, compared to the same period of 2009, primarily due to cost reductions that were partially offset by the impact of unfavorable changes in foreign currency exchange rates ($4.6 million). As a percentage of revenues, selling and administrative expenses increased slightly to 20.8% for the three-month period ended March 31, 2010, compared to 20.5% for the same period of 2009, primarily as a result of the reduced leverage resulting from lower revenues.

Adjusted Operating Income for the Industrial Products segment in the first quarter of 2010 was $20.5 million and segment Adjusted Operating Income as a percentage of revenues was 8.3%. By comparison, the Adjusted Operating Income for the Industrial Products segment was $5.2 million, or 2% of revenues, in the three-month period of 2009. The segment operating income (1) and segment operating margin (1), as reported under GAAP, for the Industrial Products segment for the three months ended March 31, 2010 was $19.6 million and 7.9%, respectively. The segment operating loss (1) for the Industrial Products segment, as reported under GAAP, for the three months ended March 31, 2009 was $261.4 million. The improvement in Adjusted Operating Income for this segment was primarily attributable to cost reductions completed over the previous twelve months. The provision for income taxes for the three months ended March 31, 2010 decreased $4.1 million to $9.7 million, compared to the same period of 2009. The provision for income taxes in the three-month period of 2009 included expense of $8.6 million associated with the write-off of deferred tax assets related to net operating losses recorded in connection with the acquisition of CompAir. In the first quarter of 2009, the Company also recognized a $3.6 million benefit as a result of the reversal of an income tax reserve and related interest associated with the completion of a foreign tax examination.

Net income attributable to Gardner Denver for the three months ended March 31, 2010 increased $281.1 million to $32.0 million, compared to a net loss of $249.2 million in the same period of 2009. The first quarter of 2009 included a preliminary goodwill impairment charge of $265.0 million, restructuring charges of $7.9 million ($5.5 million after taxes), and $5.0 million of income tax adjustments mentioned previously. Diluted earnings per share attributable to Gardner Denver for the three months ended March 31, 2010 were $0.61, compared to a loss of $4.81 on a per share basis for the same period of the previous year.

WALL STREET WATCH

Ingersoll-Rand announces 1st Quarter Earnings

Ingersoll-Rand plc (NYSE:IR), announced that total reported revenues increased by 1% for the first quarter of 2010 compared with the 2009 first quarter, orders increased by 10%, and diluted earnings per share (EPS) from continuing operations were at the top end of the prior guidance range.

The Company reported net earnings of $1.4 million, or EPS of $0.00, for the first quarter of 2010. First-quarter net income included $11.8 million, or EPS of $0.04 from continuing operations, as well as $10.4 million of after-tax costs, equal to EPS of $(0.04), from discontinued operations.

"Our first-quarter 2010 earnings were in line with our expectations, even though revenues were slightly lower than forecast. The significant increase in orders we saw in the first quarter and our growing backlog gives us confidence that we will achieve the revenue and earnings guidance we established for 2010," said Michael W. Lamach, president and chief executive officer. "We are seeing initial signs of improvement in several of our key markets including transport and stationary refrigeration, industrial, Club Car and the North American residential HVAC and security businesses. Our continuing focus on productivity and cost reduction resulted in higher operating margins. Productivity is becoming embedded in everything we do and we are extending that energy to also focus on innovation. Ingersoll Rand employees continue to find new opportunities to serve customer needs, improve operations and drive financial performance."

Additional Highlights for the 2010 First Quarter Revenues:

The Company's reported revenues increased by 1% to $2,953.4 million, compared with revenues of $2,932.9 million for the 2009 first quarter. Total revenues excluding currency were down by 1%, compared with 2009. Reported U.S. revenues were down by 1%, and revenues from international operations increased by approximately 4% (down 1% excluding currency).

Operating Income and Margin: Reported operating income for the first quarter was $133.5 million compared with $49.9 million for the first quarter of 2009. The first quarters of 2010 and 2009 both included approximately $10 million of pre-tax costs related to restructuring. First-quarter reported operating margin was 4.5%, compared to a reported operating margin of 1.7% for the same period of 2009. Continued strong productivity drove the increase in operating profits and margins. These improvements were partially offset by inflation.

First Quarter Business Review

The company reports the results of its businesses in four segments based on industry and market focus. During the fourth quarter of 2009, the company realigned its segments to more closely reflect its corporate and business strategies and to promote additional productivity and growth. The company's four segments include: Climate Solutions, which include the Trane commercial HVAC Systems, Hussmann and Thermo King businesses; Industrial Technologies, which include Air and Productivity Solutions and Club Car; Residential Solutions, which include the residential HVAC and security businesses; and Security Technologies, which include the commercial security businesses. Segment operating margins for both 2009 and 2010 include restructuring expenses.

Industrial Technologies provide products, services and solutions to enhance customers' productivity, energy efficiency and operations. Products include: compressed air systems, tools, fluid power products, golf and utility vehicles and energy generation systems. Total revenues in the first quarter of $545 million increased by approximately 1% (down 1% excluding currency) compared with the first quarter of 2009. Air and Productivity revenues declined by 2%, as volume increases in Asia were offset by lower revenues in Europe and the Americas. Revenues in the Americas decreased by 1% compared with last year, as industrial markets began to stabilize. Air and Productivity Solutions revenues outside the Americas decreased by approximately 3% (down 7% excluding currency) compared with 2009, as improved aftermarket activity in Asia was offset by weaker markets in Europe. Bookings increased by 16% year-over-year.

Club Car revenues increased by more than 20% compared with the first quarter of 2009, due to improving golf markets and easy prior-year comparisons. Bookings were up 35%.

First-quarter operating margin for Industrial Technologies of 10.9%, including $1 million of restructuring costs, increased by 7.7% compared with 3.2% last year, due to productivity, higher volumes at Club Car and lower restructuring expenditures, partially offset by inflation.

2010 Outlook

"A number of Ingersoll Rand's major end markets were beginning to show signs of recovery in the first quarter of 2010," said Lamach. "First-quarter orders were up approximately 10% compared with last year, a notable improvement compared with the double-digit year-over-year declines in the first three quarters of 2009. Backlogs also increased significantly and were up over 18%. Our recent order patterns and growing backlog underpin our confidence that we can reach our revenue forecast for 2010. We see some positive signs of recovery in residential HVAC and Security, worldwide refrigerated transport, North American stationary refrigeration, worldwide industrial markets, Club Car and across several of our businesses in Asia. However, we expect challenging U.S. and European non-residential construction markets to continue for the balance of the year.

"We anticipate revenues for full-year 2010 in the range of $13.6 to $13.8 billion, or an increase of 3% to 5%, reflecting a 1% increase in the lower end of our prior revenue guidance. Full-year 2010 EPS from continuing operations is expected to be in the range of $1.88 to $2.23 (including the health care tax expense of $0.12). Costs related to discontinued operations are expected to equal $(0.10) per share. This full-year forecast increases the lower end of our earnings range by $0.05 per share and also includes the effect of $0.25 per share of restructuring/productivity investments and also reflects a tax rate of 18% for continuing operations, and an average diluted share count of 341 million shares. Available cash flow for 2010 is expected to approximate $1.0 billion, based on projected earnings and working capital requirements.

"Given our current macroeconomic view, our second-quarter 2010 revenue forecast is $3.6 to $3.7 billion, which would be an increase of approximately 3% to 6% compared with the second quarter of 2009. We expect to capture significant additional benefits from productivity programs. However, some of these benefits will be offset by additional inflation. EPS from continuing operations for the second quarter are expected to be in the range of $0.62 to $0.72. The second-quarter forecast includes the effect of approximately $25 million of restructuring/productivity investments (EPS of $0.05) and reflects a tax rate of 18% for continuing operations and an average diluted share count of 340 million shares.

"Our internal business fundamentals continued to improve in the first quarter. We have leading and improving global brands and leading market shares in all of our major product lines. Our balance sheet is solid, we are reducing debt and we have considerable available liquidity. As the world's economies recover, we will continue to invest in new products and innovation and we will relentlessly strive to improve our operations and to become a more efficient company." BP

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