Printer Saves 1.8 million kWh **PG&E and Ecos Air Rebates**

July 2009

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Commercial Printing

SUSTAINABILITY AT RR DONNELLEY

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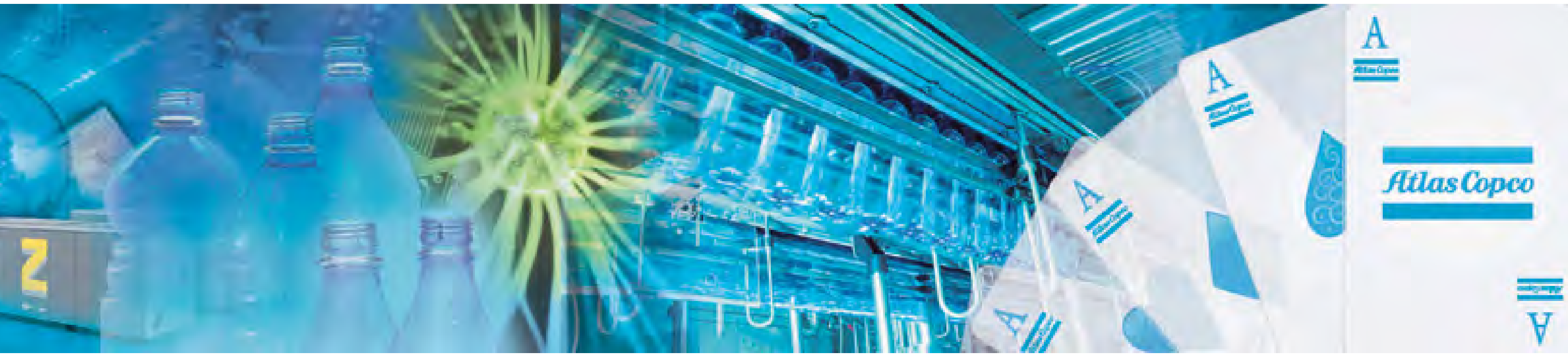

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FROM THE EDITOR

Commercial Printing

The commercial printing industry is very interesting as far as Sustainability goes. The impact of a commercial printer is tremendous when one looks at ink, paper, transportation, mail and, of course, operations. When putting this edition together, I found that most commercial printers are well down the road already with regards to procurement of materials derived from responsible sources and the reduction of energy costs. They are also working to reduce the transportation costs related to mail — which is very important. The North American commercial printing industry is ramping up formalized efforts to measure the CO_2 impact of their own operations and to formalize greenhouse gas (GHG) reporting.

The System Assessment of the Month, written by Mr. Hank Van Ormer, documents the steps taken by a commercial printing facility in the Northeast to reduce energy use by 1.8 million kWh. Annual savings of $122,000 with an 8-month ROI were achieved. This case study is interesting in that it shows how a firm can save energy by using the most energy-efficient air compressors — which it already owns. The primary savings were realized by re-piping the system and making sure the most modern and efficient air compressors carried the load.

The Energy Manager Feature interviews Mr. Michael Manzella, the Chief Sustainability Officer at RR Donnelley. The firm has actively optimized the compressed air systems in their North American facilities by focusing on compressed air system integrity and optimization initiatives. Both have yielded strong results. Mr. Manzella also shares with us the bigger picture at RR Donnelley by discussing their new utility bill management system (UBM), demand control, lighting and natural gas use-reduction projects.

The Energy Rebate Feature, written by Patricia Boyd of Ecos Air, illustrates the process in which a commercial printer qualified for an energy rebate. Located in San Francisco, Alonzo Printing worked with Ecos Air to optimize their compressed air system energy costs. Ecos Air administers incentives for Pacific Gas and Electric (PG&E) and delivered a successful result for Alonzo.

Most factories with 65 horsepower of installed air compressors and a utility rate of 2-½ cents would not consider doing a system assessment. Mr. Ron Marshall, of Manitoba Hydro, shares a story with us about a commercial printer who did one with great results. By focusing on the demand side of the system, the survey discovered a significant energy savings opportunity in the compressed air-powered humidification system and deferred a $34,000 capital expenditure for a new compressed air system.

RR Donnelley has actively optimized compressed air systems in North America.

We hope you enjoy this edition, and thank you again for your support and for investing in industrial energy efficiency.

ROD SMITH
Editor
rod@airbestpractices.com

SUSTAINABLE MANUFACTURING NEWS

Quebecor World, QuadGraphics, Transcontinental, Heidelberg

SOURCED FROM THE WEB

Quebecor Energy Efficiency

Energy efficiency means providing more services with less energy. This translates into an overall reduction in greenhouse gases (GHGs) and therefore a healthier environment. Energy efficiency is an obvious solution to a pressing problem, which is why Quebecor World is continuously searching for energy conservation opportunities; these include the implementation of efficient technologies, as well as the effective management of all energy sources (electricity, natural gas and propane).

Quebecor World

Efficient Production

The improvement of production equipment is essential to the optimization of energy use. Quebecor World's past efforts include a corporate-wide program, which, among other things, consists of evaluating all press dryers to maximize their efficiency, as well as the installation of special software in the carbon adsorption systems at some of the gravure plants. A more recent program was initiated to replace all remaining Recuperative Thermal Oxidizers by new state of the art Regenerative Thermal Oxidizers (RTOs). These RTOs use up to 95% less natural gas than the other more commonly used atmospheric emission control devices. Currently, more than 50 RTOs are operating across Quebecor World's international platform. In an attempt to render operations as energy efficient as possible, various energy saving pilot projects are being implemented.

All of the above efforts translate into a reduction in the use of natural gas, which is the primary fuel used at Quebecor World heat-set lithographic offset printing plants. By reducing natural gas consumption, Quebecor World is decreasing its consumption of fossil fuels, the single-largest contributor to global warming. Additionally, Quebecor World employs best practice operating procedures to improve internal transport efficiency. For example, many of its facilities have converted to bulk ink deliveries, as opposed to ink totes. On average, more then 900 hours of tow motor time is saved by employing bulk delivery, thus reducing consumption of propane, the primary fuel for fork lifts. Quebecor World is also currently exploring a corporate wide strategy to increase lighting efficiency in its facilities, thus further reducing its energy dependence.

Demand-Response Programs

Demand-Response programs help to reduce the demand on the grid for both electricity and natural gas, thus preventing energy shortages and maintaining the reliability of the power grid. By curtailing energy use during peak hours at 21 of Quebecor World's facilities that participate in such programs, these facilities directly contribute to the energetic well being of the areas in which they operate.

Carbon Footprint

To better understand its role in mitigating global climate change, Quebecor World has taken the important step of estimating its global carbon footprint, thus the amount of greenhouse gases (GHG) emitted, measured in equivalent units of carbon dioxide. This is achieved using a customized GHG emission calculator, which calculates emissions of the six GHGs outlined by the Kyoto Protocol. Upon request, Quebecor World can calculate the carbon footprints related to the printed products of its customers, in order to help them better evaluate their environmental impacts.

Source: www.quebecorworld.com

QuadGraphics® Innovative people driving print

Print Is Efficient at QuadGraphics®

Pulp and paper production generates about half of its own energy needs from biomass residues and makes extensive use of efficient and clean combined heat and power (CHP), also known as cogeneration.

Efficient Energy Use

The pulp, paper and printing industry accounts for about 5.7% of global industrial final energy use, of which printing is a very small share. Cogeneration is accomplished in most cases by low-impact hydroelectric generation. Turbines are placed on an adjacent river to turn generators that produce electricity. Unlike large-scale hydroelectric operations, low-impact hydroelectric generation preserves the flow of a river, allowing it to maintain healthy oxygen levels while also allowing fish migration to occur. On-site generation lowers the demand on the power grid.

To supplement on-site generation and achieve maximum use of "green power," QuadGraphics purchases renewable energy certificates from utility companies, which provide a subsidy to designated renewable energy sources such as wind, solar, hydro-electric and biomass power plants. The theory behind RECs is that by providing a subsidy to renewable energy producers, it will make them more competitive in the energy market.

Efficient Production

QuadGraphics is driven by efficiency, which results in efforts to reduce waste in every aspect of production and distribution. Modern large-format presses reduce energy consumption per printed page. Inline finishing reduces paper waste and minimizes logistics. Digital prepress technologies, such as computer-to-printing plate systems, eliminate the chemical and solid waste resulting from traditional photographic plate-making processes. Some of our systems require no printing plates at all. For example, our digital presses allow direct digital color printing using toner technology.

Lean manufacturing, implemented by QuadGraphics and many of today's forward-thinking manufacturers, has instilled formal processes to further reduce waste and add customer value at all stages of print production.

Giant spider-like pipes are part of the solvent recovery system of QuadGraphics' gravure printing plants. Between 1989 and 2007, our gravure pressrooms reduced VOC emissions by 83% despite a 1,308% increase in relative production.

QuadGraphics' gravure pressrooms are engineered to be permanent, total enclosures. This allows all of the solvent-laden air within our pressrooms to be captured for reuse. In 2007, our average corporate solvent recovery rate was 99.57%, which far exceeds the maximum standard of 92% required by the EPA.

Efficient Distribution

The SmartWay Transport Partnership℠ was introduced in 2004 as an innovative, market-based partnership to reduce fuel use, greenhouse gas emissions and air pollutants from the freight sector. Today, more than 1,000 businesses and organizations have joined. Together these companies are conserving almost 600 million gallons of diesel fuel per year, saving at least $2.5 billion in annual fuel and maintenance costs and eliminating an estimated 6.8 million tons of carbon dioxide emissions that contribute to global warming.

SUSTAINABLE MANUFACTURING NEWS

Quebecor World, QuadGraphics, Transcontinental, Heidelberg

> "In 2007 alone, we prevented the emission of 12,658 tons of carbon dioxide — the equivalent of taking 2,485 passenger cars off the road."
>
> — QuadGraphics®

QuadGraphics was the first printer to join SmartWay and is the only three-time recipient of the SmartWay Environmental Excellence Award. Our SmartWay partnership has led to efficiencies that have prevented the emission of 11,878 tons of CO_2 — the equivalent of taking 2,332 passenger cars off the road for a year.

With the industry's largest co-mailing operations, we not only reduce postal costs for our clients, we also reduce fuel consumption and delivery emissions by combining different magazine and catalog titles into a single mail stream. Co-mailing not only provides postal savings for our customers, it also results in efficiency that's good for the environment because fewer and larger pallets mean fewer trucks on the road and fewer miles driven.

Our Environmental Recognition and Awards

In the past decade alone, QuadGraphics has been awarded more than 20 major environmental achievement honors, both on a state and national level. Here are some of our most recent awards:

For the third year in a row, the EPA awarded the SmartWay Excellence Award to QuadGraphics for accomplishments and leadership in the SmartWay Transport Partnership. The award was the result of exceptional efforts at implementing innovative technologies and strategies to reduce greenhouse gases and other air emissions from its Duplainville Transport division. In 2007 alone, we prevented the emission of 12,658 tons of carbon dioxide — the equivalent of taking 2,485 passenger cars off the road.

QuadGraphics received the Going Green Recognition Award as part of the 2007 Wisconsin 75th annual awards program sponsored by the Milwaukee office of Deloitte & Touche USA LLP, a professional services firm that provides audit, tax, consulting and financial advisory services. The award recognized our environmental efforts for how we integrate and balance economic growth, social equity and environmental management into how we do business.

The American Forest & Paper Association's 2005 Business Leadership Recycling Award. The AF&PA deemed our paper recovery and recycling program the best in the large business category after considering the educational, innovative and cost-effective programs and partnerships we employ to ensure we're capturing as much recyclable paper waste from our operations as possible and in the highest grades possible for recycling.

QuadGraphics was named a 2005 Sustainable Standard-Setter by the Rainforest Alliance, a New York-based not-for-profit organization. Calling QuadGraphics a leader in the emerging certified-sustainable sector, the Rainforest Alliance lauded the scope of our environmental initiatives, which go beyond just Forest Stewardship Council certification to include sophisticated recycling operations, best available emissions control technology and extensive energy and fuel conservation programs.

The Clean Air Recognition from the Wisconsin Partners for Clean Air (WPCA) and the Wisconsin Department of Natural Resources (DNR). The award is issued to Wisconsin companies that are making a positive impact on the environment through improved air quality.

Source: www.qg.com

Green Manufacturing Practices at Transcontinental

There are many facets to producing green print materials that extend well beyond paper. Not every printer has the same knowledge of green printing or the corporate commitment to uphold the highest environmental standards. Transcontinental is a true "green" partner that not only offers a broad range of recycled paper options but also strives to bring environmental responsibility to every aspect of the manufacturing process.

We are committed to business practices that support sustainable development and offer our customers:

- Chain of custody certification at many of our manufacturing facilities
- 100% digital workflow to eliminate chemicals, proofing materials and more
- Plate-free, toner-based digital printing
- Recyclable PUR binding glues
- Paper purchasing policies that promote the use of environmentally preferable papers
- A commitment to continuously improve our environmental performance
- Monitoring our performance in carrying out our environmental policy
- Compliance with environmental laws including federal, provincial/state and municipal/local laws

Source: www.transcontinental-printing.com

transcontinental

SUSTAINABLE MANUFACTURING NEWS

Quebecor World, QuadGraphics, Transcontinental, Heidelberg

> "Considering all of the improvements for saving energy, the power consumption of a Speedmaster XL105 can be cut by about 20%, or 120,000 kWh per year."
>
> — Heidelberg

Heidelberg Designs Green Printing Presses

There is no getting around it: printing presses use up a lot of energy — large presses even more. A six-color Heidelberg Speedmaster XL105 with coating unit consumes — without technical enhancements — up to 560,000 kWh of power to produce 36 million printed and coated sheets over the course of a year. However, Heidelberg is working harder than any other company serving the industry to systematically reduce the energy consumption of every individual component of its sheet-fed offset presses.

Dryers, cooling systems, drive motors, air compressors — there are many opportunities to reduce the energy consumption of a printing press. Heidelberg takes advantage of them with an integrated approach to the design of the printing press.

Take dryers: They account for 35% of the total, making them the single largest power drain. Drying is done with infrared radiation and hot air. Reducing the distance between the paper and the dryer drives moisture faster and more effectively out of the printed sheets. Heidelberg has succeeded in placing the dryer two centimeters closer to the sheet. Each centimeter saves about 5% of the energy consumed. Altogether, Heidelberg has reduced the distance between the dryer and the sheet to 5 cm less than in competing models of equipment. This yields correspondingly great reductions in energy consumption — an excellent example of the company's technology leadership. The distance is also important with hot air: each additional centimeter means that the air is stirred up more readily and less of it reaches the sheet. The effects are even greater when drying with UV radiation; here each centimeter less means up to 10% less power consumed. In its series for the large A1 format, Heidelberg has also turned the trick of bringing the dryer and sheet 2 cm closer together.

Additional energy savings can be expected with the aid of the new "Drying Monitor," which was unveiled at this year's Drupa trade show in Düsseldorf for use with the Speedmaster XL105. Its sensors measure how much air carrying what amount of moisture flows into the dryer and out again. These two parameters can then be used to tell whether the sheet is really dry or not. For the first time, this gives the press operator a practical guide for controlling the drying process.

A very energy-efficient innovation also supports UV drying. An electronic ballast helps maintain the arc of each UV lamp while it is in standby mode, while still reducing power consumption by 5–10%. This permits much more energy-efficient operation of the lamps than with conventional transformer technology.

To take advantage of waste heat, Heidelberg is also taking a new, energy-efficient approach that is unique in the industry. It is offering nearly all of its presses with water-cooling instead of air-cooling. Because water conducts heat very well, this type of system is considerably more efficient and cost-effective than conventional air-cooling. Some Heidelberg customers are already using the waste heat stored in the cooling water, via heat exchangers, to heat single rooms or even an entire office building.

The second-biggest energy consumer in an offset printing press is the main drive motor, which eats up about one-quarter of the total power used. For technical reasons, there is less latitude for realizing savings here, but Heidelberg has also found a way to make a difference. Its developers and engineers are incorporating "sine synchronous" motors that are 2–3% more efficient than conventional motors.

Heidelberg has also achieved significantly pared energy consumption for supplying presses with blast air, which is mainly needed for largely contactless sheet transport on air cushions. This accounts for about 20% of the total energy it takes to run a press. Fast-running, variable-speed turbo radial fans output the same amount of air while consuming up to 50% less power than earlier models. Because the supplied air is up to 30 °C cooler, substantially less waste heat subsequently needs to be removed from the pressroom.

Considering all of the improvements for saving energy, the power consumption of a Speedmaster XL105 can be cut by about 20%, or 120,000 kWh per year. This means that 62 metric tons less CO_2 is emitted into the atmosphere — as much as six hectares of deciduous forest can absorb in a year. BP

Source: www.heidelberg.com

THE SYSTEM ASSESSMENT OF THE MONTH

An Offset Printer Saves 1.8 Million kWh and $121,000 per Year

BY HANK VAN ORMER, AIR POWER USA

July System Assessment of the Month

Where:	Northeast
Industry:	Offset Commercial Printing
Issues:	Piping, Supply System Design, Air Leaks, Inappropriate Uses
Audit Type:	Supply and Demand Side

System Assessment Win/Win Results*

Reduction in Energy Use:	1,787,908 kWh
Reduction in CO_2 Emissions:	1,275 metric tons
Equivalent CO_2 for Homes:	169 homes
Equivalent CO_2 for Vehicles:	233 vehicles
Total $ Savings:	$121,577
Investment:	$80,350
Energy Rebate:	n/a
Simple ROI:	8 months

*Annual energy consumption

System Overview

This commercial printing facility is located in the Northeastern part of the United States. Like most facilities, the plant has seen many changes over the years. The printing press technology at the facility has changed over the years as ink and press technology evolves. Two compressor rooms supply compressed air to multiple print production buildings. This system assessment has found opportunities to save energy in both the supply-side and the demand-side of the compressed air system.

Supply Side: The Two Compressor Rooms

The facility has several separate production areas served by two separate compressed air supply rooms — one in Building A and one in Building B.

The east side of the plant is served by a compressed air supply in the compressor room in Building B. Building B serves the major print production area with presses, baggers, etc. These are modern rotary screw air compressor units — a 200-horsepower (hp) unit (modulating-control), a 250-hp unit (spiral-valve) and another 200-hp unit (turn-valve). Normally, the East Room runs the 200-hp modulating-control air compressor at base load and trims with the 200-hp turn-valve (variable displacement) unit or with the 250-hp unit (spiral-valve, variable displacement). There is an older non-cycling, refrigerated compressed air dryer rated to handle 1,500 scfm at 100 psig at 100 °F inlet air.

	Compressor System before Assessment	Compressor System after Assessment
Operating hours:	8760 hours	8760 hours
Power Cost kW/h:	$0.0680	$0.0680
Avg. Air Flow:	1,844 acfm	1,158 acfm
Avg. Compressor Discharge Pressure:	100–107 psig	95 psig
Avg. System Pressure:	92–93 psig	92 psig
Input Electric Power:	405.8 kW	201.7 kW
Specific Power:	4.54 cfm/kW	5.74 cfm/kW
Annual Energy:	3,554,800 kWh	1,766,892 kWh
Annual Energy Cost:	$241,726	$120,149

Building A has three 150-hp rotary screw air compressors built in the 1980s. These units are significantly less power efficient, by their technological profile, than the newer units in Building B (9–12% less power efficient). The West Room, or Building A, runs only one of the three older 150-hp units at a time. Each compressor is rated to deliver 715 acfm @ 100 psig. There is a refrigerated dryer in the system rated for 750 scfm @ 100 psig @ 100 °F. Condensate from the units is handled and collected and then sent to the sanitary sewer, apparently in full compliance with local and federal regulations.

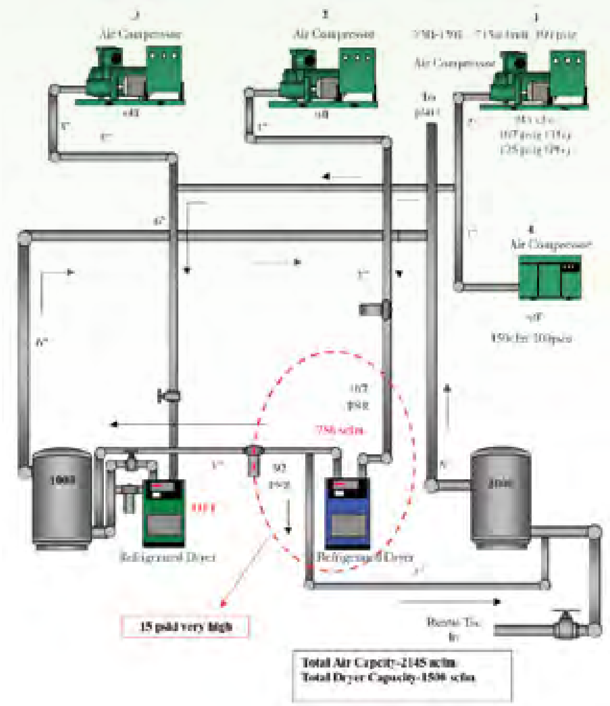
A by-pass valve separates the two systems. This valve is normally kept closed, and each system runs independently of the other. The east side runs at 90–92 psig system pressure, while the much smaller west side runs at 90–107 psig. All of the running units are water-cooled except for the air-cooled 200-hp turn-valve air compressor. Cooling air is directed to and from this unit with no apparent restrictions.

There is a low-pressure (60 psig) single-stage rotary screw compressor (200-hp), which comes with the new printing presses and is apparently very well applied in lieu of using high-pressure air for ink drying. This is a similar setup to what we noted at another printing plant, which has both 150- and 200-hp units.

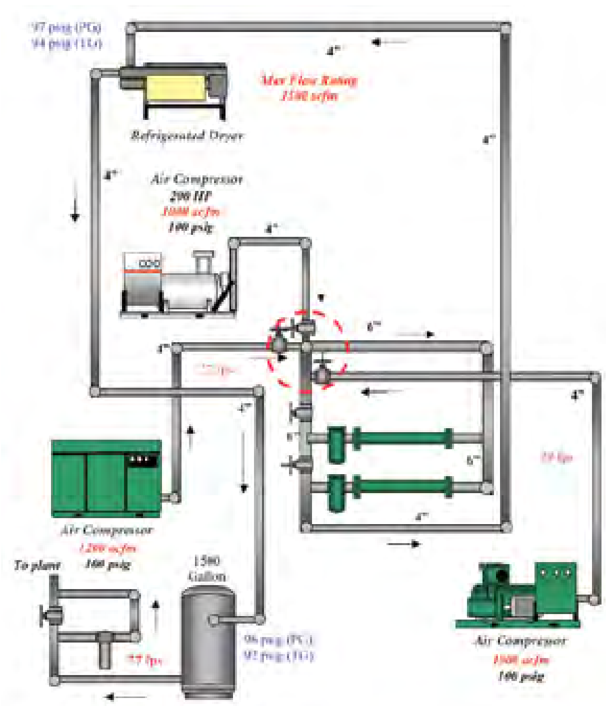
THE SYSTEM ASSESSMENT OF THE MONTH

An Offset Printer Saves 1.8 Million kWh and $121,000 per Year

Current Compressed Air Supply Situation



Building A Compressor Room



Building B Compressor Room

Measurement Establishes the Baseline

The following actions were taken to establish the baseline for flow and pressure.

Temperature readings were taken on all units with an infrared surface pyrometer. These were observed and recorded to relate to the unit's performance, load conditions and integrity. Critical pressures including inlet and discharge were measured with Ashcroft digital calibrated vacuum and pressure test gauges with an extremely high degree of repeatability.

All air compressor units had the input kW measured with a Fluke motor analyzer and the running units recorded with an MDL multi-line data logger. Flow was measured from each compressor by comparing the type of control and the type of compressor. This relationship between power (kW) and flow at certain pressure (100 psig) was plotted on the basic lubricant-cooled rotary screw (with DOE AirMaster) performance curves. The same basic measurement and logging activity was carried out for system pressure using an Ashcroft pressure transducer and the same multi-channel MDL data logger.

Supply Side: Combine the Systems

The project recommendation is to reconfigure piping and the dryer in the East Room to allow all three air compressor units to load in fully, collectively or in any combination. The project will combine the east and west systems and shut off the older, less efficient units in Building A. The printing facility will now run all production from the East Room and use the West Room as backup.

The three older air compressors in the West Room are 20–25 years old and are inherently less power efficient than the newer units in the East Room (9–12% less power efficient). They also have less effective modulation, throttled inlet-valve capacity control systems — some 60–70% at lower loads. According to plant personnel, one of these units is a little "shaky," but the other two run solidly.

The units in the East Room are single-stage, lubricant-cooled rotary screws and are relatively power efficient compared to comparable new units. Two of them share a very effective "variable displacement" capacity control (the 250-hp spiral-valve and the 200-hp turn-valve), either of which are well applied as a trim unit around 50% load or more. The 200-hp modulation-control air compressor is relatively power efficient at full load (5.95 acfm/kW) and is in fact the most power-efficient unit at full load. It is perfectly applied at base-load by very knowledgeable plant operating personnel.

The discharge and interconnecting piping is relatively small (4") with all three units tied together, creating very high turbulence. The back pressure generated by this configuration precludes running *two* units at full load at acceptable net delivered system pressures, much less *three* units. The new piping project will address this issue.

The dryer and filter are marginally rated to handle two units and way too small for three compressors. The project recommends putting the existing dryers into backup and installing one large cycling dryer which will save an additional $6,598 per year.

The West Room, as it is currently operating, is 39% less power efficient than the East Room. Combining the two production areas to run primarily off the reconfigured East Room will increase the overall efficiency by 53%. Combining the two systems will reduce the annual electrical energy cost to produce compressed air, at pre-project demand levels, by $51,942 per year.

"Savings totaled 70 cfm for the 23 leaks that were identified."

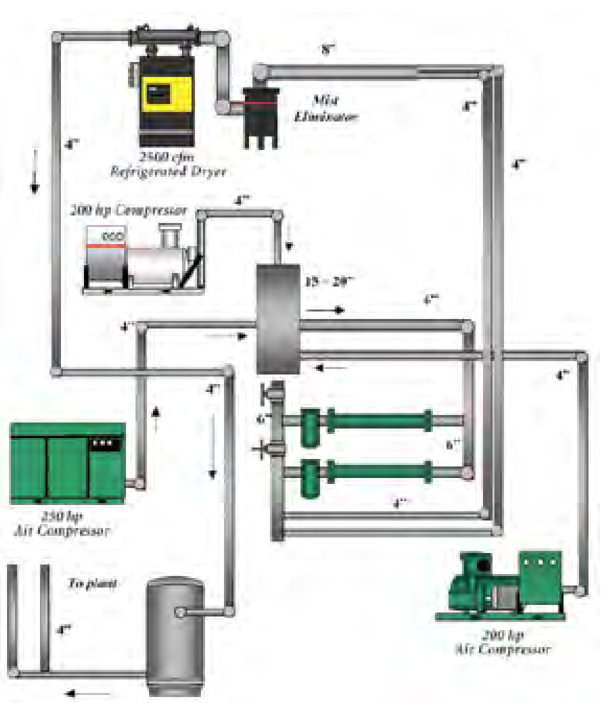
— Hank Van Ormer, Air Power USA

Table 1. Key Air System Characteristics — Current System*

MEASURE	ALL SHIFTS EAST	ALL SHIFTS WEST	PROPOSED OPERATING STRATEGY
Average System Flow	1,618 cfm	243 cfm	1,844 cfm
Average Compressor Discharge Pressure	100 psig	107 psig	100 psig
Average System Pressure	92 psig	93 psig	95/85 psig
Input Electric Power	293 kW	112.8 kW	318.6 kW
Operating Hours of Air System	8,760 hours	8,760 hours	8,760 hours
Specific Power	5.47 cfm/kW	2.11 cfm/kW	5.79 cfm/kW
Electric Cost for Air/Unit of Flow	$108.41/cfm year	$274.26/cfm year	$102.92/cfm year
Electric Cost for Air/Unit of Pressure	$872.67/psig/year	$320.88/psig/year	$948.92/psig/year
Annual Electric Cost for Compressed Air	$174,534/year	$67,192/year	$189,784/year

**Based on a blended electric rate of $0.068 per kWh, 8760 hours/year.*

***Combine systems and only operate East Room units (Project #1) — a savings of $51,942 annually.*



Building B Compressor Room New System Design.

THE SYSTEM ASSESSMENT OF THE MONTH

An Offset Printer Saves 1.8 Million kWh and $121,000 per Year

Demand Side: Compressed Air Leak Survey

A partial survey of compressed air leaks was conducted at the plant, and 23 leaks were identified, quantified, tagged, logged and repaired. These were identified and tagged during full production. Savings totaled 70 cfm for the 23 leaks that were identified. The savings estimates associated with a leak management program are based on the unloading controls of the compressors being able to effectively translate less air-flow into lower cost.

We recommend an ultrasonic leak locator be used to further identify and quantify the compressed air leaks. We use either a Superior Signal VXP AccuTrak or a UE Systems Ultraprobe 2000. With a few minor exceptions, most of the leaks could not have been found without the use of an ultrasonic leak detector and a trained operator. Leak locating during production time with the proper equipment is very effective and often shows leaks that are not there when idle.

However, a regular program of inspecting the systems in "off hours" with "air powered up" is also a good idea. In a system such as this one, some 90–95% of the total leaks will occur during the use of the machinery, not in the distribution system.

The area surveyed in the leak study included a great deal of high-ultrasonic background noise that masks many of the smaller leaks. In continuing the leak management program, plant staff should perform leak detection during non-production hours in order to eliminate some of the high-ultrasonic background noise.

Reduction of air-flow with proposed project (repair 23 tagged leaks and tag and repair 48 more @ 3 cfm each	208 cfm
Annual electric cost savings with proposed project	$19,571/year
Cost of leak detection equipment	$2,800
Cost of leak repairs (71 leaks — $15 materials and $35 labor per leak)	$3,550
Total project cost (materials and installation)	$6,350 first year only

Leak Survey Results

NO	LOCATION	DESCRIPTION	EST SIZE	EST CFM	COMMENTS
1	building 15	gate valve	small	2	refrig dryer
2	building 15	QDC	medium	5	above refrig dryer
3	building 25	lubricator	medium	5	540A
4	building 25	regulator	medium	5	539A
5	building 25	clear hose fitting	small	2	532B
6	building 25	QDC for blowgun	small	2	534B
7	building 25	regulator	small	2	535B
8	building 25	electric solenoid valve	small	2	536B
9	building 25	lubricator	medium	5	537B
10	building 25	regulator	small	2	52B
11	building 18	regulator	small	2	526
12	building 18	valve	small	2	529
13	building 18	filter	small	2	522
14	building 18	lubricator	small	2	522
15	building 18	blue hose fitting	medium	5	590
16	building 26	regulator	small	2	524
17	building 26	rider regulator	small	2	524
18	building 26	solenoid	medium	5	561
19	building 26	clutch	small	2	562
20	building 19	overhead piping	medium	5	over walkway by drop
21	building 17	piping near regulator	small	2	59B
22	building 15	tri-pipe connector	small	2	585
23	building 15	FRL	medium	5	585
TOTAL				**70**	

Demand Side: Printing Presses Switched Away from Water-Based Ink

In Building F, there are four large printing presses using 16 1" air-operated, double-diaphragm pumps. These run continuously, feeding the ink supply to the press. These pumps are currently running at about 120–150 cycles per minute with an estimated 60–65 psig inlet pressure.

These printing presses used to have electric motor-driven pumps on them. The printing presses were switched to a water-based ink in the past and the electric pump could not perform correctly. Consequently, the air-operated pumps were installed. The original electric pumps are still in stock.

The presses no longer use this water-based ink and therefore, can be switched back to the electric motor-driven ink pump.

Compressed air reduction peak production flow:	480 cfm
Average compressed air reduction at 90% utilization:	432 cfm
Energy cost to run diaphragm pumps:	$40,647/year
Annual electrical energy cost to run electric pumps @ 90% utilization:	$7,110
Net electrical energy cost reduction:	$33,537/year

Demand Side: Air Cylinder Usage

There are many air cylinders in use throughout the operation. There are eight 3" cylinders with about a 1" stroke running in Building F on Bag Machines 538 A&B. These run continuously during production.

Bag Machines 538 A&B each have four 3" cylinders (¾" rod) with 1" stroke running the cutter. These cylinders appear to run a 70-psig inlet pressure from a well-applied regulator.

Approximate air usage:

Rotation & Power Stroke: $\dfrac{3.14 \times (2.25)2 \times 1"}{1{,}728} = \dfrac{15.95 \text{ cu in} = .01 \text{ cft}}{1{,}728}$

x 120 cpm = 1.20 cfm x 5.83 return = 6.99 cfm

per cylinder x 4 = 27.79 cfm/per machine

or 28 cfm @ 70 psig per Bag Machine for each stroke or a total of 56 cfm.

Installing the X-Block return air recovery system will capture and re-use the return air on a continuing basis. This also eliminates the need for any "cushion air" and may improve cycle time, if needed.

The project has installed the X-Block air cylinder return air recovery system on the eight 3" main cutter cylinders on Bag Machines 538 A&B in Building F. This will continually recover and reuse the return stroke exhaust air, thus reducing the demand by 50%. This also eliminates any need for separate cushion air and may increase cycle time, if appropriate.

Average compressed air now used to run all eight cylinders:	117 cfm
Total air reduction of this project:	56 cfm
Annual electrical energy cost value of project:	$5,269/yr
Cost to install appropriate X-Block recovery system:	$3,400

Conclusion

Supply-side and demand-side adjustments have improved the energy efficiency of this system. The printing facility has reduced demand for compressed air by eliminating inappropriate uses and artificial demand. Supplying the whole facility from the newer, more efficient air compressors in Building B optimized the generation of compressed air. The air treatment system was improved with a new cycling air dryer and a low-pressure drop-mist eliminator. The older equipment is saved as back-up air compressors and refrigerated dryers. Total energy savings are 1.8 million kWh worth $121,000 per year. The simple ROI on the project is 8 months. BP

For more information please contact Hank Van Ormer, Air Power USA at tel: 740-862-4112, email: hankvanormer@aol.com, www.airpowerusainc.com

THE ENERGY MANAGER

Sustainability at RR Donnelley

BY ROD SMITH, COMPRESSED AIR BEST PRACTICES®

RR DONNELLEY

Compressed Air Best Practices® interviewed Michael D. Manzella. Mr. Manzella is a Senior Vice President, Environmental, Health, Safety and Quality (EH&S) and also the Chief Sustainability Officer for RR Donnelley (RRD).

Good morning. How does RR Donnelley (RRD) define and approach Sustainability?

While the term "Sustainability" was formally adopted at RRD in 2006 and applied to job titles and projects, RRD has really been involved with Sustainability all along. RRD has always looked for ways to reduce waste and energy use. Most Sustainability concepts are not new to us; we are merely formalizing the process.

Sustainability at RRD starts with a philosophy. It is then executed through a global policy and objectives. RRD's philosophy does not see Sustainability as making a choice between being cost-effective and improving environmental impacts. On the contrary, Sustainability represents integrating these two factors. This philosophy guides our Sustainability objectives and strategies.

The Global Environmental, Health, Safety (EH&S) Policy at RRD reflects our commitments to Sustainability. To support our policy, we have created four categories for Sustainability, each with underlying objectives and projects:

1. **Resource Efficiency:** we focus on our ability to measure and reduce energy and resource use.
2. **Waste Minimization:** the focus is on reduce, re-use and recycle activities.
3. **Green Procurement:** RRD purchases high volumes of paper, inks, adhesives, staples, equipment, computers, printers and energy (to name a few items). Procurement has a significant impact on our Sustainability initiatives by managing the supply chain. We continue to look for opportunities to source materials that minimize our environmental impact and as well as customers'.
4. **Stewardship:** we look to educate people on Sustainability both internally and externally to RRD. We want to educate employees, customers, investors and suppliers. This article is an example of stewardship.

THE ENERGY MANAGER

Sustainability at RR Donnelley

Mike Manzella, Chief Sustainability Officer, RR Donnelley.

The Chief Sustainability Officer

Chicago native Mike Manzella joined RR Donnelley in 1998 as a Senior Loss Control Engineer in the Environmental, Health and Safety department. Prior to his current position with RR Donnelley, Mr. Manzella has held roles as Manager of Health and Safety, Director of EH&S Operations, Director of EH&S Affairs and Vice President of EH&S.

Today Mr. Manzella manages more than 60 full-time professionals who provide support to RR Donnelley's Global Operations in the areas of Environment, Sustainability, Health & Safety, Security, Product Safety, Quality, Crisis Management and Business Continuity Planning.

Where does Sustainability fit in the RRD organization chart?

Sustainability receives attention at all levels of our organization. A subset of our Board of Directors is called the Corporate Responsibility and Governance Committee. This Committee ensures that attention and resources are allocated to RRD's Sustainability efforts.

We have integrated Sustainability into the operations side of the business — rather than setting it apart as an outside or corporate function. We are not a corporate function that arrives at a factory, tells people what to do and then leaves. We are a partner with environmental operations where initiatives and projects are done. This improves effectiveness and fosters good working relationships.

My role is to manage EH&S, Quality and Sustainability within operations. I have two direct reports with "Sustainability" in their titles, and they are heavily engaged with tactical Sustainability issues. In each facility we have an EH&S lead person. These people are primarily occupied with EH&S compliance issues but may also assist with Sustainability projects. It is invaluable to us to have a "lead" person in each facility. This is either a full-time or a part-time role depending upon the size of the facility, and they are an incredible team of employees with a genuine concern for the environment and the safety of their co-workers.

We have Engineering Groups and Process Management Groups at RRD who are also involved. There are specific people in these groups, including an energy manager, that help with Sustainability projects. We also have Procurement people (Green Procurement) to manage our supply chain and assist with Sustainability projects such as our Utility Bill Management (UBM) process.

But outside of these technical resources, I go back to my earlier statement regarding integration into operations — Sustainability must be a mindset across the Company. Just like Safety and Quality, where employees are focused on avoiding injuries and producing only quality products and providing quality service, our people are learning to identify Sustainability opportunities.

Is "Sustainability and Energy Efficiency" the next "Safety"?

Unlike Safety, it is difficult to formalize programs on how to be "Sustainable employees." Like Safety, we do, however, have a lot of communication with our employees through internal and external web sites, awareness campaigns and other venues at the operations level such as "town hall meetings." You could say there is a trend towards creating a Sustainable Employee Culture and through our communication efforts, awareness is definitely going up, especially in the area of energy efficiency and waste minimization.

Any advice on "what not to do" for a new Chief Sustainability Officer (CSO)?

The counsel I would give is don't stand still for too long. Don't get too ingrained with one or two topics. Keep your eyes open for what is next — before it sneaks up on you. Concepts and technologies are moving so fast. Government policies are changing quickly. A CSO needs to have the pulse on these issues.

At RRD, we are also very careful to avoid "Greenwashing," a practice by which a company may apply unfounded, misleading or inflated claims about their Sustainability efforts to improve their public image. We insist that all Sustainability objectives, results and communication be measurable, accurate and transparent to ensure the integrity of the data. As a service provider, RRD is very cognizant of the fact that we are stewards of our customers' images, and we are careful that our actions have positive impacts.

What is the scope of RRD's operations, and what are the energy sources?

We own or lease more than a significant number of warehouse, manufacturing and office buildings in North America. We operate many other facilities around the world.

When we look at Sustainability in our manufacturing operations, RRD distinguishes between plant-types based upon distinct printing processes. For example, some of our plants are "offset" facilities while others are "gravure." The energy consumption profiles of offset and gravure plants differ based upon the equipment requirements. Natural gas and electricity are the two primary sources of energy and their consumption profiles differ with the underlying technology.

Has RRD implemented any compressed air energy-savings projects recently?

We have implemented several types of system improvements associated with compressed air. We separate the projects into system integrity and system optimization initiatives. These projects mentioned in this article represent the more holistic system improvements we have done and are in addition to one-off projects that also have energy optimization implications.

> "These new oxidizers save the equivalent of 9 million gallons of gasoline every year — approximately the gasoline consumed annually by 10,000 cars."
>
> — Michael D. Manzella

THE ENERGY MANAGER

Sustainability at RR Donnelley

"Just like Safety and Quality, where employees are focused on avoiding injuries and producing only quality products and providing quality service, our people are learning to identify Sustainability opportunities."

— Michael D. Manzella

Please describe your compressed air system integrity initiatives.

At RRD, our compressed air system integrity initiatives focus on leak detection and mitigation. Compressed air systems are inherently prone to developing leaks. Without a program of leak detection and repair, the leaks can add considerably to the generated cost of compressed air. Ultrasonic leak detection equipment is used to identify the leaks. This allows for identification of smaller leaks outside the range of human hearing, which are then repaired to complete the process.

For example: In 2008, we continued to perform leak detection surveys in a number of our plants and identified compressed air leaks requiring repair. After fixing the leaks we have realized significant compressed air related electricity savings — which is why we make this a regular process.

Please describe your compressed air system optimization initiatives.

Compressed air system optimization initiatives at RRD involve audits of supply- and demand-side components and analysis of overall system operation. Compressed air systems can be viewed as two fundamental pieces: the supply side (compressors, control system, filters, dryers, wet and dry storage, piping scheme, etc) and the demand side (all the end users of compressed air including the inappropriate uses and uncontrolled losses).

Compressed air system growth in a plant is often the result of incremental plant growth (expansion of a plant and/or additions of equipment within a plant over time). The nature of this incremental growth is that the system in a plant today may not resemble what was intended 25 years ago when it was initially built. There are often opportunities to optimize a systems operation today through analysis of the supply and demand sides.

Demand-side improvements (elimination of inappropriate uses of compressed air as well as uncontrolled compressed air consumption) will optimize the amount of air the system needs to generate. The supply side can then be optimized to provide only the needed amount of air in the most efficient means possible.

For example: A compressed air system optimization project was undertaken in one plant that involved identification of multiple demand-side (leaks, low pressure air substitution) and supply-side (VFD compressors, control system changes, piping redesign) opportunities. Implementation of this large project, completed in 2008, saves that plant significant annual electrical costs dedicated to generating compressed air.

How is energy consumption measured at RRD?

That is an important question. RRD is currently implementing a new UBM (utility bill management) process to measure water, electricity and natural gas consumption at all of our facilities in a consistent manner. This is a critical step towards ensuring that all of our data is sound with regards to energy consumption. Our UBM system uses third-party vendor software. We have chosen one software process and are customizing it for all of our facilities in North America and looking to expand its use to our global operations.

One way we are customizing the UBM software is to allow each facility to enter the percentages of the energy sourcing. We need to know what percentage of our power comes from coal, nuclear and renewables in order to have a clear understanding of the electricity supply chain.

This is an exciting project for RRD's Sustainability initiatives. When complete, we will be able to compare the energy costs of similar facilities within the corporation. For example, we'll be able to compare the energy costs of two 1-million square foot facilities, which use similar production technologies. This will allow us to determine best practices and identify energy reduction opportunities with rock-solid data behind us. We are planning to have the UBM process implemented for all U.S. facilities during the third quarter of this year (2009).

Where does RRD find other opportunities for energy efficiency?

We have a few programs that have already helped to reduce electricity consumption. We are part of several electrical Demand-Response programs. If our facility gets a call from the local utility that is struggling to keep up with demand during a peak period, we are prepared to reduce demand. We committed to Demand-Response programs across 24 plants in 2008. The result? Over 40,000 kWh of consumption can be shed to assist the utilities and our workplace communities in times of electrical supply emergencies.

RRD is very active with lighting upgrades. In 2008 alone, we did upgrades in 57 plants. 2009 marks our third year of lighting upgrades, and we continue to find opportunities. In 2008, lighting projects saved RRD 91 million kWh per year of electricity. This is the equivalent reduction of 55,700 metric tons of CO_2 and the equivalent to the annual CO_2 emissions of 3,000 homes and 10,700 cars.

Any specific success stories with natural gas?

Yes. Oxidizers are devices used to control emissions from printing processes. These units consume natural gas. RRD worldwide has been installing new, "latest technology" oxidizers that consume significantly less natural gas while achieving better performance. These new oxidizers save the equivalent of 9 million gallons of gasoline every year — approximately the gasoline consumed annually by 10,000 cars.

Heat recovery is also a big opportunity. We are looking at many processes where heat is being allowed to escape to atmosphere. We are trying to capture that heat and use it for ambient heat. This reduces our natural gas use on our HVAC bill.

Thank you Mike for your insights. BP

For more information, please contact Rod Smith, Compressed Air Best Practices® at email: rod@airbestpractices.com

"In 2008, lighting projects saved RRD 91 million kWh per year of electricity."

— Michael D. Manzella

ENERGY REBATES

A Green Printer Reduces Compressed Air Energy Costs by 50%

BY PATRICIA BOYD, ECOS AIR

Introduction

The primary objective of this case study is to illustrate the process in which industrial facilities can qualify for energy incentives on projects that reduce the energy usage of their compressed air system. In this case, Alonzo Printing, a printing facility in San Francisco, followed the process and reduced their compressed air system energy costs by 50%. Ecos Air, the contractor hired by the California utility company Pacific Gas and Electric (PG&E), managed the incentive process for both Alonzo Printing and PG&E.

Alonzo Printing

Compressed air is used both in the production and clean-up processes at Alonzo Printing. Alonzo President Jim Duffy commented the following for his facility's use of compressed air, "Alonzo uses house air to run the hydraulics and pneumatics on our presses, plate maker, automated paper splicer and bindery equipment. It is essential to the operation and productivity of our manufacturing processes. Our new system has increased our efficiency and reduced our cost of operation."

Alonzo Printing

Alonzo has 40 employees working together in a productive union environment. It is an $8 million per year commercial printer facility offering sheet fed, open web and digital print with complete bindery, direct mail and fulfillment. They have 21 years of "green" history and a sincere commitment to maintaining a sustainable environment. Alonzo educates employees, customers and their industry on the benefits of sustainable print solutions. The Company works with vendors and manufacturers to supply products and materials that are cost effective and sustainable. Alonzo focuses on implementing programs and systems that reduce waste, save time and energy while increasing productivity. Alonzo is the San Francisco Bay Area's first "Green Certified" Color Printing Specialist and the winner of American Printer Magazine's 2008 Gold Award for Environmental Excellence.

Executive Summary

The energy cost to operate the existing compressed air system at Alonzo Printing was $25,754 (based on $0.14 per kWh) per year. As discovered during a system analysis, an opportunity existed to reduce the annual energy consumption of the compressed air system by 51% from 183,960 kWh to 90,420 kWh, which was verified during post monitoring. This improvement has translated into annual energy savings of $13,096 per year. With the energy incentive provided, the project's simple ROI was 1½ years.

	DESCRIPTION	EEM	CALC
A	Existing Annual Energy Consumption, kWh	183,960	Monitored
B	Existing Annual Energy Cost	$25,754	a* e
C	Post EEM Annual Energy Consumption, kWh	90,420	Calculated and Monitored
D	Annual Energy Savings, kWh	93,540	a – c
E	Marginal Energy Cost per kWh	$0.14	
F	Estimated Annual Utility Cost Savings	$13,096	d* e

System Measurement Methodology

Ecos Air worked with auditor Ed Williamson to perform the data logging and the energy assessment report. The energy assessment sought opportunities for energy savings by investigating system controls and supply-side equipment and storage. Options were explored to increase overall part load efficiency, decrease system operating pressure and reduce pressure drop. The analysis was careful to avoid impairing plant operations in any way that would be detrimental to the profitability of the company.

Additionally, the focus of this study was on the supply side of the compressed air system. As such, the distribution (demand side) is not addressed in detail in this article. Consideration of demand side problems and solutions took place through informal discussions.

During the measurement period, power, pressure and flow were measured and/or calculated to determine an accurate baseline profile for the system. Compressor power and system pressure data were collected via DENT data loggers and data storage equipment. Power and compressor performance were then used to calculate compressor output for each three-second time interval. These values were averaged to 60-second intervals for graphing purposes. All the data logging results were entered into DOE Air Master Plus software, which analyzed Alonzo's usage. Energy savings solutions were investigated, and the minimum energy cost to produce the calculated air demand was determined.

Ecos Air

Ecos Air is an innovative program that works with commercial and industrial manufacturing plants to audit their entire compressed air system, identify inefficiencies and implement system solutions. Ecos Air works with customers in a utility's service region to provide financial incentives — based on energy savings — which can pay for up to 70% of a project's cost. For PG&E, the Ecos Air program is funded by California utility ratepayers under the auspices of the California Public Utilities Commission.

While there are many utilities that provide kWh reduction incentives for customers that implement efficiency measures, the process is normally administered by either the customer themselves or the equipment vendor. Alternatively, the Ecos Air program has been developed for utilities willing to fund a vendor neutral third party contractor to implement an efficiency incentive program for industrial system compressed air users. In this case, the utility simply establishes a financial budget and leaves program execution to Ecos Air. Ecos Air actively searches for users of compressed air, coordinates walkthroughs and site audits, manages all applications and forms, establishes flow and kW baseline parameters, develops a financial summary with payback and verifies final conditions to ensure that the savings claimed by the utility are genuine and verifiable when reporting to utility commissions.

ENERGY REBATES

A Green Printer Reduces Compressed Air Energy Costs by 50%

Air Dale Compressors

The customer chose to use Air Dale Compressors, Inc. as their new compressed air system vendor. Air Dale Compressors, Inc. was established in 1992. They have been at their San Francisco, CA location from the start of business, servicing all brands of air compressors and accessories. They represent CompAir/LeRoi compressors as their primary line of industrial electric, motor-driven compressors and have been the major west coast distributor representing this company for sales, service and rentals since 1992.

Baseline Conditions

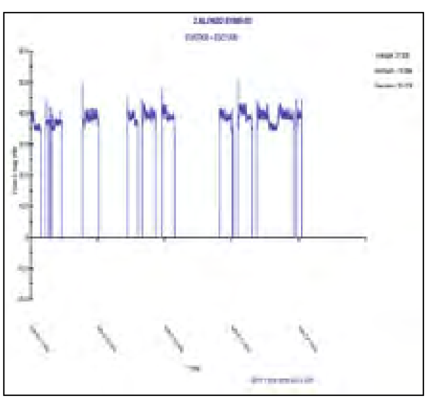
The baseline compressed air system consisted of two 50-horsepower (hp) oil-flooded, fixed-speed rotary vane air compressors manually alternated on a daily basis. The two compressors in the main compressor room were each controlled by a local "hand-off auto control" switch. One compressor was in off, and the other was in hand, otherwise known as continuous run control. The compressed air is then sent through a refrigerated dryer and a 120-gallon storage tank for moisture removal and storage respectively.

Baseline data collection took place over the course of a 14-day period during typical plant operating conditions. Estimated annual energy consumption and savings were extrapolated from the study period to a full year. Each weekday production day and weekend has a similar demand profile. Since the average kW value for a 14-day monitoring period was used, the number of annual hours of operation used for all calculations was 8,760. The plant itself does not typically run every weekend or operate a third shift; however, there are extended second shifts and some weekend production schedules during the year.

Alonzo Printing is currently paying PG&E $0.14 per kWh as part of the E-20P rate schedule. Demand savings were not calculated in this analysis because, at some point during a month, the maximum demand may still exist.

Each day, one of the two existing 50-hp modulating air compressors was manually started to provide compressed air to the system at approximately 125 psig. Data logging shows that the average power used over the 14-day period was 21 kW.

Existing Power Calculation
21 kW x 8,760 hours = 183,960 kWh



The New System

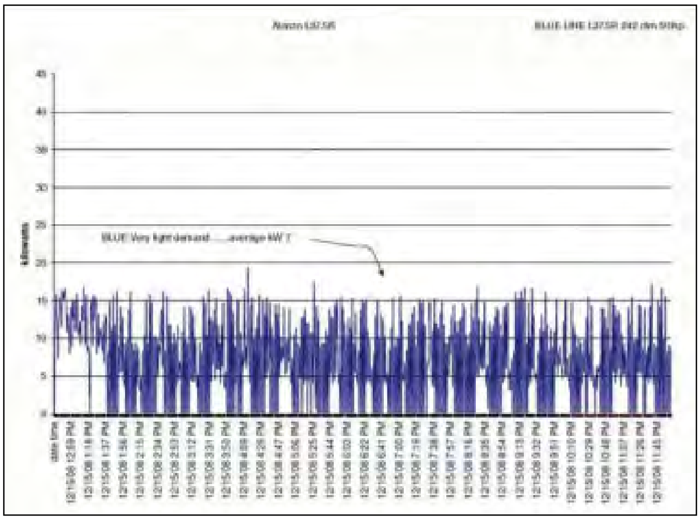
The auditor concluded that one of the existing fixed-speed 50-hp air compressors should be replaced with a new, switched-reluctance 50-hp air compressor, which was determined to be the best alternative for saving power when compared to other options. A smaller compressor was not recommended due to instances of peak demand that would have necessitated the back-up compressor to initiate. Considerations were made for choosing an efficient air end, ensuring that the average load corresponded to the most efficient part of the new compressor's power curve and minimizing excess starts, which would cause the compressor to run unloaded instead of stopping.

Many utility incentive programs do not require post monitoring to prove savings. However, the Ecos Air program requires post monitoring to validate each efficiency project's savings. Once the post system data and calculations were approved, the customer was presented an incentive amount that covered approximately ⅓ of the cost of the equipment.

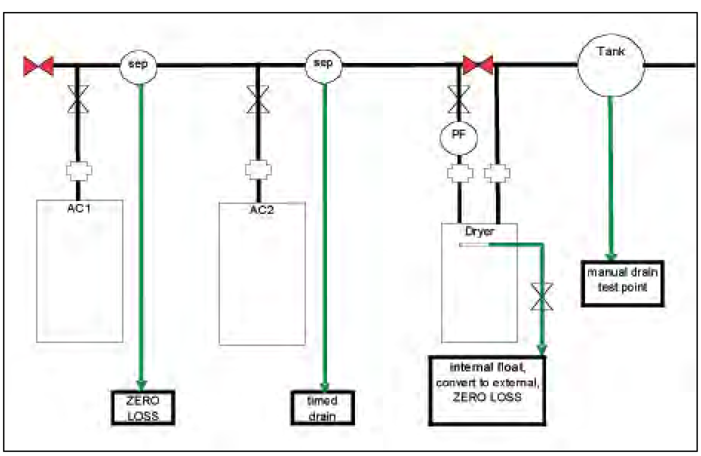
The results of data logging performed after the installation which validate the savings of the new system are shown below in a representative plot of the new compressor's power. The average power for the entire data set was 10.3 kW. Additionally, system pressure has been decreased to 100 psig.

New Compressor Calculation
10.3 kW x 8,760 hours = 90,420 kWh

Energy Savings Summary Calculation
183,960 kWh – 90,420 kWh = 93,540 kWh



New System Design Diagram



NOTE: AC1 is a new switched-reluctance controlled air compressor, and AC2 is the existing fixed speed compressor

Steps Required to Qualify for a PG&E Energy Incentive

PG&E provides incentives to customers ranging from $1,000 to $1,000,000 based on final measurement and verification (M&V) or commissioning tests that verify final kWh savings. In order to qualify for the incentive the customer must follow certain requirements, which include allowing the baseline system to be monitored, implementing the specific recommendations developed by the Ecos Air Auditor, accepting the terms of a Money Reservation Form and allowing the post system to be monitored. Ecos Air manages this process closely to ensure that all savings are verifiable for reporting purposes. BP

For more information, please contact Patricia Boyd, Ecos Air, Technical Lead at tel: 415-399-0661, email: pboyd@ecosconsulting.com, www.ecosconsulting.com

"PG&E provides incentives to customers ranging from $1,000 to $1,000,000 based on final measurement and verification (M&V) or commissioning tests that verify final kWh savings."

— Patricia Boyd, Ecos Air

THE SYSTEM ASSESSMENT OF THE MONTH

Printing Facility Reduces Air Demand and Avoids a $34,000 Capital Expenditure

BY RON MARSHALL, CET, CIM, MANITOBA HYDRO

Introduction

This article will focus on a compressed air system assessment done at a printing facility in Canada. The energy costs at the time in Manitoba were $0.025 per kWh, and the installation was of just 65 horsepower of air compressors. The compressed air demand was very high on the system, which was causing pressure problems and, as a result, the company was planning the purchase of a new 50 hp air compressor and air dryer to meet demand.

The portion of the system assessment we will review is the work done to understand the demand profile and constituents of compressed air demand. The results were significant in that they not only reduced air demand, but, more importantly in this case, helped the facility NOT to have to purchase an additional air compressor. Purchasing an additional air compressor would have created an unnecessary $34,000 capital expenditure. Further to this, the study also helped identify and eliminate electrical demand caused by a boiler-style humidification system and avoid proposed air powered humidification load being placed on the compressed air system. Due to space limitations, this article focuses only on the "constituents of demand" segment of the compressed air system assessment.

"Total energy savings were $23,800 per year."

— Ron Marshall, CET, CIM, Manitoba Hydro

Constituents of Compressed Air Demand

The plant had two lubricated rotary screw type compressors and refrigerated dryers installed: one 50 horsepower (hp) and one 15-hp unit. In general, the piping system consisted of a mixture of loop and radial feeds appearing to be adequately sized, in most instances, based on pressure logger data collected during the study.

A detailed end use assessment was performed to determine the makeup of the compressed air demand. Some of this demand was deemed as "inappropriate use" that could be reduced or eliminated by applying efficiency measures. The following is a constituents of demand table, which takes into account the potential reductions in air demand identified during the plant study. The demand reductions were to be achieved by reducing blowing and by eliminating existing humidification load and other poor air demands.

"Replacing the boiler system with a high-pressure water system saved 482,900 kWh."

— Ron Marshall, CET, CIM, Manitoba Hydro

Table 1: Constituents of Compressed Air Demand

CONSTITUENTS OF DEMAND (AVG. CFM)	CURRENT DAY/EVENING	CURRENT MIDNIGHT/ SATURDAY	CURRENT WEEKEND/ HOLIDAY	PROPOSED DAY/EVENING	PROPOSED MIDNIGHT/ SATURDAY	PROPOSED WEEKEND/ HOLIDAY
Machines	100	5	0	90	5	0
Blowing	15	5	0	5	2	0
Humidification	10	8	5	0	0	0
Leaks	30	30	30	20	20	20
Artificial Demand	10	7	5	0	0	0
Total Avg. cfm	**165**	**55**	**40**	**115**	**27**	**20**

THE SYSTEM ASSESSMENT OF THE MONTH

Printing Facility Reduces Air Demand and Avoids a $34,000 Capital Expenditure

Idle Machines

Compressed air is commonly used to supply equipment and machines in a standard industrial plant. Many times the machines are used for only a small portion of the day, yet the air system must continue to feed these idle machines. A number of machines in the plant were observed standing idle but with significant air demand. It was estimated that 10 cfm of plant air load was attributed to these machines. Estimated energy consumption for this load was calculated to be 18,000 kWh costing $1,674 per year.

High-Pressure/Low-Pressure Blowing

Compressed air is sometimes used to move or position material in process machines to aid in proper operation of the device. Many times these applications require low-pressure, high-volume air streams. Using high-pressure plant air for these application is expensive since a large amount of energy is expended in compressing the air to high pressures, only to have it expanded down again to lower pressures. As an example of the difference in energy requirements, a regenerative blower can produce 220 cfm, around 2 psi at 12 hp. A similar 100-psi screw compressor producing 220 cfm would consume 55 hp.

In this case, because the compressed-air system was heavily loaded at times due to compressed-air powered humidification nozzles, these high-volume blowing applications took needed air demand from the system and caused low-system pressures, in turn affecting production machines. This being the case, the following high-pressure demands were identified as loads that could be converted to low-pressure blowing:

1. The Perfect Binder operators were using high-pressure air to prevent paper jams when binding cookbooks requiring single page inserts. Whenever this happened, low-pressure problems occurred in the plant. This application was measured at 40 cfm peak. This blowing was being done because a regenerative blower had failed, and a replacement was not forthcoming. Replacement of the blower was recommended as soon as possible.

2. The paper cutter in the sheeting area had a blowing device fashioned from a copper pipe. Holes are drilled in the pipe to provide blowing to position the paper web. This application was measured at 20 cfm. In addition, this machine uses flexible nozzles for paper positioning measured at 20 cfm. Low-pressure blowing could provide a better solution to this application.

Because these applications were used intermittently, the average compressed air and annual kWh consumption associated with the applications was not all that significant. However, the impact on the system pressure was a concern. Addressing these applications helped defer the purchase of an additional air compressor.

Humidification System

Humidification systems are commonly seen in plants in Manitoba that have large ventilation systems. Printing plants need this ventilation to remove ink fumes. Since the ventilation return air is taken from outdoors, the extremely cold weather in winter months makes the ambient plant air very dry. The humidification systems add water to the air and reduce problems associated with static charges and drying/shrinkage of raw materials. Common varieties of systems use steam, compressed air and

high-pressure water to add moisture to the environment. Costs associated with the systems vary widely. The most expensive energy consumer is the steam system with energy intensity of about 340W per pound of water added, and the least expensive is the high-pressure water system with energy ratings of about 1W per pound. The compressed air powered system installed in the sheeting and Heidelberg area of the plant (24 nozzles at 1.8 cfm per nozzle) was consuming 43 cfm with annual costs of $2,399 per year. Converting these existing systems to high-pressure water was projected to reduce air demand by 43 cfm.

A further examination of existing electric boilers operating throughout the plant showed that their total energy consumption was 486,900 kWh per year. These systems were slated for conversion to compressed air powered nozzles. Replacing them, instead, with a high-pressure water system was projected to eliminate future compressed air consumption by 59,000 kWh and avoid further compressed-air demand. Total energy savings of the final conversion would be worth an estimated $30,000 per year — plus the cost avoidance of adding a new air compressor.

Energy Savings and Cost Avoidance

Reducing the constituents of demand played an important role in reducing the compressed air energy consumption by 115,000 kWh. Replacing the boiler system with a high-pressure water system saved 482,900 kWh. Total energy savings were $23,800 per year. Deferring the purchase of the new air compressor avoided a $34,000 capital expenditure.

COMPRESSED AIR SYSTEM	kWh	KVA	$ COST
Present System	291,000	59	$16,700
Proposed System	176,000	45	$11,400
Savings	**115,000**	**14**	**$5,300**

HUMIDIFICATION SYSTEM	kWh	KVA	$ COST
Present Boiler System	486,900	162	$18,700
Proposed System	4,000	1.5	$200
Savings	**482,900**	**160.5**	**$18,500**

NOTE: Savings due to conversion of the existing units are included in the air system calculations

COST AVOIDANCE	CAPITAL $
Defer 50-hp air compressor	$25,000
Defer 250-cfm dryer	$9,000
Savings	**$34,000**

Conclusion

Many owners of compressed air systems with less than 100 hp of installed capacity do not think they can achieve substantial savings with a compressed air system assessment.

Whenever a "smaller" system is at its limit, and a new compressor purchase is being planned, we highly recommend a system assessment before making any decisions. This printing facility received an unexpectedly positive result from the assessment, which helped their financial performance. BP

Manitoba Hydro® is a registered trademark.

For more information, please contact Ron Marshall, CET, CIM, Industrial Systems Officer, Business Engineering Services, Manitoba Hydro at tel: 204-360-3658, email: rcmarshall@hydro.mb.ca

The 2009 Association of Independent Compressor Distributors (AICD) Membership Meeting & Exhibition

BY COMPRESSED AIR BEST PRACTICES®

The 2009 edition of the AICD was held May 17–19 in Santa Fe, California. The big, blue skies were amazing as was the venue at the Hilton Santa Fe at Buffalo Thunder. The golf outing went well with no injuries (just sunburns), and the speaker line-up and exhibition was educational as always.

The current President of the AICD, Mr. Jim Bruce of Repair Compressor Services, commented that the AICD member turnout was very solid considering the state of the economy. The vendor participation was good and lively discussions (plus virtual bowling at Parker domnick hunter's booth) had the exhibition humming and sometimes screaming (strike!).

I donned my "roving reporter" hat and with no real methodology, got into interesting, random conversations during the exhibition. Below is a summary. My apologies go to the many booths and firms not mentioned, as we don't have space to document the technology in every booth at the AICD exhibition.

Hydrothrift Corporation had an interesting booth with their range of cooling systems. We got into an interesting discussion with Mike Wlodarski and Bruce Williams regarding the work they are doing with heat recovery units for air compressors. Hydrothrift is seeing growing demand for engineered heat exchangers recovering the heat from the oil in the air compressor. Factories use it to heat water for other processes and capitalize on this "free" source of energy, which otherwise goes unused.

Rogers Machinery displayed their oil-free rotary screw air compressor technology. Lane Hawkinson, from Rogers, commented that they are seeing growth with their 20–100-hp oil-free medical air packages. Rogers Machinery customizes packages for customers and is also seeing growth with this. Examples include oil-free air compressors with remote air-cooled modules and booster packages raising compressed air pressure from 80 psig to 140 psig. These oil-free rotary screw boosters are doing well as replacements for double-acting reciprocating units.

Reviewing condensate management technologies at the JORC Industrial booth are: Eric White (JORC), Matt Zorn (Zorn Compressor & Equipment), and Mike and Angie Sims (BiState Compressor) (left to right).

Reviewing the multi-plex cycling refrigerated dryers from ZEKS are: Rick Walsh (Q-Air California) and Dale Alexander (ZEKS) (left to right).

"Hydrothrift is seeing growing demand for engineered heat exchangers recovering the heat from the oil in the air compressor."

— Mike Wlodarski and Bruce Williams, Hydrothrift

THE 2009 ASSOCIATION OF INDEPENDENT COMPRESSOR DISTRIBUTORS (AICD) MEMBERSHIP MEETING & EXHIBITION

Reviewing the new cycling refrigerated air dryer from SPX Hankison are: Steve Reed (C.H. Reed), Ray Brahm (SPX Hankison), Rusty Welch (McKenzie Equipment) and Jay Francis (SPX Hankison) (left to right).

Bruce Williams and Mike Wlodarski from Hydrothrift Corporation displayed their cooling systems (left to right).

Discussing oil-free rotary screw applications at the Rogers Machinery booth are: Ron Nordby (John Henry Foster Minnesota), Jim Bruce (Reapair Compressor Services), Lane Hawkinson (Rogers Machinery) and Bill Kiker (National Pump & Compressor) (left to right).

SPX Hankison had their new thermal mass refrigerated air dryer on display. Jay Francis and Ray Brahm said that interest levels are very high for the new technology from Hankison. Apart from being a compact, cycling dryer, the unit allows for an integrated coalescing filter to improve the outlet air quality to include oil removal.

A newcomer to the AICD meeting was Airfilter Engineering. The firm offers a full range of coalescing filters manufactured at their main plant in Malaysia. Ms. Adelaine Yeo made the trip from Airfilter's subsidiary in Germany and said they are looking for import partners in North America.

Mr. Bob Foege, from Standard Pneumatic Products, displayed their Universal Autodual compressor controllers from the Belair/Nortek booth. Mr. Foege said demand is solid for this cost-effective, pneumatic solution to sequencing air compressors. They have several models, which can act as Lead/Lag, AutoDual Starters and other compressor control combinations.

In summary, the AICD exhibition didn't disappoint as I learned some new things about technology and companies in the industry. I'm looking forward to the 2010 AICD! BP

"Rogers Machinery customizes packages for customers and is also seeing growth with this. Examples include oil-free air compressors with remote air-cooled modules and booster packages raising compressed air pressure from 80 psig to 140 psig."

— Lane Hawkinson, Rogers Machinery

Printing Facility Vacuum System Upgrades

BY COMPRESSED AIR BEST PRACTICES®

Most printing facilities use vacuum for one process or another. We recently spoke with Jesse Krivolavek, a vacuum system efficiency specialist with IVS, Inc., about his recent adventures in the world of printing:

Where do you see the most vacuum efficiency opportunities in printing?

Many of the printers we visit have tremendous vacuum efficiency opportunities. But recently, we have seen a spike in interest and opportunity in vacuum efficiency from the *envelope manufacturers.*

The two types of envelope manufacturing machines we see the most of are "FL Smithe" and "W+D" machines. In these machines, vacuum is applied to small holes in large metal rollers, which hold and convey the envelopes through the machine. The deeper the vacuum, the more holing force is generated. Unfortunately, running too deep unnecessarily wastes energy.

Also, in this application there is always a leak. However, it varies depending upon how many and which holes are covered with paper. This is why it is important to isolate machines that are going through a "change out."

Can you be more specific on the type of efficiency opportunities?

Sure. Usually, the primary driver for a vacuum audit at an envelope factory is energy reduction. This is because many utilities and state governments are offering grants and rebates for energy reduction studies, as well as energy reducing projects.

Other reasons we are asked to look at an envelope manufacturer's vacuum system include increasing reliability, providing redundancy, increasing production and reducing operating costs.

Energy reductions mean operating cost reductions, and we're all trying to save money right now. What makes our job really fun is when clients discover additional operating cost reductions by reducing consumables like oil, water and parts. This is usually accomplished by implementing operational changes or technology upgrades.

What type of operational changes?

Sometimes, we see operators cranking the vacuum as deep as possible, usually fearful of operating anywhere less than "their standard." We'll see plants with a central vacuum system operating at 24"Hgv at the furthest machine (26"Hgv at the pumps), when they only needed 18"Hgv (20"Hgv at the pumps). The energy consumed to create about 4"Hg-absolute (26"Hgv), when they could be creating 10"Hg-absolute (20"Hgv), is more than twice as much as necessary. The potential energy saving can be a big deal.

We'll also see several machines on a central system that do not having working isolation valves, and when one or more machines are going through a "set-up" or "change-over," their cylinders are just open to the atmosphere. It can become expensive if it causes cascading slippage on all the surrounding machines.

Decentralization of the vacuum system can help with this issue and also save energy through on-demand vacuum when only select machines are in production. Let's say it is third-shift and 3 out of 12 machines are running on a central system that uses throttling to balance the pressure level. The client is only utilizing about 25% of what he's paying to create.

What types of technology upgrades are being implemented?

In the field we usually see liquid ring pumps, oil-flooded screw pumps, dry vane pumps, rotary lobe blowers, side channel blowers and claw pumps. They all have different energy efficiency characteristics and operating requirements.

The simplest unit of vacuum supply efficiency is cfm/hp at a given pressure. It's a lot like your miles per gallon at a specific speed in a car. Depending on your required pressure level, you can easily have a 5:1 difference or 5 cfm/hp versus 25 cfm/hp. Upgrading to more efficient technology automatically saves you energy and money. It all depends on the payback. Some technology upgrade paybacks where water or oil usage is removed from the equation, and kW reduction rebates are available, bring the "simple payback" conversation from how many years or months, to how many days.

Other upgrades may include VFDs on point-of-use pumps, VFDs for a trimmer pump on a central system, cell-based systems or cabinets that serve two to three machines and can provide two different vacuum levels simultaneously. Even efficient central systems that have an extra pump and use lead-lag are being installed to always have redundancy. Eliminating downtime can be a big cost savings.

Anything else you would like to add for CABP readers?

Yes, if you're using vacuum for making envelopes or any printing application, please ask yourself three things: (1) Are we operating deeper than necessary? (2) What's our cfm/hp at the required pressure level? (3) Is there money available from our utility or state for energy efficiency studies or improvements? BP

For more information, please contact Mr. Jesse Krivolavek at email: krivo@vacsolver.com, www.independentvacuumsolutions.com

7 SEVEN SUSTAINABILITY PROJECTS FOR INDUSTRIAL ENERGY SAVINGS

Project #6: Heat Recovery

BY THOMAS MORT, CEM

Overview:

Reducing energy costs and pollution emissions involves many areas within an industrial facility. My studies have found seven key (or common) areas where low-cost, practical projects can be implemented. Combined, these projects provide savings exceeding 10% of the annual energy spend with an average payback of less than one year.

This months article will focus on the opportunities for using waste heat sources to supplement winter building heat.

Seven Key Sustainability Projects

1. Metering
2. Demand Control
3. HVAC Optimization
4. Compressed Air
5. Lighting
6. Heat Recovery
7. Project Implementation and Funding

The Big Picture

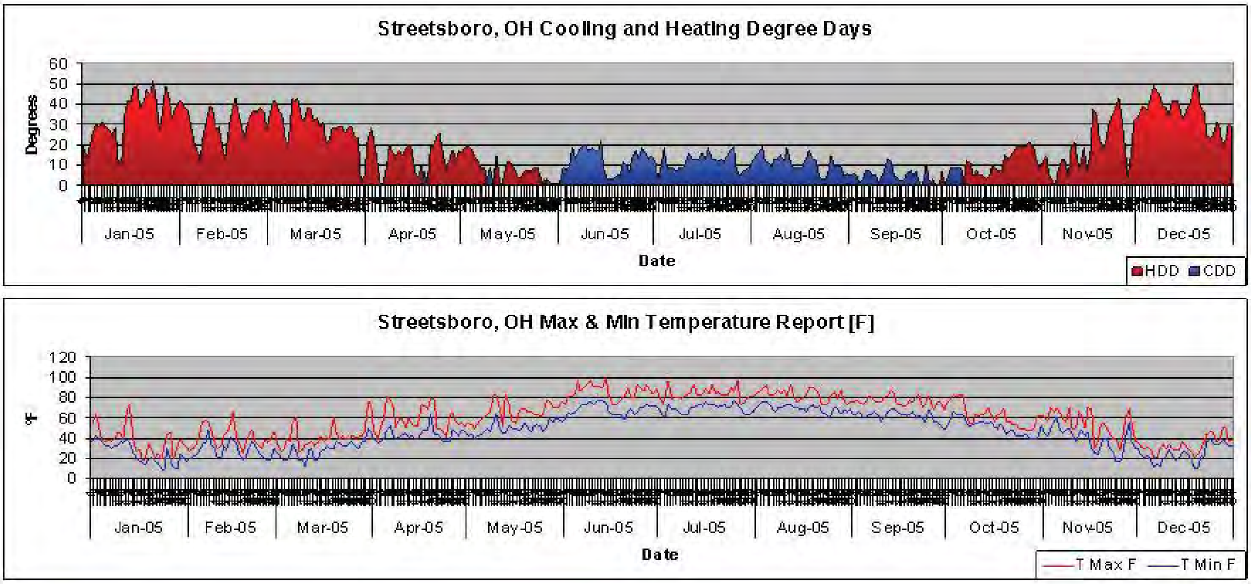
Heat recovery opportunities have resulted in the largest amount of savings. It is not the easiest type of project to implement, but the amount of savings and the reduction of emissions make this project very worthwhile.

The first question I ask in workshops is: What is the purpose of the cooling tower located outside of your plant? The answer: To remove waste heat. Second question: Does it make sense to use a system to remove heat from your plant and then use expensive natural gas to provide heat for makeup air?

Many times, I get this response: The low-grade heat from the coolant loop is not sufficient to provide the heat we need for our factory. My answer: Is the coolant loop temperature >10 °F warmer than the outside winter air temperature? Then warming the incoming air will reduce the heating load. Look at this table of weather data from Ohio. There are 4,000 hours where the average temperature is less than 37 °F!

Cooling Tower

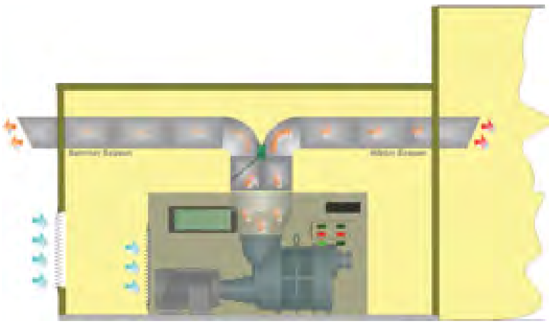
Dry Cooler



Weather									
hrs/yr <46[F]	Avg[F] <46[F]	hrs/yr <56[F]	Avg[F] <56[F]	HDD/yr	CDD/yr	hrs/yr >65[F]	Avg[F] >65[F]	hrs/yr >75[F]	Avg[F] >75[F]
3,168	32	4,464	37	5,452	1,251	3,072	75	1,320	80

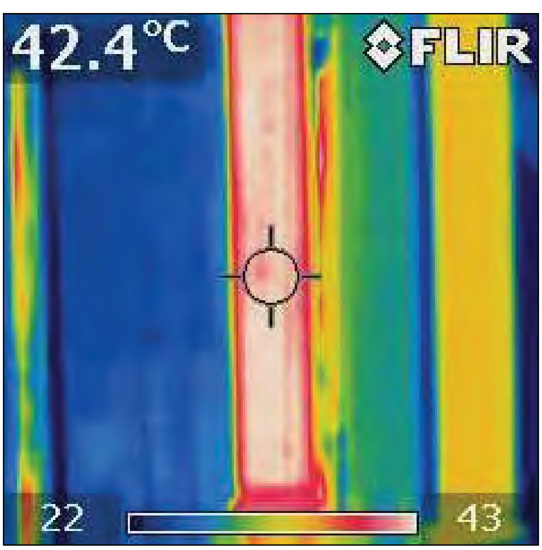
Weather Charts

SEVEN SUSTAINABILITY PROJECTS FOR INDUSTRIAL ENERGY SAVINGS



Air-cooled Air Compressor

Injection Mold Coolant



Injection Mold Coolant Thermal Image

Project Review

Let's begin the review of this project by mentioning the symptoms that can help identify the opportunities for this project:

1. The facility has sources of waste heat such as cooling towers, furnace or equipment exhaust
2. The facility has a large amount of air exchange such as exhaust hoods, filtration systems and ceiling or wall exhaust fans
3. Winter heating is required and provided from different sources such as natural gas forced air, steam or hot water systems

Air-Cooled Air Compressors

One of the simplest projects to get waste heat is from an air-cooled compressor. This is a common project, but I continue to find plants where this source of free heat is not being utilized.

A key to the success of this project is to be sure to use outside makeup air for the intake and discharge the warmed air into the ceiling area of the facility, not directly blowing on an individual.

To calculate the value of this free heat use this simple formula:

Air Cooled Air Compressor	Average kw/hr	hours/year requiring winter heat	mmbtus/kwh	$/mmbtu	recoverable heat	$ Savings per year
Compressor #1	100	4000	0.00341214	$10.000	90%	**$12,284**

Coolant Loop of an Injection Molder

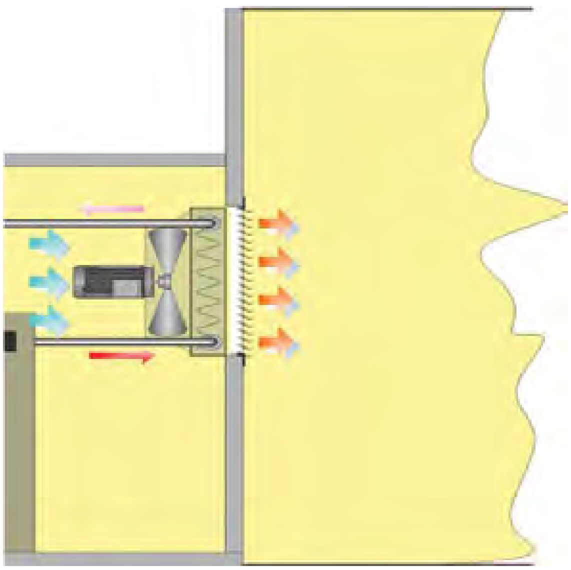
Another method to recover waste heat is from the coolant loop. By intercepting the water at its warmest point, before it arrives to the cooling tower and passing it through a radiator, the heat in the water can be used to provide warmed make up air.

This photo shows the coolant water from an injection-molding machine. The thermal image shows the temperature of the water. As you can see the temperature of the coolant water is significantly above the outside air temperature in the winter.

Saving with Energy
Thomas Mort Consulting, LLC

Heat Wasters

The next diagram shows a typical installation drawing. As with the air-cooled compressor, it is important that this system be set up to bring in outside makeup air and then exhaust the air into the ceiling area of the facility.



Water-to-Air Heat Exchanger

Here is a photo of what I call a, "Heat Waster." This is exactly the type of unit that could have the discharge air ducted into the plant during the winter for free heat.

Water-to-Air Heat Exchanger Photo

Here is the formula that can help to determine the value of heat available.

Heat Recovery from Coolant Loop	Differential Temperature	hours/year requiring winter heat	GPM flow	Conversion to mmbtus	$/mmbtu	
water to air heat exchanger	10	4000	100	0.000501	$ 10.00	$ 20,021

Many plants have been able to reduce their winter heat loads using this concept. Many, even in Michigan and Wisconsin, have been able to eliminate the need for natural gas heat during production hours.

I have found a company that supplies this type of heat recovery device, along with some electronic measurement equipment, which provides details of the amount of energy and savings that is being recovered from the coolant water (www.amsenergy.com). This 100 gpm radiator unit with a metering system can cost around $25,000 to $30,000.

"Combining heat recovery projects and the HVAC projects described in previous articles creates a combination where you can significantly reduce winter heat costs."

— Thomas Mort, CEM

SEVEN SUSTAINABILITY PROJECTS FOR INDUSTRIAL ENERGY SAVINGS

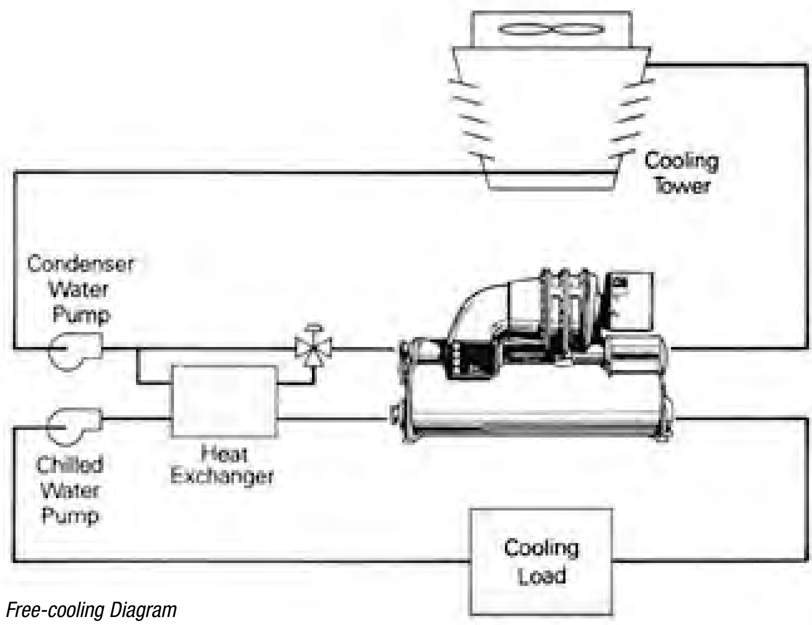
Free-cooling Plate-and-Frame Heat Exchanger

Free-cooling and Free-Heating

Free Cooling

Another area to find savings is called "free cooling." The concept of "free cooling" is that when the outside temperature is more than 10 °F below the required coolant temperature, the electric chiller can be bypassed, and the cooling tower can be used to provide the cooling with a much lower energy use. Many facilities, especially those with injection molding processes use electric chillers to cool molds and hydraulics. A common temperature for the cooling loop ranges from 55–75 °F. Refer to the chart above, and you can see there were more than 3,000 hours with an average temperature of 32 °F in Ohio.

This one line diagram shows how this type of system is configured.



Free-cooling Diagram

Calculating the savings is based upon the following formula.

Free Cooling	kw/hr	hours/year temperature is < 46 F	Electric $/kwh	$ Savings per year
Electric Chiller	150	3000	0.085	$ 38,250

Free cooling projects can often be combined with heat recovery projects using much of the same equipment and getting two types of savings: electric from shutting down an electric chiller and gas from reducing the load on the makeup air heating units.

Summary

Combining heat recovery projects and the HVAC projects described in previous articles creates a combination where you can significantly reduce winter heat costs. BP

For more information, please contact Thomas Mort, CEM, Thomas Mort Consulting at tel: 210-858-8454, email: tcmort@savingwithenergy.com, www.savingwithenergy.com

RESOURCES FOR ENERGY ENGINEERS

TRAINING CALENDAR

TITLE	SPONSOR(S)	LOCATION	DATE	INFORMATION
Compressed Air Challenge® Fundamentals of Compressed Air	PNM, DOE EERE	Albuquerque, NM	9/10/09	Carmen Chico tel: 505-241-4404 Carmen.Chico@pnm.com www.compressedairchallenge.org

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

PRODUCT PICKS

New Current Transformers

DENT Instruments, a global leader in the design and manufacture of power and energy measurement instruments, announced the introduction of the RoCoil mV™ Series of Current Transformers (CTs). These flexible Rogowski Coil CTs offer significant advantages over conventional Split Core or Clamp-On CTs in certain installations. They deliver "installer-friendly" features such as large window size, light weight, wide current range and mechanical flexibility for mounting in tight quarters.

Like its name implies, the RoCoil mV™ produces a millivolt output for use with DENT's ELITEpro and DATApro Series data loggers, as well as other manufacturers' metering instruments. RoCoil mV™ CTs are available in standard lengths up to 72" and current ranges up to 6000A.

DENT Instruments
Tel: 541-388-4774
Email: timv@dentinstruments.com
www.DENTinstruments.com

RESOURCES FOR ENERGY ENGINEERS

PRODUCT PICKS

Sigma Air Manager

Kaeser Compressors' Sigma Air Manager (SAM) monitors, sequences and analyzes low-pressure air or vacuum system performance. SAM allows auto-dual control, balances service hours, prevents simultaneous motor starts and maintains tight pressure band control — something standard sequencers cannot do! SAM can be adapted to almost any system and can manage up to 16 blowers, including differing brands.

SAM is the first master controller to incorporate an industrial PC with Internet technology. SAM alerts operators to service requirements and provides trending data for plant operational analysis. The standard Sigma Air Control *basic* software displays real time operational status through an Internet browser on your PC, including system trends as well as service and alarm messages. Optional Sigma Air Control *plus* stores data for reporting, system audits, control optimization and long-term trend analysis. With either software, the entire air system can be monitored and controlled from any location. Combined with our unloaded start valves, Omega Frequency Control panels and Wye-Delta Start Controls, Kaeser ensures the most efficient and automated low-pressure air or vacuum system.

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www.kaeser.com/omega.

Compressed Air Filtration

LA-MAN® Corporation has a unique approach to providing filtration for compressed air systems. The patented Extractor/Dryer® is a two-stage filter designed as a point-of-use filter that removes moisture and contaminates. It is most effective when installed within 25 feet of the point of use. Each model offers a standard 5-micron rating, with lower micron ratings available. Flow ranges from 15 scfm to 500 scfm.

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LITERATURE & SERVICES PICKS

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.

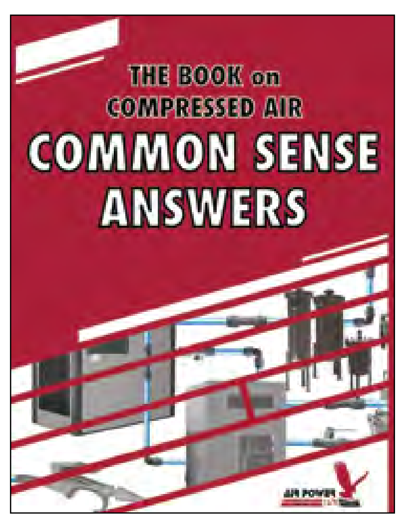
The Best Practices manual created by the Compressed Air Challenge® begins with the considerations for analyzing existing systems or designing new ones. The reader can determine how to use measurements to audit their own system, how to calculate the cost of compressed air and even how interpret electric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

**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

The Book on Compressed Air Common Sense Answers

NEW! Providing practical solutions to the everyday issues facing plant staffs who operate and maintain plant air systems and the engineering staff who design and evaluate air systems. Real life experiences flow throughout covering common problems and opportunities that touch all industries. New electronic energy saving products are reviewed in detail, and how to apply them through the complete air system, from the compressor room to the shipping dock, is explained. Savings calculation methods and measurement protocols are identified. Features "Ask the Experts" section answering questions posed by real users to Air Power USA staff. (Red book, Hard cover. 1st edition — 2009)



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or visit www.airpowerusainc.com BP

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 this column to provide any opinions or recommendations related to stock valuations. All information in this column was gathered on June 9, 2009.

JUNE 9, 2009 PRICE PERFORMANCE	SYMBOL	OPEN PRICE	1 MONTH	6 MONTHS	12 MONTHS	DIVIDEND (ANNUAL YIELD)
Parker-Hannifin	PH	$47.24	$46.58	$38.01	$78.35	2.17%
Ingersoll Rand	IR	$22.85	$22.81	$16.05	$42.32	3.16%
Gardner Denver	GDI	$27.54	$28.96	$24.54	$53.40	—
United Technologies	UTX	$56.57	$52.70	$48.43	$67.36	2.73%
Donaldson	DCI	$36.49	$34.00	$34.43	$50.56	1.26%
EnPro Industries	NPO	$19.76	$17.02	$18.64	$39.51	—
SPX Corp	SPW	$49.11	$45.41	$31.96	$131.29	2.05%

EnPro Industries, Inc. (NYSE: NPO) reported net income of $3.2 million, or $0.16 a share, for the first quarter of 2009 compared with $12.5 million, or $0.58 a share, in the first quarter of 2008. In the first quarter of 2009, the company reported a pre-tax loss of $8.5 million and a tax benefit of $11.7 million. The tax benefit was due primarily to the jurisdictional mix of earnings and losses. The company's sales decreased by 24% to $216.4 million from $283.1 million in the first quarter of 2008.

Earnings before interest, income taxes, depreciation, amortization, asbestos-related expenses and other selected items (EBITDAA) declined to $22.2 million, 54% below the first quarter of 2008 when EBITDAA was $48.5 million. The decline primarily reflects the effects of weaker markets and lower volumes, especially in the company's Engineered Products segment. As a percentage of sales, these earnings fell to 10.3% from 17.1% a year ago.

"The weaknesses in our markets that we began to encounter in 2008 have continued into 2009," said Steve Macadam, president and chief executive officer of EnPro Industries, Inc. "Sharp declines in volume in most of our industrial markets have significantly reduced our profitability. As our markets have deteriorated, we have acted quickly to reduce employment levels, freeze salaries and shorten work weeks, and we have taken other significant steps to lower production costs and reduce spending. We expect to benefit from these steps over the remainder of the year. We are fully focused on meeting the challenges of the current environment and successfully guiding our company through this difficult time."

Sealing Products Segment

$ IN MILLIONS		
Quarter Ended	3/31/09	3/31/08
Sales	$97.1	$123.6
EBITDA	$16.9	$24.4
EBITDA Margin	17.4%	19.7%

Sales in the Sealing Products segment decreased by 21% compared to the first quarter of 2008. About 5 percentage points of the decline came from the effect of changes in foreign exchange rates. Although sales to certain segments of the power generation and upstream oil and gas markets, served by Garlock Sealing Technologies, improved slightly, demand from the segment's other industrial markets and its heavy-duty truck markets declined due to soft conditions and customers who are supplying their needs from existing inventories.

The segment's earnings before interest, taxes, depreciation and amortization (EBITDA) decreased by 31%, and the EBITDA margin declined by 230 basis points, primarily because of lower volumes across most of the segment's operations.

Engineered Products Segment

$ IN MILLIONS		
Quarter Ended	3/31/09	3/31/08
Sales	$88.0	$133.1
EBITDA	$4.0	$26.9
EBITDA Margin	4.5%	20.2%

The Engineered Products segment reported a 34% decrease in sales compared to the first quarter of 2008. Contractions in the segment's markets produced a decline of 30% while the impact of foreign exchange rates reduced sales by 7%. Acquisitions provided a contribution of 3% to the segment's sales. GGB Bearing Technology recorded the most significant decrease in sales in the segment, reflecting sharp downturns in demand for its products from automotive and industrial markets both in the United States and Europe. Quincy Compressor and Compressor Products International (CPI) also reported lower sales as demand for their products from industrial and energy-related markets declined.

The segment's EBITDA fell by 85%, and segment EBITDA margins dropped to 4.5%, primarily because GGB experienced a substantial decline in volumes and was not able to fully recover its fixed costs. Lower volumes also led to reduced profits and profit margins at Quincy and CPI.

Engine Products and Services

$ IN MILLIONS		
Quarter Ended	3/31/09	3/31/08
Sales	$31.7	$26.5
EBITDA	$6.5	$4.4
EBITDA Margin	20.5%	16.6%

Sales in the Engine Products and Services segment were 20% higher than in the first quarter of 2008. The segment benefited from increased parts and services sales and from the sale of engines and associated equipment to U.S. Navy shipbuilding programs.

The segment's EBITDA improved by 48%, and EBITDA margins improved by 390 basis points as Fairbanks Morse Engine benefited from increased volumes, a more profitable mix of business and better pricing.

Cash Flows

The company's cash balances declined to $56.3 million at March 31, 2009 from $76.3 million at December 31, 2008. Operating activity provided net cash of $0.5 million in the first quarter of 2009, compared with $9.4 million in the first quarter of 2008. Working capital increased by $7.7 million in the first quarter of 2009, down significantly from the $23.3 million increase in the first quarter of 2008 as a result of lower levels of activity in the first quarter of this year.

Capital expenditures in the first quarter of 2009 decreased to $7.3 million from $12.7 million in the first quarter of 2008, while spending on acquisitions fell to $5.3 million from $27.2 million.

WALL STREET WATCH

SPX Corporation (NYSE:SPW) today reported results for the first quarter ended March 28, 2009:

Revenues decreased 13.9% to $1.16 billion from $1.35 billion in the year ago quarter. Organic revenues declined 7.5%, completed acquisitions increased reported revenues by 0.2% and the impact of currency fluctuations decreased reported revenues by 6.6%.

Segment income and margins were $125.8 million and 10.8% compared with $160.4 million and 11.9% in the year-ago quarter.

Net cash used in continuing operations was $35.3 million compared with net cash from continuing operations of $1.0 million in the year-ago quarter. The decrease in cash flow was due primarily to decreased operating income and increased cash restructuring spend.

Free cash flow from continuing operations during the quarter was a negative $50.6 million compared with a negative $18.9 million in the year-ago quarter. The decrease was due primarily to the items noted above, offset partially by lower capital expenditures in 2009.

Chris Kearney, Chairman, President and CEO said, "We continue to face very difficult conditions in many of our key end markets, as our customers deal with the economic recession and its impact on their businesses. While the current environment remains challenging, our cost control activities are taking hold, and we continue to execute on strategic restructuring actions to improve SPX for the future.

"We believe we are well-positioned to execute on the long-term growth opportunities in our three core end markets, global infrastructure, process equipment and diagnostic tools, and our financial strength provides us the flexibility to weather this economic downturn," Kearney concluded.

"While the current environment remains challenging, our cost control activities are taking hold, and we continue to execute on strategic restructuring actions to improve SPX for the future."

— Chris Kearney, Chairman, President and CEO, SPX

Financial Highlights — Continuing Operations

Flow Technology — Revenues for the first quarter of 2009 were $394.0 million compared to $492.1 million in the first quarter of 2008, a decrease of $98.1 million, or 19.9%. Organic revenues declined 9.8% in the quarter, driven primarily by softness in the dehydration, industrial and food and beverage markets. The impact of currency fluctuations decreased revenues by 10.1% from the year-ago quarter.

Segment income was $50.1 million, or 12.7% of revenues, in the first quarter of 2009 compared to $46.7 million, or 9.5% of revenues, in the first quarter of 2008. Segment income and margins were favorably impacted by improvement from the APV acquisition and the oil and gas end markets, offset by the softness noted above. In addition, the 2008 results included a charge of $7.5 million representing the excess fair value of inventory acquired in the APV acquisition.

Test and Measurement — Revenues for the first quarter of 2009 were $196.0 million compared to $270.0 million in the first quarter of 2008, a decrease of $74.0 million, or 27.4%. Organic revenues declined 21.3% in the quarter, driven primarily by the continued difficulties being experienced by global vehicle manufacturers and their dealer service networks. The impact of currency fluctuations decreased revenues by 6.9% from the year-ago quarter, while acquisitions contributed 0.8% to reported revenues.

Segment income was $5.8 million, or 3.0% of revenues, in the first quarter of 2009 compared to $23.9 million, or 8.9% of revenues, in the first quarter of 2008. Segment income and margins declined due to the organic and currency related declines noted above.

Thermal Equipment and Services — Revenues for the first quarter of 2009 were $342.2 million compared to $346.8 million in the first quarter of 2008, a decrease of $4.6 million, or 1.3%. Organic revenue growth was 4.2% in the quarter, driven primarily by increased sales of thermal equipment into the power generation market. The impact of currency fluctuations decreased reported revenues by 5.5% from the year-ago quarter.

Segment income was $21.4 million, or 6.3% of revenues, in the first quarter of 2009 compared to $36.4 million, or 10.5% of revenues, in the first quarter of 2008. The decrease in segment income and margins was due primarily to unfavorable product mix as compared to the year-ago quarter. The decline in revenues is attributable to currency fluctuations also contributed to the lower segment income.

Industrial Products and Services — Revenues for the lfirst quarter of 2009 were $229.8 million compared to $241.0 million in the first quarter of 2008, a decrease of $11.2 million, or 4.6%. Organic revenues declined 3.5% in the quarter, driven primarily by softness in the hydraulic tools product line. The impact of currency fluctuations decreased revenues by 1.1% from the year-ago quarter.

Segment income was $48.5 million, or 21.1% of revenues, in the first quarter of 2009 compared to $53.4 million, or 22.2% of revenues, in the first quarter of 2008. The decrease in segment income and margins was driven largely by the organic decline in the hydraulic tools product line noted above. BP

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