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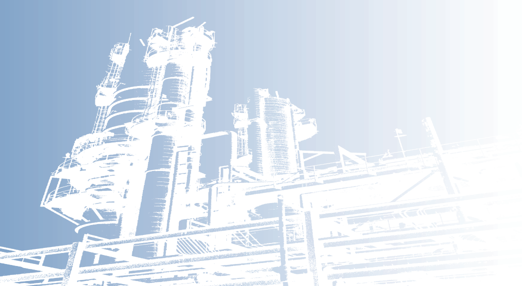
ISSUE FOCUS:
Industrial Energy Systems Management

IN THIS ISSUE



Best Practices debuts, see page 11.

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Celebrating the New Steel

Once again, innovative technologies have galvanized the U.S. steel industry to realize significant energy savings and productivity increases. On May 4 and 5, DOE's Office of Industrial Technologies (OIT), the State of Pennsylvania, the American Iron and Steel Institute (AISI), and the Steel Manufacturers Association cohosted an event called "A Celebration of the New Steel—Pittsburgh Regional Technology Showcase." Held in the heart of the U.S. steel industry, the 2-day event included plant tours, technical sessions, and new technologies.

Plant improvements based on new DOE-sponsored technologies were installed and demonstrated at U.S. Steel Group's Edgar Thomson Plant in Braddock, Pennsylvania, and at Weirton Steel Corporation in Weirton, West Virginia. These plant improvements will help the steel industry forge ahead in their efforts to save energy, save costs, and increase productivity. In fact, both showcase companies are already reaping the benefits of the new technologies.

Following several energy- and cost-saving projects, U.S. Steel embarked on sensors and control projects for process improvements.

Heating Up Productivity at U.S. Steel

With a company-wide commitment to continuous improvement, the U.S. Steel Group has already implemented more than 40 energy- and resource-saving technologies—with an estimated annual savings of about $2 million. These projects include modifying natural gas pilots on boilers, insulating steam lines, repairing steam traps, recovering condensate, and repairing leaks in compressed air systems. That commitment was further evidenced by the technologies showcased at the Edgar Thomson Plant. This time the focus was on sensors and controls. The showcased projects included:

- **A blast furnace burden** monitor that uses an infrared imaging camera to detect where the bulk of the heat is located. Operators can distribute the burden to keep heat in the center of the furnace, which increases the furnace's life and fuel efficiency. Maintenance costs are also decreased.
- **A KTB degasser** lance incorporates a video camera, a vessel preheat burner, and an oxygen blower to adjust the chemistry of a batch of steel. An operator can see alloy additions more clearly to enhance the steel quality. The process can now be done in one step instead of three, and it eliminates the burner's high maintenance costs.
- **A basic oxygen process (BOP) vessel contour sensoring system** measures the thickness of a vessel lining. This helps locate weaknesses in the vessel to prevent molten steel from seeping through, which can cause damage and injury. The new system reduces downtime to do vessel lining checks from 30 minutes to 30 *seconds,* and it saves $10,000 a month for a contractor to do vessel lining measurements once a day.
- **A BOP vessel off-gas sensor** measures carbon levels and predicts slopping (when hot steel erupts and splashes out of the vessel) using an infrared sensing system. It eliminates the downtime

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COMMENTS?

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Guest Column

Energy Savings in Industry Through Use of Insulation and Refractories

By Arvind C. Thekdi, Executive Vice President, CSGI, Inc., Rockville, MD

Role of Insulation and Refractories

Insulation and refractories, individually or in combination, are used to contain heat in all applications where heat is generated, transferred, transmitted, or recovered. Typical industrial applications include boilers, steam and hot fluid piping, furnaces, ovens, heaters, and storage tanks.

The terms "refractories" and "insulation" refer to a large family of inorganic, nonmetallic materials used primarily to reduce heat losses or for thermal insulation. Insulating materials include those with low-thermal conductivity that divide an air space into very small pockets, thereby minimizing solid and gas conduction and radiation, and, for most applications, eliminating convection. Figure 1 shows several types of refractory and insulating materials used by industry. Properly designed refractory and insulation systems reduce heat losses, conserve energy, maintain desired process temperatures, assist in heat transfer, and safely contain process atmosphere, such as flammable toxic or hazardous gases, vapors, or liquids.

Potential for Energy and Cost Savings

U.S. industries use more than 15 quads (one quad equals 1000 trillion Btu) of energy per year in the form of heat generated from fuels (natural gas, fuel oils, etc.) and electricity. Many industrial processes require proper insulation to be carried out. However, inadequate or improper use of insulation in industry accounts for 10% to 30% of total industrial energy loss. These losses amount to 1.5 to 3 quads of energy and represent a $3 to $5 billion in annual energy costs for industries.

Although it is not feasible, or in some cases, not advisable, to eliminate all losses, industry can reduce losses by 10% to 25% and achieve cost savings of $.5 to $2 billion. This requires plant personnel to review process requirements, know available and applicable insulation materials, and select materials to meet the process requirements. It also requires proper design, installation, and preconditioning of insulation systems during startup. This should be followed by proper operation of the equipment to avoid damage to the insulation, periodic maintenance, repairs, and replacement of the insulation. In certain high-temperature processes, such as steel or glass melting or steel reheating, properly installed and maintained insulation can eliminate or greatly reduce the use of water or air-cooling, which can represent 15% to 40% of the total heat input to the process.

Refractories and Insulation Materials

Refractories are classified by chemical composition or physical properties. The main classes are silica, alumina-silica, high alumina, basic, and insulating. With the exception of insulating refractories, most high-temperature refractories, such as firebricks, are high-density (>120 lb/ft^3). They offer excellent resistance in challenging operating environments, such as slags with different chemical compositions, fumes,

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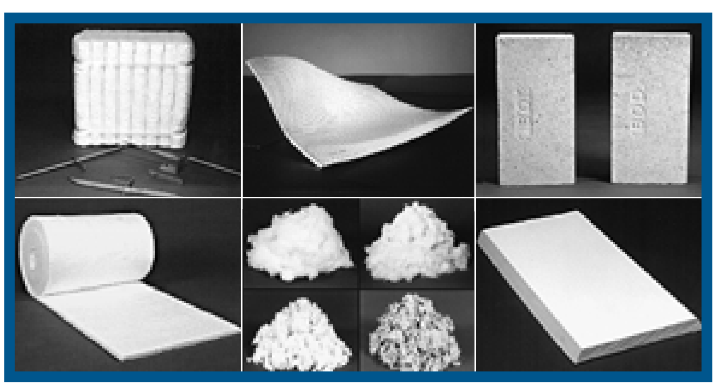

Source: Thermal Ceramics

Figure 1. Commonly available forms of refractories and insulation materials.

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dust, and gases. Insulating refractories have lower densities (50 to 70 lb/ft^3) and provide insulating properties, while offering resistance to corrosion and chemical reactions with the operating environment.

The three basic types of insulating materials for industrial use are: 1) thin (less than 20 micrometers), low-density (less than 12 lb/ft^3) fibers made from organic or inorganic materials; 2) cellular material in closed or open cell form made of organic or inorganic material; and 3) flaked or granular inorganic materials bonded in the desired form. In most cases, glass (silica), mineral wool, high alumina, mulite, or zirconia are the base materials and can be used to temperatures as high as 2900°F. This class of materials has a lower density that varies from 4 lb/ft^3 to 12 lb/ft^3 and offers higher thermal resistance compared to firebricks or insulating firebricks.

In all cases, thermal conductivity of the insulation increases significantly as temperature increases. Figure 2 shows the thermal conductivity values of commonly used refractories and insulating materials.

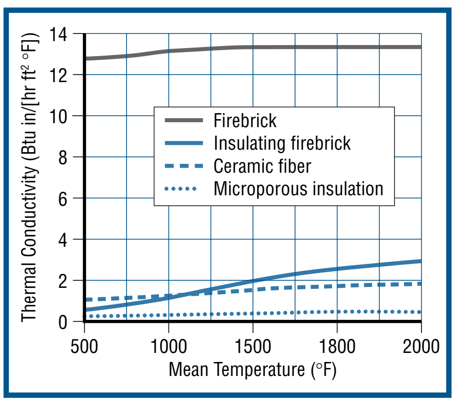

Figure 2. Typical thermal conductivity values for commonly used refractory and insulating materials.

Selecting Refractories and Insulation for Industrial Use

Proper design and installation of refractories and insulation play important roles in a system's performance and life and the overall economics of plant operation and profits. Selecting insulation materials and designing insulation systems requires consideration of four factors:

- **Thermal performance,** which involves temperature limit; melting or fusion temperature; thermal conductivity that represents insulation capability; heat capacity or storage; thermal expansion; and thermal shock (spalling) resistance.
- **Physical properties,** which include density or porosity; abrasion; wear and erosion resistance; electrical resistivity for use in electric heating; mechanical strength; and other structural properties at high temperatures.
- **Chemical considerations,** which include uniformity of composition; reactions between base materials and operating environment; and issues such as volatilization of the constituents or binding agents, corrosion, chemical attack, or diffusion and reactions with the product.
- **Economics,** which mean initial installation labor; maintenance and repair; and replacement costs.

In most applications, economics and performance require use of more than one type of insulating material. All major suppliers offer guidelines and help in application and installation of insulation systems. In some cases, special tools and techniques are developed, and personnel must be trained for proper installation work.

Design and Selection Tools

The cost of an insulation material relates to its temperature capability. Hence, insulation and refractory systems are designed to include several layers of different materials that offer optimum economic performance. Selecting the most economical system requires consideration of its cost compared to potential savings from reduction of heat losses. Figure 3 shows a typical system cost vs. savings for different insulation thicknesses in a furnace application.

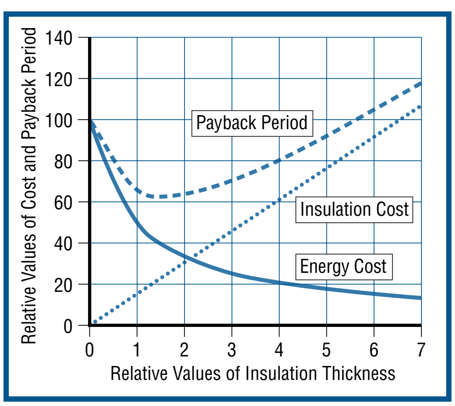

Figure 3. Trends in costs, savings, and payback.

In some cases, the most economical thickness may not meet regulatory requirements for the safety of personnel and property. In such cases, appropriate design and materials should be used. In other cases, thickness may be reduced when there is a danger of exceeding the limiting refractory or insulating temperature.

A number of tools and design methods are available for selecting the most economical or appropriate refractories or insulation. For example, *3E Plus Insulation Thickness* software, developed jointly by DOE's Office of Industrial Technologies (OIT) and the North American Insulation Manufacturer's Association (NAIMA), can be used to calculate and select the insulation thickness for a variety of conditions. Download the program at **www.oit.gov/bestpractices/software_databases/software.html.**

For high-temperature furnaces, many layers of insulation are needed that may include different types of materials, such as refractory bricks, fiber blocks or blankets, or, in rare cases, loose fiber wool or granular material. Other programs on the market allow users to select a number of material combinations of the available materials and calculate heat losses, surface temperature, and heat storage for the selected system.

Resources on the Horizon

Currently, a number of private and publicly funded programs are underway to develop new refractory and insulating materials. These programs will result in the development and application of new equipment design that can make significant reductions in energy loss from industrial heating processes, while improving productivity and safety for all major industries.

Go to Energy Matters Extra at **www.oit.doe.gov/bestpractices/explore_library/emextra** to link to information about insulation resources. ●

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Understanding Your Compressed Air System is Important to Managing it Well

The first step in improving a plant's compressed air system is to understand how compressed air is used. This will determine the system's compressed air requirements. Start with an assessment of your plant's end-use applications to identify high-pressure, high-volume/intermittent, and inappropriate applications. Use this information to devise an effective system-level strategy for each application. Then, with the best strategy selected, implement the plan to optimize each application's compressed air consumption.

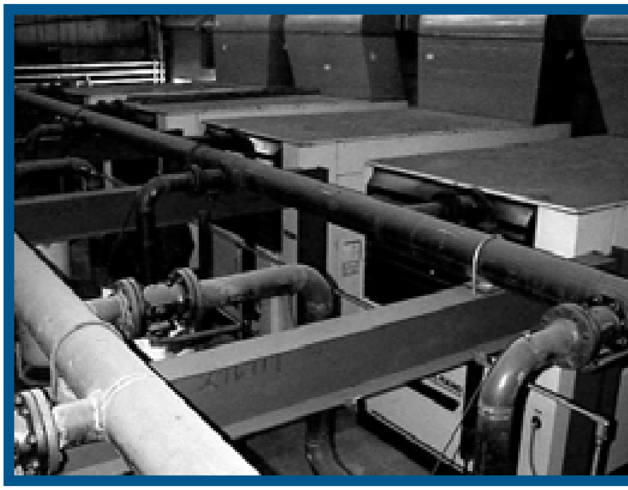
The example below describes one company's steps to understand its compressed air system use and requirements, then to implement improvements. In this case, the results were substantial cost savings, improved product quality, and increased productivity.

CASE STUDY: Cutting Costs and Improving Productivity at Weirton Steel

Weirton Steel recently completed a project to improve the compressed air system at its Tin Mill facility. New compressors, new air treatment equipment, and the repair of leaks significantly reduced compressor shutdowns, production downtime, and product rejects. In addition, the new system operates more efficiently, leading to lower energy and maintenance costs. The total project cost was $246,000, with expected annual savings of $136,000 and a simple payback of 1.8 years.

Weirton Steel's plant in Weirton, West Virginia, is one of North America's most advanced integrated steel production facilities. Compressed air is an integral part of the production process, with compressed systems located in four main areas: the Steel Works and Utilities, the Tin Mill, the Strip Steel Mill, and the Sheet Mill. Of these, the Tin Mill and the Strip Steel Mill use the greatest volume of compressed air.

The Tin Mill uses compressed air mainly for pneumatic cylinders, blowing operations, and spray guns in producing steel rings for metal cans. Prior to the implementation, the Tin Mill's compressed air system was a combination of six aging, water-cooled, manually controlled centrifugal and sliding vane compressors totaling 2200 connected brake horsepower. With this system, the mill experienced a high degree of product rejects and frequent production interruptions.



Weirton Steel took stock of its Tin Mill compressed air systems for improved performance and cost savings.

Assessing the System

Weirton's management performed a compressed air system assessment of the Tin Mill that began with an evaluation of compressed air applications. The assessment identified inadequate treatment of the compressed air and the aging compressors as major contributors to excess water and lubricant in the system.

In this case, inadequate treatment caused large amounts of water to carry over into the system's air cylinders. This produced two consequences. First, it prevented the compressors from maintaining a stable system pressure as water steadily increased the pressure gradient. Second, it led to periodic stoppages in production because the cylinders had to be manually drained.

Lubricant that leaked from compressor bearings was mixing with the compressed air. The lubricant migrated onto steel rings in cans during the coating process, which resulted in an unacceptably high degree of contaminated cans that had to be destroyed. In addition, the old and poorly operated compressors only produced 70% of rated airflow, which meant the mill had to bring extra compressors online.

Implementing Solutions

Weirton replaced its old compressors with five 350-hp rotary screw compressors that supply approximately 8500 scfm at 90 psig. Each new compressor has a dedicated thermal mass refrigerated dryer, and the compressors have been sequenced to respond to varying compressed air demands. The mill also replaced leaking filters and old valves. Additionally, air cylinders that had been damaged from years of water buildup were rebuilt. To ensure the quality of the compressed air used in the coating process, the mill installed a dedicated, lubricant-free, rotary screw 100-hp compressor with a desiccant dryer, a conventional filter, and two charcoal filters to supply compressed air for that application.

Taking Stock of the Benefits

Weirton's Tin Mill overhaul resulted in improved production and substantial savings. The dryers have eliminated water buildup in the air cylinders, which means there is no longer a need to drain and perform maintenance on the cylinders. The dedicated system that supplies lubricant-free compressed air has drastically reduced the rejection of cans. Production downtime has also been reduced, while productivity at the Tin Mill has increased. With the new system, the mill operates more effectively, using less total energy for production. In addition, less water buildup means the resistance to the airflow has been reduced, allowing compressors to more easily maintain system pressure. By fixing valve leaks, the mill has also cut its air demand.

Learning by Example

For Weirton Steel, the key to a proper compressed air system configuration was to understand the needs of its end-use applications. The company also determined the appropriate level of treatment and its air quality requirements. By taking similar steps, other companies might achieve similarly positive results. ●

Turn to page 5 to learn about the Compressed Air Challenge's™ Advanced Compressed Air Management Training and the 8-Step Action Plan to guide you to better system performance.

Advanced Level Compressed Air Management Training Now Available

The Compressed Air Challenge™ (CAC) announces the newly developed Advanced Management of Compressed Air Systems training. The 2-day training builds on the system approach to compressed air management presented in the Fundamentals of Compressed Air Systems, the training course previously introduced by CAC in the spring of 1999. This approach is part of the DOE's Office of Industrial Technologies' (OIT) diverse portfolio of assistance with near-, medium-, and long-term strategies to increase the resource efficiency and competitiveness of U.S. industry.

Designed for facility engineers, maintenance supervisors, equipment distributors, and engineering consultants, Advanced Management of Compressed Air Systems is an intensive training that provides up-to-date, in-depth technical information on troubleshooting and improving industrial compressed air systems.

Participants will learn to:

- Collect and use data and tools to assess system efficiency and the cost-effectiveness of compressed air systems.
- Develop and use a system profile.
- Implement a system maintenance program.
- Address air quality, pressure requirements, and high-volume intermittent applications.
- Understand complex control system strategies.
- Align supply-side to demand-side operation.
- Explain the value of heat recovery.
- Successfully sell compressed air improvement projects to management.

The training is organized around a comprehensive 8-Step Action Plan for Improving Compressed Air System Performance. By following this plan, training participants will be able to operate their compressed air systems at a lower cost and with greater efficiency and reliability. CAC has qualified 10 instructors to teach the advanced training, all experts in compressed air systems and all with extensive field experience and strong training skills.

The first training sessions were in May and early June. Other sessions will be scheduled in several cities across the country. Be sure to check the calendar page in each issue of *Energy Matters* or Energy Matters Extra at **www.oit.doe.gov/bestpractices/explore_library/emextra** for dates and locations. And to find out more about upcoming sessions, how to register for the training, or the instructors, go to the BestPractices Web site at **www.oit.doe.gov/bestpractices/compressed_air.**

DOE is one of 15 cosponsors of CAC, a voluntary collaboration of industrial end users, manufacturers, distributors and their associations, facility operating personnel and their associations, consultants, state research and development agencies, energy efficiency organizations, and utilities. Learn more about the resources available through the Compressed Air Challenge™ by calling the OIT Clearinghouse at (800) 862-2086. ●

8-Step Action Plan for Improving Compressed Air System Performance

1. *Develop a system block diagram.*
2. *Create a system pressure profile.*
3. *Address point-of-use issues:*
   - *Determine actual air quality requirements and treat air appropriately.*
   - *Investigate and reduce point-of-use pressure requirements.*
   - *Investigate and address high-volume, intermittent applications.*
   - *Take stock of what you have and challenge point-of-use requirements and appropriateness or inappropriateness of applications.*
4. *Develop a compressed air system maintenance program.*
5. *Analyze existing compressor(s) and system control, and implement an effective control strategy.*
6. *Align supply-side with demand-side operation.*
7. *Implement strategies to maintain system alignment.*
8. *Communicate to gain support of plant and production management:*
   - *Target decision-makers.*
   - *Develop a cost-benefit analysis that addresses life-cycle cost savings, benefits to production (such as reliability and productivity), and return-on-investment.*
   - *Report to management using an effective format.*
   - *Use pre-measurement and post-measurement of kWh and production output to document cost savings from actions taken with production's support, and report to management.*

Performance Optimization Tips

Field Measurements in Pumping Systems—Practicalities and Pitfalls

By Don Casada, OIT BestPractices Program

This article is the 5th in a series dealing with practical considerations and pitfalls of field measurements needed to understand pumping systems.

In the March/April 2000 issue of *Energy Matters,* we discussed the estimation of flow rate from pump head-capacity curves. In this issue, we'll look at two other methods of estimating flow rate in systems with no installed flow meters.

Method 1: Level Change over Time

A frequently used method measures change in the level of tanks or other storage devices over time. It can be used to both determine flow rate in unmetered systems and to verify the accuracy of existing flow meters.

Figure 1 shows a simple system that uses a pump to transfer fluid from one tank to another. By measuring the change in level (ΔL) in Tank 1 in the period from "Start of Test" to "End of Test," the average flow rate can be determined.

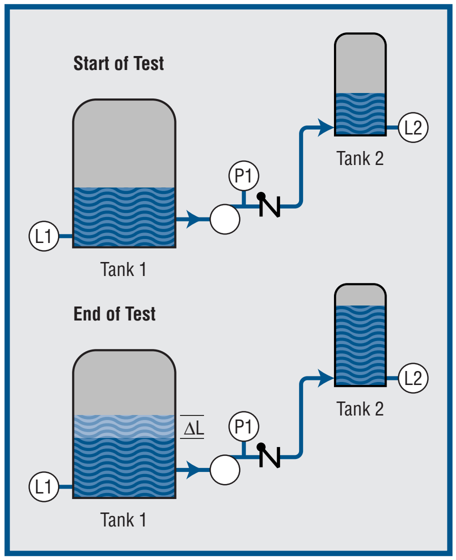


Figure 1. Fluid transfer between tanks.

In some industrial applications, a tank that receives incoming flow is periodically pumped down, with pump stop and start being controlled by low- and high-level switches. In such situations, the average pump flow rate can be estimated as follows:

1. Calculate the volume between the high- and low-level switches.
2. Measure the fill time (from pump stop to pump start).
3. Determine the individual cycle's inflow rate during the fill period by dividing the volume (Step 1) by time (Step 2).
4. Measure the time from pump start to pump stop (pump run time).
5. Estimate the average pump flow rate by multiplying the inflow rate (Step 3) by the pump run time, and add this volume* to the volume between the level switches.

Repeat the steps a few (or many) times, as needed, to get the distribution of the inflow rate. Figure 2 shows an example of many readings that represent a year's observations. Figure 3 shows an alternative representation, usually called a flow-duration diagram. These types of graphs are critical to understanding system needs and selecting the most suitable pumps.

*Learn about two BestPractices demonstration projects where this estimating method was used. Go to Energy Matters Extra at **www.oit.doe.gov/bestpractices/explore_library/emextra** for details about the Town of Trumbull and the City of Milford, Connecticut.*

Method 2: Bernoulli-based Estimating

Venturi and orifice flow meters estimate flow rate by measuring the difference in pressure between two points with different velocities. The Bernoulli equation below is the general basis for this type of metering.

$$\frac{P_1}{\gamma} + z_1 + \frac{V_1^2}{2g} = \frac{P_2}{\gamma} + z_2 + \frac{V_2^2}{2g}$$

(P = pressure, V = velocity, z = elevation, γ = specific weight, g = gravitational constant, and subscripts 1 and 2 refer to two streamline locations).

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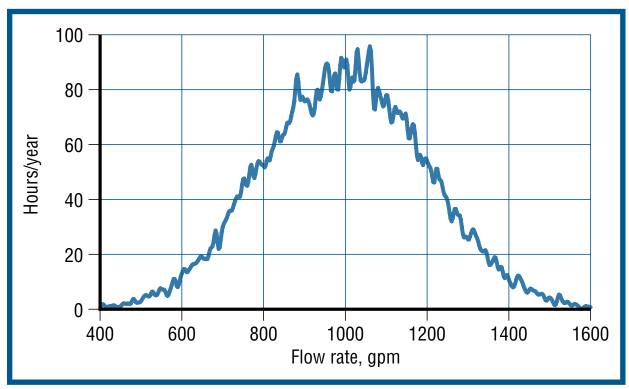

Figure 2. Example flow rate distribution curve.

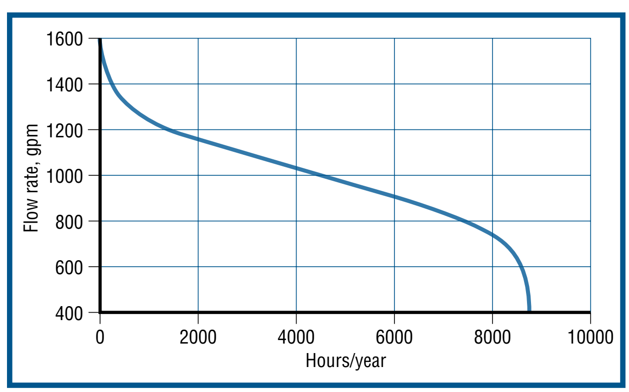

Figure 3. Flow-duration diagram for Figure 2 distribution.

Is There a Better Way?

The method Don describes above is one way to determine the flow rate for this configuration, but not necessarily the only way. Do you have another idea how it can be done? How would you run the test to get the most accurate and useful information?

*Submit your idea to the "Think Tank", an Energy Matters Extra online discussion forum at **www.oit.doe.gov/bestpractices/explore_library/emextra.** Other readers will be interested in your ideas, so we'll print some of them in an upcoming issue of* Energy Matters.

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In some field applications, the Bernoulli principle can be used, albeit in a cruder sense, to estimate flow rate by observing the pressure difference between two points in a flow path where the velocity differs. The most typical situation for this technique is when the suction lines of several parallel pumps are connected to a common header or tank, and one pump is running and one or more others are not.

Photo 1 shows an example of an actual installation where a Bernoulli-based estimate was made. Transparent plastic tubing filled with dyed water connects to the suction of two parallel pumps. Only the one on the right is running. The 16-inch suction lines for each of the two pumps connect to a common suction header (behind the test engineer).

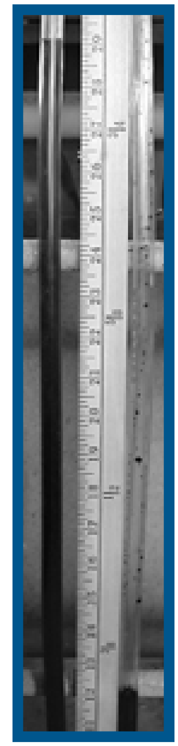

Photo 1 (above left). General layout of pump installation.

Photo 2. (above right) Plastic tubing close-up.

Photo 2 shows a close-up of the plastic tubing. A simplified flow diagram for this system section is shown in Figure 4. The difference in column elevation between the idle pump (left column) and the running pump (right column) is about 17 inches. In this case, the velocity in the idle pump's suction is zero. Thus, the difference in liquid level in the tubing is attributable to the running pump's suction line velocity. If we were to chug through the numbers, the 17 inches would correspond to a velocity of about 9.55 ft/sec, or about 5400 gpm.

But notice a tee (obscured by the gate valve body) followed by a full-open gate valve through which the fluid must traverse. We must account for the frictional losses induced by these components. Using generic values from the Hydraulic Institute (Reference 1), a total loss coefficient of 0.5 to 0.6 was estimated. Adjusted for the head loss from these components, the estimated flow rate was between 4300 and 4440 gpm.

Two other methods of estimating flow rate were used for comparison:

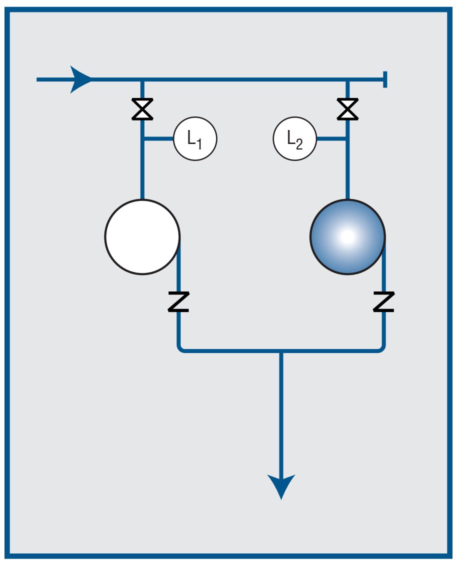

Figure 4. Simplified flow diagram for Photo 1 installation; L1 and L2 indicate locations for plastic tubing level indicators shown in Photo 2.

1. A transit time ultrasonic flow meter, which indicated 4280 gpm.
2. The pump head-capacity curve, used in conjunction with measurements of the pump discharge and suction pressures, suggested 4420 gpm.

The fact that three independent methods agreed within 4% provided strong confirmation. In my experience, one shouldn't count on field flow estimates to be more accurate than around 5% (excluding volume-based determination discussed above, which can be better than 1% under the right conditions).

Two important points can be drawn from this example:

1. Basic principles, applied with reasonable prudence, can provide at least rough indication of flow rate.
2. It is always useful to estimate flow rate by independent means. ●

E-mail Don Casada with questions or comments at: doncasada@icx.net.

References

1. Hydraulic Institute Engineering Data Book, 2nd Edition, 1990.

*A variation uses the average of the inflow rate before *and after* the pump run period.

Ask the Clearinghouse

Through the Office of Industrial Technologies (OIT) Clearinghouse, you can access the full portfolio of OIT resources to help make your industry more energy efficient, productive, and competitive. The OIT Clearinghouse can help you find hundreds of resources such as publications and software, or information about working with OIT and cost-sharing opportunities. You should also think of the Clearinghouse as a resource that specializes in providing technical advice to customers on topics such as motor, steam, and compressed air systems. The Clearinghouse also has access to industry experts around the country. Clearinghouse engineers and technical staff expertly answer a wide range of industrial efficiency questions, 11 hours a day, Monday-Friday.

Energy Matters introduces "Ask the Clearinghouse" to highlight some key questions from industrial customers on energy systems. Here is what one customer recently wanted to know, and what was recommended after consulting with CAC technical experts. It might be helpful advice for your operation, too.

Q: We plan to purchase a new 75-hp rotary screw compressor with inlet valve modulation followed by unloading power controls. "Manufacturer A" claims its unit will deliver 20 cfm more than the unit proposed by its competitor. Is this the most efficient compressor?

A: A compressor with a full-load capacity of 20 cfm more than another having the same power consumption is more efficient *at full load* than the other. However, a compressor with modulation followed by unloading controls uses a throttle, turn, or poppet valve to modulate airflow to match plant air requirements. The compressor unloads when the plant air requirements fall below the unload point, usually about 40% of full capacity. Most rotary screw compressors unload by venting or "bleeding down" the lubricant sump/separator pressure, with the residual pressure used to provide for oil circulation. Simultaneously, a valve at the intake of the compressor closes to prevent air from being drawn into the intake. Some compressor models are equipped with low-unloaded power controls or oil circulation pumps, so they can blow down closer to atmospheric pressure.

To properly evaluate the efficiency of compressors from two manufacturers, obtain performance values taken in accordance with a standardized testing protocol. To compare "apples versus apples," obtain the specific package power for each compressor at rated conditions (kW/100 acfm), the capacity control method, the percent of full flow before unloading, the unloaded power in kW, and the sump/separator blowdown time.

Compressor power requirements, when unloaded, vary significantly because of differences in blowdown time and the residual sump pressure. Compressor A might use 30% of full load power when unloaded, while Compressor B only requires 20%. However, Compressor A might modulate to 40% of full airflow before unloading, while Compressor B unloads at about 60%. The importance of each performance characteristic depends on your system requirements and plant airflow profile.

Adequate receiver capacity is required to obtain the benefits of load/unload capacity control. To determine the most efficient compressor for your application, you must first determine your air flow requirements, then estimate the percentage of operating time that each compressor would run fully loaded, modulated, and unloaded. Annual energy consumption (kWh) is calculated by multiplying the number of hours in each operating mode times the appropriate power.

Compressed Air Challenge™ training materials include graphs of the different control strategies, and the training sessions are recommended for a better understanding of compressors and the systems in which they operate. For more about Compressed Air Challenge™ materials and training dates go to **www.oit.doe.gov/bestpractices/compressed_air.** ●

Call the OIT Clearinghouse at (800) 862-2086, or go to ***www.oit.doe.gov/clearinghouse*** *for additional information.*

BestPractices Tools—Knowledge at Your Fingertips

NEW

Now Featuring: Pump System Assessment Tool (PSAT)

BestPractices keeps knowledge at your fingertips with its collection of software and database tools. One of these tools, the Pump System Assessment Tool (PSAT), helps industrial users assess the efficiency of pumping system operations. PSAT software uses achievable pump performance data from the Hydraulic Institute standards and motor performance data from the *MotorMaster+* database to calculate potential energy and associated cost savings. Using PSAT, industrial users can measure flow rate, head, speed, power, and duration to find ways to quantify savings opportunities. This downloadable software is available online at **www.oit.doe.gov/bestpractices/software_databases/software.shtml.** ●

Find out about upcoming PSAT training dates on the Energy Matters Extra calendar at **www.oit.doe.gov/bestpractices/explore_library/emextra.** ●

Uncover "New" Tools and Resources for Improving Steam Systems

What was true 50 years ago about steam system efficiency still applies today—many economic opportunities exist to improve industrial steam systems. The idea seems new again, though, as industry becomes more aware of opportunities and techniques to improve steam systems.

OIT's Steam BestPractices aims to renew the concept by helping steam users adopt a systems approach to managing steam. Fred Hart, OIT's Steam BestPractices Manager, explains the importance of a systems approach: "Significant savings can be obtained from 'low-hanging fruit'—boiler tune-ups, traps, leaks, and insulation." But, Hart says, "Looking at the steam system across generation, distribution, and recovery will yield savings and increased productivity, reliability, and safety."

> "Looking at the steam system across generation, distribution, and recovery will yield savings and increased productivity, reliability, and safety."

One important way OIT's program helps steam users move toward system efficiency and improved productivity is by identifying and making available many tools and resources they need. At the recent Industrial Energy Technology Conference (IETC), in Houston, Texas, the Steam BestPractices team described an extensive group of steam tools and resources brought together through the program. The presentation, "Steam BestPractices Resources and Tools: 'Old' News Is 'New' News," emphasized the benefits of having information from many sources available in one place. The tools and resources are easily accessible and usable—that's something new.

"There have been lots of discussions about steam over the years," explains Anthony Wright of the Steam BestPractices program, who coauthored the presentation. "A lot of information is available, from many sources, on opportunities to improve steam systems. The idea of one-stop shopping makes it less overwhelming," Wright adds.

What is Available?

Among the resources Steam BestPractices has compiled are:

- **Technical tools and information,** including technical references; steam tips that provide a description and specific actions for implementing an improvement; insulation thickness software; and an energy efficiency handbook.
- **Case studies** that provide detailed descriptions that document steam improvement projects, their energy-savings and cost benefits, and demonstrate opportunities for improving steam systems.
- **Training information** that describes 80 steam training courses provided by 31 organizations throughout the United States.
- **Awareness resources,** such as the BestPractices Web site; the OIT Information Clearinghouse; the *Steaming Ahead* newsletter; *Energy Matters* newsletter; and Steam Awareness workshops that help steam users and service providers stay current on Steam BestPractices efforts.

How to Access Resources

All of the steam systems tools and resources brought together by Steam BestPractices can be found on the BestPractices Web site at **www.oit.doe.gov/bestpractices/steam.** Steam users should tap in to these resources as part of a new approach—a systems approach—to improve steam efficiency and enhance productivity in their plants.

What Others are Doing

At the April 2000 IETC, some companies and service providers described what they are doing to help customers achieve steam efficiency and savings. For example, Nalco Chemical Company offers its customers a 7-step method for implementing boiler best practices to achieve plant-wide benefits. One customer expects to reap benefits of more than $1.3 million in operational savings and improved profits. In another example, Enbridge Consumers Gas, a natural gas distributor, began a program to identify steam efficiency and fuel savings opportunities for its steam customers. The program has identified $4.3 million in savings from audits of 30 steam plants.

These two steam efficiency presentations from IETC are available on Energy Matters Extra at ***www.oit.doe.gov/bestpractices/explore_library/emextra.*** *Find out how these companies have helped their industrial customers improve steam systems. A similar approach might be the answer for your company and service provider.*

You can find the OIT presentation "Steam BestPractices Resources and Tools: 'Old' News Is 'New' News" on Energy Matters Extra at **www.oit.doe.gov/bestpractices/explore_library/emextra.** ●

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needed to take samples. Predicting slopping and then taking preventive measures increases yield and safety.

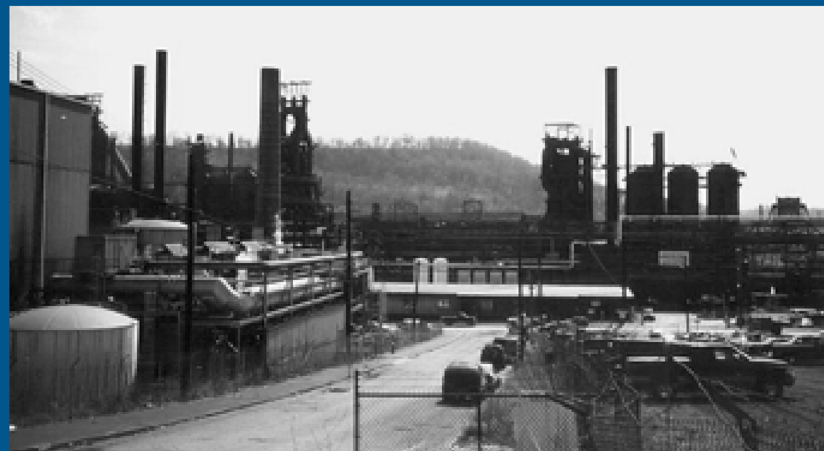
Many of the demonstrated technologies are too new yet to quantify savings, although savings will be documented as part of the projects. Still, U.S. Steel is already achieving increases in productivity and decreases in the amount of maintenance required in their processes. "The showcase gives us the opportunity to apply continuous improvements to our steelmaking processes," says Bill Federoff, U.S. Steel's Power, Steel, and Environmental Facilities Supervisor. "Even though some of the technologies may still be experimental, once they're installed at the plant for the showcase, we get to keep the equipment and the technologies and their resulting improvements permanently."

Strengthening Profits at Weirton Steel

Howard Snyder, Weirton's Technical Director of Operations, is similarly positive about his company's experience with the showcase and with the new technologies that have been implemented at Weirton's facilities. "The technologies that have already been installed have resulted in energy savings and productivity increases," says Snyder.

In 1997 and 1998, with DOE's assistance, Weirton upgraded its control systems to replace antiquated equipment with modern, computer-controlled systems that are monitored from a central location. The successful implementation of this project improved both the productivity and efficiency of the plant's steam and electrical generating facilities. What formerly required 110 operators to manually monitor and adjust now requires just two computer operators. The company has saved more than $17 million annually from reductions in purchased fuels and maintenance costs, resulting in a project payback of less than one year.

With the success of this project, the staff at Weirton has taken on several new projects, many of which were highlighted during the showcase. These unique technologies include:



Plant improvements have saved Weirton Steel more than $17 million annually in fuel and maintenance costs.

- **A galvanneal temperature measure system** is a fluorescence-based system that allows Weirton to achieve more accurate and repeatable strip temperature measurements and better real-time adjustments, resulting in improved quality.
- **Nickel aluminide burner tubes and furnace rolls** can continuously withstand the 1800°F temperatures inside the annealing furnaces, maintain strength, and provide increased life. The new rolls and tubes provide greater heating efficiency and safety, and also prevent the loss of millions of Btu per hour.
- **Compressed air improvements** consisted of replacing six aging compressors at Weirton's Tin Mill with five 350-hp rotary screw compressors, and sequencing them to respond more appropriately to system demands. A dedicated 100-hp, lubricant-free compressor was installed to purify the air used in the coating process. These system improvements are expected to save about $136,000 annually in energy and maintenance costs, and have dramatically improved product quality. (See page 4 for more.)

With OIT's help, Weirton also recently discovered that insulating steam pipes could result in significant energy savings. After applying *3E Plus Insulation Thickness* software, Weirton realized that for every 100 feet of piping insulated, energy savings could be $19,000 each year. In addition, a review by OIT's BestPractices staff confirmed that, with proper level control, the boiler at the basic oxygen furnace could be operated with a single pump, dropping energy consumption by about 2/3 of the original level. Snyder and his team plan to continue implementing these and other energy efficiency technologies at Weirton Steel's plants and have several projects in progress or planned for the next few months.

"Even the simple improvements have helped increase the awareness at Weirton about how energy costs affect the cost of a ton of steel," explains Snyder. "My business plan targets a certain cost per ton of steel, and energy and process efficiency improvements like these help reduce those costs, improve our steel quality, and increase our profit margin."

Forging Partnerships for the Future

Both U.S. Steel Group and Weirton Steel Corporation have been working with OIT for several years, with the help of AISI. Based on their successes to date, both plan to continue those partnerships for the foreseeable future. The positive relationship with OIT that both companies have experienced is summed up nicely by Snyder. "The expertise that OIT brings to the table is invaluable. They help us pinpoint projects with a short payback that we might otherwise overlook. It's a good partnership." ●

*Download 3E Plus software used by Weirton at **www.oit.doe.gov/bestpractices/software_databases/software.shtml.***

BestPractices Debuts

With a goal of plant-wide improvements in costs and energy efficiency, the Office of Industrial Technologies (OIT) has rolled out the BestPractices initiative. This new approach provides integrated delivery of energy-saving products, services, and technologies to help industry increase efficiency, reduce waste, and boost productivity.

All the resources, tools, and expertise that previously made up OIT's Challenge programs—Motor Challenge, Steam Challenge, Compressed Air Challenge, and the Industrial Assessment Centers—are now part of BestPractices. OIT has brought together a BestPractices team to help plants take a look at energy-consuming components as part of a total system where significant savings can be achieved and emerging technologies best applied. The team also includes IOF industry representatives who provide specific knowledge of energy savings opportunities and emerging technology needs valued by their industries. Working with BestPractices, industries can tap into technical assistance and explore technology solutions to improve industrial processes.

One way to tap in is through the new BestPractices Web site, which encompasses the program's array of resources. Whether you want to assess your plant, are interested learning from other plants' successes, or you want to explore an extensive library of technical tools and publications, begin at **www.oit.doe.gov/bestpractices.**

Another way to find out about plant efficiency opportunities is through *Energy Matters*. The newsletter will focus on plant-wide benefits industry can gain from improvements to energy consuming systems. In addition, future issues will introduce OIT-supported emerging technologies that could work in a plant like yours. To reflect the new approach, we've launched two new features—Ask the Clearinghouse and BestPractices Tools (see page 8)—that highlight some BestPractices resources. We've also updated the newsletter's look.

BestPractices is OIT's new and improved way of delivering products and services to industrial customers. It's part of an ongoing effort to assist industry in applying energy smart technology for today—and the future. ●

Letters to the Editor

Energy Matters welcomes your typewritten letters and e-mails. Please include your full name, address, organization, and phone number, and limit comments to 200 words. Address correspondence to:

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We publish letters of interest to our readers on related topics, comments, or criticisms/corrections of a technical nature. Preference is given to letters relating to articles that appeared in the previous two issues. Letters may be edited for clarity, length, and style.

***Energy Matters* columnist Don Casada received this inquiry from one of our readers:**

I am trying to get a better understanding of what systems use control valves and how the control valve system works, i.e., for flow control or otherwise. Are there any good references that explain the purpose of flow control valves and the general design concepts around using them for flow control?

Craig Forsyth, P.Eng.
Senior Industrial Systems Engineer
Business Engineering Services
Manitoba Hydro
Winnipeg, Manitoba, Canada

We've summarized Don's reply to Mr. Forsyth:

The ISA Handbook of Control Valves, edited by J.W. Hutchison has good coverage of control valve types and issues. A more recent book, entitled *Valve Handbook,* by Philip W. Skousen, addresses a broader spectrum of valves, including check, manual, and relief valves. But first, I'd encourage you to see what some of the valve vendors have available, particularly if their stuff is free!

A caution: valves that have good control characteristics are usually high-loss valves, even when full open. Where the system is operating most or all of the time and the flow rate (and/or head) varies considerably, consider adjustable speed drives for flow control. When making the switch, also consider replacing the existing control valve with a lower loss valve (e.g., replace the globe with a butterfly). *Read more about control valve replacement in a previous Performance Optimization Tips article on Energy Matters Extra:* ***www.oit.doe.gov/bestpractices/explore_library/emextra/casada_july98.shtml.***

Mac Smith, guest columnist in the January/February 2000 issue, received several positive comments about his article on Reliability Centered Maintenance. Here are a few of them:

Your explanations on RCM are simple and to the point! The concepts are powerful and timely as ever.

Terrence O'Hanlon
Reliabilityweb.com
Blair, NE

Great article. Hope to start implementing such a program.

Phillip Koundakjian, Treatment Manager
Des Moines Wastewater Reclamation Facility
Des Moines, IA

(Editor's note: Mr. Koundakjian expresses his own opinion and not any present or future policy of his employer.)

Your article was well written and right on target. The RCM approach not only makes sense in the reliability/maintenance domain, but is in many ways analogous to the systems approach we recommend in looking for energy savings opportunities.

Don Casada
OIT Best Practices Program
Knoxville, TN

Back issues of Energy Matters *are on Energy Matters Extra at* ***www.oit.doe.gov/bestpractices/explore_library/emextra.***

Coming Events

Capturing the Value of Steam Efficiency

- August 25 in Atlanta, GA
- September 15 in Charlotte, NC

Call the OIT Clearinghouse at (800) 862-2086 for information.

Fundamentals of Compressed Air Systems

- August 17, Morristown, NJ, GPU Headquarters

Call Karen Paine of GPU (973) 401-8544 for registration information.

- September 7 in Yakima, WA
- September 12 in Bend, OR

Call the OIT Clearinghouse at (800) 862-2086 for information.

- September 14 in Eatontown, NJ, Eatontown Sheraton

Call Karen Paine of GPU (973) 401-8544 for registration information.

- September 27 in Boise, ID

Call the OIT Clearinghouse at (800) 862-2086 for information.

Pump Systems/Pumping System Assessment Tool Workshop (PSAT)

- September 11, Louisville, KY, Pump Users Expo

Call Vestal Tutterow at (202) 484-0884, ext. 108 for information.

To keep up-to-date on OIT training and other events, check the calendar regularly on Energy Matters Extra at ***www.oit.doe.gov/bestpractices/explore_library/emextra.***

BestPractices

The Office of Industrial Technologies (OIT) BestPractices initiative and its *Energy Matters* newsletter introduces industrial end users to emerging technologies and well-proven, cost-saving opportunities in motor, steam, compressed air, and other plant-wide systems. For overview information and to keep current on what is happening office wide, check out the newsletter—The OIT Times—at www.oit.doe.gov/oit-times.

Information Clearinghouse

Do you have questions about using energy-efficient process and utility systems in your industrial facility? Call the OIT Information Clearinghouse for answers, Monday through Friday 9:00 a.m. to 8:00 p.m. (EST).

HOTLINE: (800) 862-2086

Fax: (360) 586-8303, or access our homepage at www.oit.doe.gov/clearinghouse.

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