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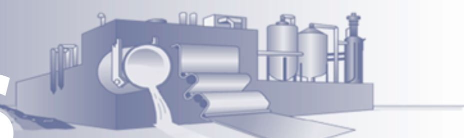
INDUSTRIAL TECHNOLOGIES PROGRAM



Winter 2004

ISSUE FOCUS:
The Value of Training

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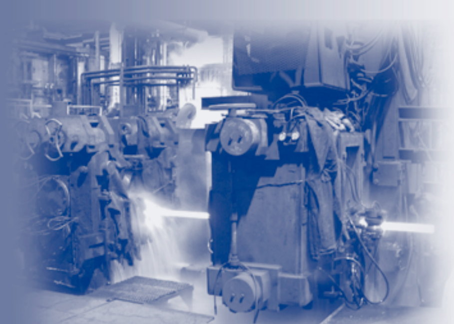

Energy efficiency, increased productivity, and reduced waste at North Star Steel page 5.

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Miami Device: Data Loggers Help IAC Team Identify Wasted Power

When the University of Miami's Industrial Assessment Center evaluated one Florida manufacturer's energy consumption recently, it reached a startling conclusion. More than 40% of the 107,000-square-foot facility's electrical power usage was taking place during the 12 hours between 6:00 pm and 5:59 am. But these were overnight hours when the plant was idle. The University of Miami team calculated the plant was spending nearly $90,000 a year for roughly 1,850,000 kilowatt-hours of electricity (the equivalent of producing 4.2 million pounds of greenhouse gas emissions each year), all of it consumed when no manufacturing was taking place.

The University of Miami research team made its finding after studying energy use data gathered by data loggers, which the team installed during a detailed plant-wide energy assessment. Assessments are done as part of the Industrial Technologies Program's Industrial Assessment Center (IAC) effort, available to small manufacturers in Florida and in many places nationwide.

As part of its program, the University of Miami's energy monitors are attached to electrical devices throughout a participating Florida-based manufacturer's facility. Once in place, the devices log how much energy each major piece of electrical equipment uses. Data are collected every 24 seconds for a full seven days.

At the start of its assessment, the research team typically installs at least 18 and as many as 120 data loggers in a plant. At a minimum, each electrical main disconnect is monitored with one logger per phase. Additional monitors may be installed on equipment such as chillers, air conditioning units, compressors, and motors.

With 18 data loggers in place, as many as 450,000 pieces of data can be collected over the course of a week. With 120 loggers installed, the data points can exceed 3 million. Armed with this raw energy consumption data, the University of Miami IAC team uses a custom-designed software program known as LIBERTAD (Spanish for "freedom") to estimate a plant's annual energy use and related expenses.

Ghost Power

And because the data loggers record energy consumption every 24 seconds for seven days, the IAC team is also able to build a detailed energy usage profile for each day. (See the accompanying table.) The evaluation software divides each 24-hour period into four 6-hour segments. These are known as "Gate Power," which lasts from 6:00 am to 11:59 am; "Stretch Power," from 12:00 pm to 5:59 pm; "Red-Eye Power," from 6:00 pm to 11:59 pm; and "Ghost Power," which lasts from 12:00 am to 5:59 am.

The software is also designed to account for any on-peak and off-peak energy pricing during each of the four daily segments. When all the data are analyzed, the resulting summary table looks like the one reproduced here, completed for an actual manufacturing facility. Using the table, plant managers can see how much energy their plant consumes every day of the week, and how much that consumption costs. The data are also used to estimate annual energy consumption and expenses.

(continued on page 2) ▶

Is Your Plant IAC Eligible?

To be eligible for an IAC assessment, a manufacturing plant must meet the following criteria:

- Within Standard Industrial Codes (SIC) 20-39
- Within 150 miles of a host campus
- Gross annual sales below $100 million
- Fewer than 500 employees at the plant site
- Annual energy bills more than $100,000 and less than $2 million
- No professional in-house staff to perform the assessment

Miami Device: Data Loggers Help IAC Team Identify Waste Power *continued from page 1*

Annual Consumption of Electrical Energy in U.S. Dollars

	Gate Power 6:00 am to 11:59 am				Stretch Power 12:00 pm to 5:59 pm				Red-Eye Power 6:00 pm to 11:59 pm				Ghost Power 12:00 am to 5:59 am			
	On-Peak		Off-Peak		On-Peak		Off-Peak		On-Peak		Off-Peak		On-Peak		Off-Peak	
Days	%	Cost ($)	%	Cost($)	%	Cost ($)	%	Cost($)	%	Cost ($)	%	Cost ($)	%	Cost ($)	%	Cost ($)
Sat.	0.00	0.00	2.19	4,765.00	0.00	0.00	2.29	4,987.10	0.00	0.00	2.06	4,478.70	0.00	0.00	1.96	4,270.80
Sun.	0.00	0.00	1.54	3,348.00	0.00	0.00	1.59	3,458.90	0.00	0.00	1.44	3,127.60	0.00	0.00	1.96	4,260.20
Mon.	1.28	2,793.50	3.98	8,657.00	3.43	7,456.60	2.10	4,572.70	2.37	5,167.00	1.56	3,386.40	0.00	0.00	2.03	4,418.20
Tues	1.29	2,811.60	3.96	8,620.00	3.53	7,690.80	2.17	4,716.30	2.49	5,412.10	1.51	3,285.30	0.00	0.00	3.15	6,847.70
Wed.	1.26	2,732.00	3.86	8,406.00	3.34	7,279.30	2.05	4,463.90	2.46	5,362.70	1.58	3,446.30	0.00	0.00	3.14	6,838.00
Thrs.	1.29	2,798.40	4.01	8,718.00	3.49	7,602.00	2.14	4,661.80	2.48	5,392.50	1.62	3,523.50	0.00	0.00	3.36	7,320.40
Fri.	1.10	2,394.80	3.32	7,218.00	2.62	5,697.90	1.61	3,494.20	1.37	2,989.80	0.87	1,883.00	0.00	0.00	3.16	6,874.40
Total	6.22	13,530.30	22.85	49,732.00	16.42	35,726.60	13.95	30,354.90	11.18	24,324.20	10.63	23,130.80	0.00	0.00	18.76	40,829.70

For example, data loggers installed at the Florida manufacturer showed the plant had an annual energy consumption profile that looked like this:

- Ghost Power: 19% of total consumption at a cost of $41,000
- Gate Power: 29% of total consumption at a cost of $63,500
- Stretch Power: 30% of total consumption at a cost of $66,000
- Red-Eye Power: 22% of total consumption at a cost of $47,000.

This particular manufacturing facility was approximately 107,000 square feet in size (30,000 of offices and 77,000 square feet of manufacturing space). The entire facility was air-conditioned.

The University of Miami's IAC is one of 26 university-based IACs located around the country. Dr. Shihab Asfour, chairman of the Department of Industrial Engineering, directs Miami's IAC. He says the Miami IAC has been in existence for four years and has been using data loggers as part of its energy assessment strategy for 18 months.

No-Cost Assessments

Nationally, the IAC program provides small- and medium-sized manufacturers with no-cost individual assessments of their plant's energy, waste, and productivity efficiency, followed by recommendations for specific cost savings.

These assessments are conducted by engineering faculty and students from IACs hosted by 26 universities across the United States. The Industrial Technologies Program sponsors the program as part of its efforts to transfer energy-efficiency and environmentally sound practices and technologies to U.S. industry.

Assessments are provided at no direct cost to participating manufacturers, who are under no obligation to act on any recommendations. On average, recommended actions from an assessment result in annual cost savings of about $55,000. The university-based IAC team typically conducts the assessment during a 1- or 2-day site visit. Within 60 days the team will send a report to the client detailing its analyses, findings, and recommendations.

To find out if your company is eligible to benefit from the IAC program, check the IAC Web site at www.oit.doe.gov/iac. Dr. Asfour may be reached at sasfour@miami.edu.●

Fostering Good Habits Through Planned and Proactive Training

Adam Hudson and Christopher Russell
Alliance to Save Energy

Not long a go, we participated in an industrial steam training program. The class instructors discussed industrial boiler operations and safety. Each attendee came to learn something different. Most came to find ways to improve the operations of their respective plants to save money.

Our instructor, a self-proclaimed "boiler Q-tip", had a great deal of knowledge, and, perhaps more importantly, practical experience to share with us. The topics we covered included the function of boilers and their various components, characterizing and

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Comments?

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accounting for system losses, and boiler safety and code compliance.

Along with technical instruction on boilers, our instructor shared many stories of hard-won lessons in boiler function and malfunction. Since most of the attendees were operators, the class taught primarily hands-on, usable theory supplemented with some technical information. Attendees were also given methods for quantifying system losses in dollar amounts

Students were exposed to projects and solutions in areas they had not previously considered. Instead of looking for savings through infrastructure changes, many operators will save money through simple changes in procedure and maintenance. An understanding of the steam system through training will allow these operators to anticipate problems instead of waiting for them to occur.

Workplace Culture

One of the most important lessons we learned was the value of training. The workplace isn't only an environment but also a culture. Without proper guidance, the workplace can become a culture of bad habits. When employees lack an understanding of all aspects of the steam system, they can't see the impact their actions have on the system. Under pressure to meet production goals, employees may use a quick fix to address a serious problem, not understanding the implications of such an action.

Whether they realize it or not, operators at industrial plants will receive some sort of "training" during their career. This training can be through a formal program, through mentoring by more experienced operators, or through the "school of hard knocks." For an operator to know how to maintain a steam system and how to address failures and malfunctions effectively, a plant must be sure of the quality and method of training. An ad hoc, improvised training program will result in ad hoc results. The value of planned and proactive training is found in the creation of competent, effective, and proactive plant operators.

Interested in improving the efficiency of your plant's compressed air, motor, pump, steam, and process heating systems? The Industrial Technologies Program offers system-wide and component-specific best practices training programs to help you run your plant more efficiently. Training is offered throughout the year and around the country. For a current calendar of training, as well as training locations, visit www.oit.doe.gov/bestpractices/training/.

The Value of Training

The value of a planned, proactive training program is the creation of competent, effective, and proactive plant operators, who can anticipate problems to ensure plant efficiency, reliability, cost-savings, and safety

For example, one steel company offered hands-on safety awareness training and supervisor safety training. In three years, recordable accidents decreased by 25% a year (63% overall). There also was a 75% increase in worker's perception that they had some influence over co-worker safety

The lesson? Planned, high-quality training leads to proactive and effective operators.

Lunching on Leftovers

Don Casada
Diagnostic Solutions, LLC

The DOE provides a system-level prescreening methodology whose goal is to highlight the most likely targets for energy-cost reduction in motor-driven pumping systems. Much of this process has been previously covered in *Energy Matters* [1, 2]. Although the methodology is specific to pumping systems, the same basic concepts apply in many other types of systems.

The first two steps in the process narrow the focus to larger loads that run most of the time. Specific symptoms are then explored. The overall goal is to set the table with energy-reduction dishes that are likely to provide a feast of energy savings.

Does this mean that no energy-cost reduction opportunities exist in the "leftover" systems; namely, those that use smaller components, or those that run infrequently? The answer, of course, is no. This article explores a couple of areas that are explicitly excluded from more detailed system-level review.

Component-Level Opportunities

Two important efficiency-size relationships are common in most energy-related components:

- Efficiency increases as the component size increases
- The gap between top-of-the-line and average-grade component efficiencies generally shrinks as size increases.

Such is the case for motors and pumps. Figure 1 shows typical top-of-line pump and motor efficiencies as a function of size. Figure 2 illustrates representative gaps between high- and medium-pump [3] and motor efficiencies as a function of size.

While the efficiency gap between average and top-of-line performance equipment is larger for the smaller sizes, the gap is very small relative to the types of overall system efficiency improvements that would be pursued by the prescreening process. I usually expect to find 20% or greater systems-level savings opportunities in systems that have been flagged by the prescreening process. This is roughly an order of magnitude greater than the gap in component efficiencies shown in Figure 2.

But the fact that a gap exists points to the merits of implementing good standard policies and practices, such as purchasing policies that take energy considerations into account (including those for smaller components).

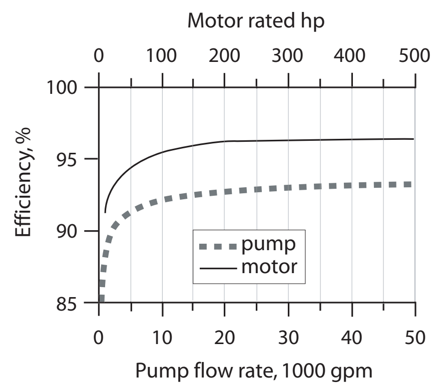

Figure 1. Approximate top-of-line pump and motor efficiencies

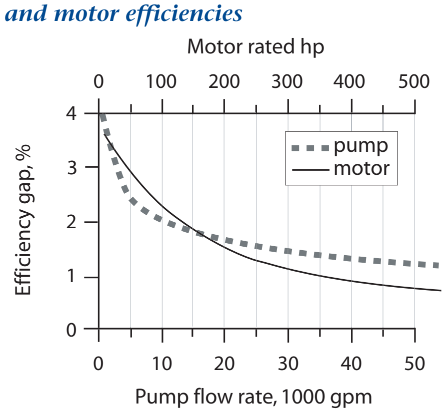

Figure 2. Approximate gaps between top-of-line and average pump and motor efficiencies

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The basis for not including systems that seldom run is obvious: they use less energy than comparably sized systems that run most of the time.

But energy and energy cost aren't necessarily related on a straight-line basis. Many industrial, municipal, and large commercial rates include demand and power factor charges. These non-energy-charge components can be significant parts of the overall bill. (For a brief discussion of these elements see the current issue of *Energy Matters Extra* at www.oit.doe.gov/bestpractices/energymatters/emextra/).

There are almost as many ways of assessing demand and power factor charges as there are utilities. But to illustrate what the charges can mean, we'll use a pair of example rate structures, shown in Table 1. The energy charge rate for customers in the Schedule A territory is half the rate for those in Schedule B. Note that the demand charge for Schedule B is applied to the peak true power (kilowatts—kW) instead of the peak apparent power (kilovolt-amperes—kVA) used in Schedule A.

TABLE 1. RATE STRUCTURES FOR INDUSTRIAL CUSTOMERS IN TWO DIFFERENT PARTS OF THE COUNTRY

Schedule	A	B
Energy rate	$0.019/kWh	$0.038/kW
Demand rate (30-minute peak)	$7.00/kVA	$7.00/kW

In addition to comparing the cost of operating under two rate schedules, let's use a pump that is optionally driven by either a 150 horsepower (hp) energy-efficient motor, or a 200hp premium-efficiency open drip-proof motor. The fluid and electrical conditions specified in Table 2 are based on manufacturer-reported performance characteristics. Note that the larger premium-efficiency motor will operate at a higher speed; the pump fluid and power requirements are adjusted according to the centrifugal affinity laws.

The annual costs of operating the selected pump under the two rate structures and the two different motor sets are shown in Table 3 for several assumed operating times. Several items are noteworthy. First, the premium-efficiency motor costs more to run than the energy-efficient motor. This is true even though it is 1% more efficient. There are two reasons for this:

- The 200-hp motor operates at a higher speed than the 150-hp motor when connected to the same equipment. Since this is a centrifugal pump, the shaft load is proportional to the cube of the speed. This speed difference essentially negates the greater efficiency, as indicated by the electrical power for the alternative motors in Table 2.
- The slightly lower power factor with the 200-hp motor results in the apparent power (kVA) being greater than for the 150-hp motor. The demand charge for Schedule A, which is kVA-based, implicitly penalizes the lower power factor.

Another notable feature is that while Schedule A is clearly less costly for equipment that runs a lot, it is more expensive than under Schedule B for equipment that runs a relatively small amount of the time.

Perhaps the most interesting feature is the significant cost that can be incurred when operating times are low. The demand componet accounts for 60-80% of the pump's total electrical cost if the pump is only operated 4 hours a day.

An inherent assumption in calculating these costs is that the demand associated with this particular load is coincident with the 30-minute monthly peak demand. Of course, that may or may not be true. But unless some sort of active control is exercised to specifically avoid running this pump during periods when the combined sum of the other plant loads are at or near the maximum, chances are excellent that the pump will, in fact, add to the load.

But that points toward the potential savings associated with an active control scheme that monitors the overall plant demand and regulates those seldom-used loads that can be operated in a flexible manner, time-wise. If it is feasible to move the operation of seldom-used equipment to periods when they will not add to the monthly peak, significant annual savings can result (the "Demand Component" on the last line of Table 3). This is certainly not a trivial amount. Furthermore, it could prove more important, cost-savings-wise, than anything we'd be likely to find in terms of the overall system optimization of this size that runs all of the time.

Moving the times when seldom-used equipment is operated may not save a single watt-hour of energy, but it can be an excellent option to consider in terms of reducing energy costs. Seldom-run loads that can be operated flexibly may not yield the feast that a systems-based approach does, but leftovers can be pretty tasty, too.

TABLE 3. ANNUAL OPERATING COSTS FOR TABLE 1 RATE SCHEDULES AND TABLE 2 CONDITIONS

*Hours per day	% of time running	Schedule A 150-hp EE motor	Schedule A 200-hp PE motor	Schedule B 150-hp EE motor	Schedule B 200-hp PE motor
24	100	$31,010	$31,272	$48,946	$48,929
20	83	$27,753	$28.016	$42,432	$42,418
16	67	$24,496	$24,760	$35,918	$35,906
12	50	$21,239	$21,505	$29,404	$29,394
8	33	$17,982	$18,249	$22,890	$22,882
4	17	$14,725	$14,993	$16,376	$16,371
1	4	$12,282	$12,551	$11,491	$11,487
Demand Component		$11,469	$11,737	$9,862	$9,859

TABLE 2. ELECTRICAL AND FLUID DATA FOR THE SAME PUMP WHEN OPERATED BY TWO DIFFERENT MOTORS

Motor rated hp	Motor efficiency class	Speed, rpm	Flow rate, gpm	Head, ft	Pump efficiency	Shaft power, hp	Motor efficiency	Power factor	True electric power, kW	Apparent power, kVA
150	Energy efficient	1,783	3,000	150	76.0%	149.5	95.0%	86%	117.41	136.53
200	Premium efficiency	1,789	3,010	151	76.0%	151.0	96.0%	84%	117.37	139.72

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Achieving Immediate Savings by Taking a Systems Approach to Compressed Air

Ram K. Kondapi, CPE, Chief Project Engineer, Crucible Specialty Metals

Compressed air is a utility that is generated in-house and is often referred to as the "fourth utility." Because it is generated on-site, you have more control over it than any other utility.

Paying attention to your compressed air system can lead to a number of benefits, including improved efficiency, reduced costs, and increased productivity and reliability. In turn, these benefits can lead to improved competitiveness, less downtime, and greater return on investment.

As an example of what can be accomplished through the application of a systems-based approach, recommended by the Compressed Air Challenge (CAC), Crucible Specialty Metals recently completed a comprehensive plant-wide study of compressed air generation, distribution, and usage at its main plant in Syracuse, New York. The study was funded by the New York State Energy Research and Development Agency (NYSERDA) and DOE, and included in-kind participation from Crucible's staff. Also participating was Tom Taranto of ConservAir Technologies LLP, a Senior AIRMaster+ Instructor, Qualified AIRMaster+ Specialist, certified CAC Instructor, and co-developer of the DOE curriculum to qualify AIRMaster+ Specialists.

Collecting Data

Before the study began, instrumentation was installed at key locations within the plant's compressed air piping. This was done to monitor pressure and flow through major subsectors of the system. Along with pressure and flow instrumentation, kilowatt metering equipment was installed on four major compressors servicing the plant. Data were collected over a 2-week period, representative of typical plant operations. Data were also collected during a facility walk-through. Both sets of data were used to analyze and plot pressure and flow patterns for each of the major sectors, compressor cycling, and kilowatt power usage by each of the compressors servicing these sectors.

The study team was able to:

- Develop compressed air generation costs for each generation point as well as a plant-wide overall average generation cost.
- Outline a strategy to shut down the oldest and least efficient plant compressor and improve the utilization of other existing compressors. As part of implementing this strategy, a new plant compressed air primary distribution network was planned. All compressors would connect with this new system. Buying a smaller capacity compressor was also proposed. This alternative was expected to provide improved flexibility in generation capacity to match air demand, and needed backup capacity to make it easier to schedule maintenance.
- Utilize ultrasonic leak detection methods to identify and repair major and minor air leaks resulting in overall annual net cost savings of approximately $200,000.
- Identify point-of-use applications requiring further study to determine the feasibility of replacing compressed air applications with more energy efficient alternatives. These alternatives included blowers or other means to achieve the same objective. Intermediate controls and surge tanks were also proposed to achieve sector control and prevent overall system drawdown from short-cycle high-demand operations. These measures, along with integrating plant compressed air generation into the primary backbone piping when implemented, could yield additional significant energy cost savings.
- Develop a plant-wide compressed air strategy to implement monitoring, control, and data acquisition to facilitate ongoing management of compressed air as a utility.

Crucible's pipe fitters and maintenance personnel have accomplished immediate follow-through on several cost-saving measures. In addition to the leak repairs mentioned earlier, rerouting distribution piping, equipment repair, and minor process changes have been implemented. These changes have resulted in 30% less running time on a 450 horsepower (hp) compressor, and complete shutdown of another 100hp compressor. Savings to date have been achieved with a less than $40,000 investment, leading to a less than 3-month simple payback.●

North Star Steel Completes Plant-Wide Energy Assessment at Mini-Mill

North Star Steel Co.'s Wilton, Iowa, plant recently completed a plant-wide energy assessment designed to examine potential process changes and technologies that could improve energy efficiency. If all projects were implemented, the assessment team estimated that total annual energy savings would be about 139 billion British thermal units (MMBtu) in natural gas and nearly 39 million kilowatt-hours (kWh) in electricity. Total annual cost savings would be more than $2.6 million. The estimated implementation cost for all projects would be about $8.2 million.

North Star Steel believes that the opportunities identified in the assessment and in the corresponding technical and management solution options will not only have a considerable impact on the plant's energy efficiency, but will increase productivity and reduce waste as well. Furthermore, assessment methods, data, and technical solution options will be shared with North Star Steel's other mini-mills where similar evaluations and energy or waste reduction improvement methods can be employed.

Cargill, Inc., North Star Steel's parent company, has embarked on a corporate-wide goal to reduce waste by 30% and reduce energy use by 10% by 2005. The North Star Steel plants have also adopted this goal. Total energy costs at the Wilton plant were $8.73 million for fiscal year 2000-2001. Reducing energy consumption to match Cargill's strategic goals would result in average annual savings of $873,000.

North Star Steel was founded in 1965 in St. Paul, Minnesota, and began steel scrap

(continued on page 6) ▶

recycling operations at the St. Paul mini-mill in 1967. Cargill acquired the company in 1974. North Star's operations currently include electric-arc furnace mini-mills in Beaumont, Texas; Monroe, Michigan; St. Paul, Minnesota; and Wilton, Iowa. North Star also has a steel rolling mill in Calvert City, Kentucky, a grinding-ball plant in Duluth, Minnesota, and a joint venture with BHP Steel of Australia, which operates a 1.5-million-ton-per-year flat-rolled steel mini-mill near Delta, Ohio. Since 1974, North Star's annual steel-production capacity has risen from 300,000 tons to 3.5 million tons, and employment has increased from 600 to over 3,000.

Making Steel at Wilton

The Wilton plant is a steel mini-mill that uses electric arc furnace (EAF) steelmaking and 100% recycled steel scrap to manufacture steel products. The recycled steel scrap is melted in the EAF and refined by adding alloys, carbon, and other materials. The molten steel is tapped into a preheated ladle and transferred to the tundish at the billet caster. From the tundish, the molten steel flows into molds that make square billets that are then cooled, solidified, and cut to length. The billets are stored until needed, then fed into the reheat furnace and brought to a temperature of about 2,200°F. When the correct rolling temperature is reached, the billet is passed through water-cooled roll stands where the steel is formed and shaped. The final step involves shearing the steel products into custom lengths, which are bundled together for storage. The Wilton plant produces structural steel products including flats, angles, rebar, and round-cornered squares.

A Total Assessment Audit (TAA) was used to evaluate the Wilton plant for energy savings, waste reduction, and improved productivity. TAA methodology is an integrated energy, waste, and productivity audit implemented by a team of experts chosen specifically for a particular manufacturing system facility. TAA was developed by the Iowa Energy Center (IEC) and deployed by the Iowa Manufacturing Extension Partnership (IMEP) under an IEC grant. Both IEC and IMEP, along with MidAmerican Energy Co., were partners in the Wilton assessment.

TAA team members were asked to assess the plant's chances of achieving its efficiency goal of 10% energy reduction and 30% waste reduction by 2005. The consensus was that a high probability of achieving the goals existed. North Star Steel and the TAA team members identified five areas for improvement based on pre-assessment findings:

- EAF dust reduction
- Motor program
- Melting and reheat process upgrades
- Heat recovery measures
- Overall energy planning.

These five areas were then scrutinized for ways to cut energy, reduce waste, and improve productivity. In addition to identifying projects to meet these goals, the benefits and costs of possible technological solutions or improvements were also studied.

A number of projects were identified by the plant-wide assessment (PWA) with the potential savings in energy, waste, or increased productivity. Together, these could help North Star Steel more than achieve energy-savings goals identified by Cargill Corp.

The assessment identified several potential ways to improve the energy efficiency of the electric arc melting furnace. These included the following suggestions for further investigation:

- Use more powerful transformers and long arcs, which are efficient when a foamy slag practice is used to envelop the arc (thus minimizing heat losses and arc flare damage)
- Increase productivity by minimizing power-on time
- Identify bottlenecks in scrap charging efficiency and caster productivity. Install larger magnets and/or increase the power to reduce the number of lifts per bucket; increase tundish size
- Install a More' lance system to permit carbon injection that promotes slag foaming which in turn increases the electrical efficiency of the furnace
- Increase casting speed by using longer molds and/or molds of different designs.

The potential annual energy savings were 19.8 million kWh (natural gas use will increase by 48,000 MMBtu); the potential annual cost savings were $675,000; and the implementation cost was $1,800,00.

Upgrades to the rolling mill billet reheat furnace include:

- Adding a bottom preheat zone, a top preheat zone, and replacing heat zone burners with lower capacity ultra low NOx burners
- Replacing a natural draft stack with an ejector stack
- Relocating furnace controls to the charge end of the furnace to a new control area (pulpit)
- Relocating the controls for the initial rolling operation (rougher controls) to the main pulpit

The potential annual energy savings were 26,000 MMBtu; the potential annual cost savings were $341,000 (including productivity increase and other non-energy related benefits); and the implementation cost was $3,000,000

Increasing the combustion air preheat temperature from 600°F to 900°F in the reheat furnace will increase efficiency and reduce energy consumption by about 10%. Potential annual energy savings were 62,000 MMBtu; the potential annual cost savings were $278,000; and the implementation cost was $150,000.

To learn more about the plant-wide assessments, visit http://www.oit.doe.gov/bestpractices/plant_wide_assessments.shtml. Or, contact Grace Ordaz of the Department of Energy's Industrial Technologies Program by phone at 202-586-8350 or by e-mail at grace.ordaz@ee.doe.gov. For technical details about the assessments, contact Bob Leach of the Oak Ridge National Laboratory by phone at 865-576-0361, or by e-mail at leachre@ornl.gov.

Roll mill at North Star Steel

Infrared Oven Saves Energy, Lifts Production at a Metal Finishing Plant

Progressive Powder Coating implemented a project at its metal finishing plant in Mentor, Ohio, that saved energy and increased production. The company uses a convection oven to cure its products but was experiencing bottlenecks in its production process. This was because curing thicker pieces of metal caused the conveyor line speed to slow, reducing productivity. In an effort to eliminate the production bottlenecks, Progressive Powder installed an infrared (IR) booster oven on its production line.

Because the IR oven can reach temperatures of up to 475° F, plant personnel used it to partially cure thicker pieces of metal after they left the powder booth and before they entered the convection oven. The IR oven also could fully cure many thinner pieces of metal.

Installing the oven allowed the plant to increase its conveyor line speed from 4 feet per minute to 6 feet per minute, lifting production by 50%. The IR oven also improved product quality because less powder was shaken off by the conveyor line, or blown off by the convection oven's turbulence prior to reaching gel temperature.

Through this project, the plant reduced its annual natural gas consumption by 25%, yielding annual energy savings of approximately $54,000. With a total project cost of $136,000, the simple payback was 2.5 years.

Manufacturing plants having process heating applications may benefit from installing IR heating ovens, particularly if their product mix requires varying degrees of heat treatment for different lengths of time. In the case of Progressive Powder, an IR oven was able to pre-gel and cure many types of metal pieces before they entered the convection oven. This eliminated costly production bottlenecks, which led to increased production, better product quality, and reduced energy consumption.

Since the IR oven's installation, personnel at the plant have been able to further increase production levels by using the IR oven for thinner products and exploring additional ways to fully utilize it. By optimizing the proportion of IR oven heating versus convection oven heating to deliver the highest efficiency, Progressive Powder Coatings improved the effectiveness of its production process.

To learn more about this and other kinds of energy saving techniques that can improve your plant's bottom line and overall productivity, visit the Industrial Technologies Program's home page at www.eere.energy.gov/industry. Or call the Energy Efficiency and Renewable Energy Information Center at 877-EERE-INF or 877-337-3463●

ENERGY MATTERS EXTRA

Energy Matters Extra Highlights

Go online to see the Winter issue of Energy Matters Extra, which features extra information on topics covered in this newsletter and more. Link to supplemental material from Don Casada's column on energy-cost reduction opportunities, and access the full plant-wide assessment report for North Star Steel. Learn about new reference materials that ITP is now offering, such as the Compressed Air Sourcebook, and ITP Annual Reports on energy-intensive industries. Make sure to check the training schedule to find DOE-sponsored training opportunities nearest you. And, access the newest version of AIRMaster+. You can download it directly to your computer or order it on CD. Find it all on Energy Matters Extra at http://www.oit.doe.gov/bestpractices/energymatters/emextra/.●

Attention: Decision Tools CD Users

If you have received a copy of Decision Tools for Industry: A Portfolio of Powerful Assessment Tools, dated March 2003 or December 2003, please visit the BestPractices Software Tools Web page at www.oit.doe.gov/bestpractices/software_tools.shtml to download the most current version of AirMaster+ 1.0.9.

About the Office of Energy Efficiency and Renewable Energy

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. By investing in technology breakthroughs today, our nation can look forward to a more resilient economy and secure future.

Far-reaching technology changes will be essential to America's energy future. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a portfolio of energy technologies that will:

- Conserve energy in the residential, commercial, industrial, government, and transportation sectors
- Increase and diversify energy supply, with a focus on renewable domestic sources
- Upgrade our national energy infrastructure
- Facilitate the emergence of hydrogen technologies as a vital new "energy carrier."

The Opportunities

Biomass Program
Using domestic, plant-derived resources to meet our fuel, power, and chemical needs

Building Technologies Program
Homes, schools, and businesses that use less energy, cost less to operate, and ultimately, generate as much power as they use

Distributed Energy & Electric Reliability Program
A more reliable energy infrastructure and reduced need for new power plants

Federal Energy Management Program
Leading by example, saving energy and taxpayer dollars in federal facilities

FreedomCAR & Vehicle Technologies Program
Less dependence on foreign oil, and eventual transition to an emissions-free, petroleum-free vehicle

Geothermal Technologies Program
Tapping the earth's energy to meet our heat and power needs

Hydrogen, Fuel Cells & Infrastructure Technologies Program
Paving the way toward a hydrogen economy and net-zero carbon energy future

Industrial Technologies Program
Boosting the productivity and competitiveness of U.S. industry through improvements in energy and environmental performance

Solar Energy Technology Program
Utilizing the sun's natural energy to generate electricity and provide water and space heating

Weatherization & Intergovernmental Program
Accelerating the use of today's best energy-efficient and renewable technologies in homes, communities, and businesses

Wind & Hydropower Technologies Program
Harnessing America's abundant natural resources for clean power generation

To learn more, visit ***www.eere.energy.gov***

Coming Events

FUNDAMENTALS OF COMPRESSED AIR SYSTEMS (LEVEL 1), RENO, NV

- Apr 14, 2004

For more information, contact Dirk Van Zyl at dvanzyl@mines.unr.edu or call 775-784-7039

FUNDAMENTALS OF COMPRESSED AIR SYSTEMS, ELKHART, IN

- Apr 20, 2004

For more information, contact Beth Holliday at bholliday@bmtadvantage.org or call 317-635-3058

PUMPING SYSTEM ASSESSMENT (END USER), JOLIET, IL

- Apr 22, 2004

For more information, contact Tim Owens at towens@jjc.edu or call 815-280-1513

PROCESS HEATING ASSESSMENT (END USER), HOUSTON, TX

- Apr 23, 2004

For more information, contact Kathey Ferland at kferland@mail.utexas.edu or call 512-232-4823

STEAM SYSTEM (END USER), NAPERVILLE, IL

- Jun 10, 2004

For more information, contact Debbie Bloom at dbloom@nalco.com or call 630-305-2445

BestPractices

The Industrial Technologies Program's BestPractices initiative and its *Energy Matters* newsletter introduce industrial end users to emerging technologies and well-proven, cost-saving opportunities in motor, steam, compressed air, and other plant-wide systems.

EERE INFORMATION CENTER

Do you have questions about using energy-efficient process and utility systems in your industrial facility? Call the Energy Efficiency and Renewable Energy (EERE) Information Center for answers, Monday through Friday 9:00 a.m. to 7:00 p.m. (EST).

HOTLINE: 877-EERE-INF

or 877-337-3463

DOE Regional Office Representatives

- David Godfrey, Atlanta, GA, 404-562-0568
- Scott Hutchins, Boston, MA, 617-565-9765
- Brian Olsen, Chicago, IL, 312-886-8479
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