ENERGY MATTERS

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Issue Focus: Contracted Services and Other Partnerships

In This Issue

Small Town Plastics Manufacturer Produces Big Local Energy and Cost Savings

When the Board of Public Utilities (BPU) in the small community of Salamanca, New York, wanted to impact its energy conservation program, *Energy Discoveries,* sponsored by the Municipal Electric Utility Association, they turned to Highland Injection Molding, Inc., the town's largest consumer of electricity, for help. In an effort to reduce energy consumption and keep power costs low in the area, Highland installed variable frequency drives (VFDs) on two of its injection molding machines.

By retrofitting the machines, Highland reduced energy consumption, initiating cost savings of $13,000 annually. Because of Highlands' upgrades, the local power company has also experienced an annual savings of $3,500 through avoided purchases of expensive incremental power that would otherwise be needed to supply the community with adequate power during the winter months. And, Salamanca BPU's savings are ultimately passed along to its utility customers. "The avoided kW demand and kWh consumption enable us to keep rates stable," says Jim Brundage, general manager at the BPU.

Highland, the largest industrial employer in Salamanca, manufactures plastic parts for a variety of automotive, consumer, and industrial products. To handle production, the company operates 24 machines, ranging in size from 100- to 1,200-ton press capacity, around the clock. Large amounts of energy are required where high-power hydraulic pressures are needed, but this only occurs during two stages of production. However, Highland's pump motors were operating at full capacity regardless of the stage of the press cycle, wasting energy and money in the process.

Seeking ways to reduce energy consumption, the city asked Honeywell DMC, a Motor Challenge Allied Partner, to assess the energy savings opportunity at Highland. Honeywell DMC used the *MotorMaster+* software tool to analyze Highland's energy options and determined that the greatest potential savings would come through managing the energy used by the molding machines.

In December 1996, drive units were installed on two of Highland's biggest and most frequently used presses—a 700-ton capacity molder with two 75-hp motors and an 800-ton molder with 100-hp and 60-hp motors.

Highland's molding machines benefitted from a VFD retrofit.

By early January 1997, independent monitoring performed by Technical Assistance and Services verified a 66% reduction in peak kW demand and a kWh reduction of 71%. In addition to the cost and energy savings, Highland has also noticed reductions in wear and tear on the pump motors and in the noise inside the factory now that the motors do not continually run at full tilt.

If the steps taken by Highland exemplify what a company of 130 employees can do to reduce energy consumption and impact the bottom line, larger companies can create even greater savings. According to Mike Lyons of Honeywell DMC, "The Salamanca BPU has some of the lowest rates in the country. If this project were implemented with an injection molder in a territory with more typical electricity costs, payback would be in months."

Energy Matters

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COMMENTS?

Contact:

Julia Oliver, DOE, at (510) 637-1952, or e-mail julia.oliver@oak.doe.gov

Erika Ericksen, *Energy Matters* Editor, at (303) 275-3914, or e-mail erika_ericksen@nrel.gov
1617 Cole Blvd., MS 1713
Golden, CO 80401

Technical Advances Improve Industrial Energy Efficiency

By CarolAnn Giovando, Associate Editor, POWER Magazine

Excerpted from the May 1999 issue of POWER Magazine *and reprinted with permission.*

Industrial, commercial, and institutional facilities have long recognized that energy efficiency can boost productivity, lower costs, and minimize environmental impacts. But smaller facilities, of say, less than 500 employees, often pay more for their energy, per unit of production, than larger facilities. Reasons may be that: (1) they don't qualify for large volume discounts; (2) they use less efficient equipment and processes; and/or (3) they lack the capital or technical expertise to invest in efficiency improvements.

According to DOE surveys, the potential energy savings for these facilities are substantial because small and medium-sized companies use over 42% of the energy consumed by manufacturers and represent over 98% of manufacturing plants.

Now, thanks to the power of partnerships and alliances, both large and small facilities can benefit from energy efficiency investments, even capital-intensive ones. The case studies profiled here showcase the range of today's partnerships and demonstrate how energy efficiency projects best leverage strengths and resources.

Pinch Some Pennies

Engineers at Pennzoil's Atlas Refinery in Shreveport, Louisiana, considered energy-efficiency alternatives when adding a residual catalytic cracking (RCC) unit, a gas plant, and an alkylation unit. Because the facility expansion would significantly increase the refinery's electric demand, Pennzoil looked to Southwestern Electric Power Company (Swepco), in Shreveport, for energy efficiency ideas and to provide a detailed optimization study for the new equipment.

The study used pinch technology, developed by the Electric Power Research Institute (EPRI), Palo Alto, California, for analysis and design of plant energy systems. Pinch technology tracks heat flow for all steam processes. Swepco's study uncovered opportunities to save nearly 24% of process heat through improved system integration. Financial savings were estimated at $880,000/yr in fuel and $475,000/yr in electricity, for total savings of $13.7 million over 10 years. Pennzoil incorporated several steam system optimization recommendations into the final design, including installing a 4,400-hp steam turbine to drive key equipment in the RCC steam system.

Pulp Mill Steam Recovery

Bowater Inc., Greenville, South Carolina, the world's second largest producer of newsprint and third largest producer of market pulp in North America, operates 10 pulp and paper mills and three sawmills in the United States, Canada, and Korea. One of its most successful energy savings projects recaptures steam normally lost during green-wood-chip processing. Key to the energy savings: the thermo-mechanical pulping process (TMP).

Energy formerly lost when low-pressure steam from pulp production was vented from seven refiner lines now is recaptured with two mechanical vapor recompression (MVR) heat pumps. The MVR pumps convert 19-psig steam at 250°F to 57-psig steam at 470°F, and the recaptured steam is used in paper-drying stages. The MVR pumps feature a 50% turndown, which enables rapid response to changing steam demands.

Other benefits include daily recovery of approximately 200 gallons of turpentine—a TMP byproduct—which is later resold, and controlling steam vapor upon release to the atmosphere, reducing the plant noise level. The $1.5-million investment was repaid within 1.5 years.

Upgrading Air Compressors

These days, most electric utilities are willing to help customers evaluate their manufacturing processes and suggest new technologies to cut energy consumption. Bodine Electric, Chicago, Illinois, a manufacturer of fractional-horsepower gear motors, currently saves over $100,000 a year, thanks to projects initiated by its utility, Commonwealth Edison (ComEd), in Chicago.

A key project was an upgrade of Bodine's compressed air system. The utility conducted an energy analysis and provided technical recommendations to Bodine.

Before the analysis, Bodine considered rebuilding its 10-year-old compressed air system, which powers air drivers, screwguns, and other equipment. The analysis convinced Bodine to exchange its three aging, oversized compressors for three new 75-hp units and a sequencer controller, which acts as the main control to constantly monitor and meet compressed air needs.

Contact CarolAnn Giovando at POWER Magazine *by phone (314) 436-4252, or e-mail: carolann_giovando@mcgraw-hill.com.*

Energy Service Companies: Cost-Savings Partners for Industry

As electric utilities transform themselves to meet the changing marketplace, energy users must learn a new lexicon of acronyms and abbreviations. Enterprises such as ESPs, LDCs, ISOs, PXs, UDCs, RESCOs, DISCOs, Transcos, and ESCOs operate alongside traditional electric utilities. Of these, the ESCO, or energy service company, may be the least understood, since it offers services historically outside the domain of regulated electric utilities. ESCOs also provide the broadest range of services to energy users.

What is an ESCO?

An ESCO provides energy efficiency and/or load reduction services to commercial or industrial facilities. There are, however, many types of firms providing these kinds of services. The table below shows some of the energy efficiency services offered by the various types of providers. To one degree or another, the primary goal of these energy services providers is to help their clients reduce energy expenditures through energy efficiency improvements.

Energy Services Offered by Various Types of Providers

Energy Services	ESCOs	Vendors	Contractors	A&E Design/ Build Firms	Consultants
Energy Audits	✔		✔	✔	✔
Engineering Design	✔		✔	✔	✔
Equipment Installation	✔	✔	✔	✔	
Construction and Project Management	✔		✔	✔	
Performance Monitoring and Verification	✔				✔
Performance Guarantees	✔				
Commissioning and O&M	✔	✔	✔	✔	
Financing	✔	✔			
Integrator	✔	✔			

Source: Goldman and Dayton.

The ESCO is the only type of energy services provider whose compensation depends upon energy savings. This is the "shared savings," or "performance-based" contract where the ESCO retains a portion of the value of the saved energy as compensation.

ESCOs that concentrate their efforts within the industrial sector tend to differentiate themselves by focusing within specialized industries, such as textiles or petroleum refining.

ESCO Services

ESCO projects often employ a variety of measures and technologies to achieve energy savings, including:

- High-efficiency lighting
- High-efficiency heating and air conditioning
- Efficient motors and variable speed drives
- Centralized energy management systems

ESCOs generally act as project developers and assume much of a project's risk. Typically, they offer these services:

- Develop, design, and finance energy efficiency projects.
- Install and maintain energy-efficient equipment.
- Measure, monitor, and verify the project's energy savings.
- Assume the risk of guaranteed energy savings.[1]

For manufacturing facilities with significant motor-related end uses, there are potentially large energy saving opportunities through motor system and pump system upgrades. However, resources such as time, expertise, and capital are often not available to facility management for energy efficiency projects. In addition, management may be more concerned with increasing productivity and reliability than reducing energy costs.

Energy consumers tend to look for comprehensive solutions to their operating situation instead of just energy savings. While the effort may concentrate on energy efficiency improvements, there are usually collateral improvements in reliability, process control, environmental compliance, and increased productivity associated with it.

Project Funding

One of the greatest benefits of the performance-based contract is that the ESCO supplies the project funding, which relieves the company of paying up-front capital costs. This makes the ESCO a valuable partner for facility management and ownership. In return for providing the up-front capital, the ESCO receives some portion of the measured savings that result from the project over a number of years.

Who is at Risk?

Clearly, there is risk associated with performance-based contracting, and there are many ways the ESCO and customer can share that risk. Typically, the ESCO shoulders much of the risk, since the ESCO estimates energy savings *a priori* and determines whether the savings will repay their investment. However, if the customer does not operate the project as planned, then energy savings will be less than forecasted and payback will be delayed. The same is true if the ESCO overestimates savings, even if the customer operates the project as planned. Thus, ESCOs have led the effort to measure and verify, rather than simply estimate energy savings.

When the customer is responsible for operating the equipment, the ESCO must train operating personnel in the principles of energy efficiency and proper operation. Training is also valuable to the customer, who could assume some risk if energy savings do not meet forecasts.

ESCO Accreditation

The National Association of Energy Service Companies (NAESCO) promotes the delivery of "comprehensive energy services including energy efficiency, to maximize customer benefits and environmental sustainability." Members represent several types of energy services providers.

NAESCO sponsors a rigorous accreditation program that encourages high standards of quality and integrity in members. The process is exacting enough that just over half of its eligible members have received accreditation. While accreditation indicates the ESCO is technically and managerially competent and committed to ethical business practices, it is not a guaranty of energy savings.

Energy consumers who seek total energy solutions are likely to find firms that can supply both the energy and energy-related services they need. According to Goldman and Dayton, "ESCOs that have survived (to this point) have recognized that most customers are looking for 'solutions' rather than improved energy efficiency, per se."[2]

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[1] NAESCO
[2] Goldman and Dayton

References:
1) Goldman, C.A. and D.S. Dayton. 1996. "Future Prospects for ESCOs in a Restructured Electricity Industry." *1996 ACEEE Summer Study on Energy Efficiency in Buildings*. 10.59. American Council for an Energy Efficient Economy: Washington, D.C.
2) NAESCO (National Association of Energy Service Companies) Web site, 1999.

Choosing the Right Energy Service Company to Prove the Value of Motor Upgrade Projects

By Jay Raggio, PE, CEM, Manager, Energy Services, Electro-Test Inc., Danville, CA

Imagine you're a facility engineer with responsibility for the operation and maintenance of numerous electric motors serving a variety of applications. Each time you review the monthly electric utility bill, you have an intuitive feeling that a well-planned program to upgrade your motors could save real money for your facility. You consider:

- Replacing existing motors with premium efficiency motors
- "Rightsizing" motors
- Applying variable frequency drives (VFDs)
- Installing control systems to vary motor operations.

The problem is—HOW? *How* do you develop an accurate and compelling economic model to present to financial decision-makers? The answer could be in finding the right *qualified* energy service company (ESCO).

What Can a Qualified ESCO Do?

In today's rapidly changing electric power industry, there may be more to consider than in the past. A qualified ESCO can pull all of the pieces of the puzzle together to accurately quantify the costs and benefits of potential motor upgrade projects and then provide results in a manner meaningful to your facility's financial decision-makers.

Utility Cost Savings

Often the single largest component of future benefits, utility cost savings, is difficult to project. You must begin with a solid understanding of the operational patterns of the existing equipment.

- How many hours per year does each motor operate?
- Does each motor's operation vary daily, weekly, or seasonally?
- Are there redundant motors for the same application?

A qualified ESCO can develop an accurate annual operating profile for each motor that is a candidate for upgrading. They employ "motor run-time metering," using loggers to assess motor run times during different utility costing periods.

Motor loads must also be assessed. The qualified ESCO conducts spot measurements of kilowatt demand for each motor. Because conditions such as ambient temperatures and filter cleanliness can skew measurement results (e.g. kilowatt demand), it is important to choose an ESCO that is experienced and knowledgeable in the electrical testing industry.

Motor load measurements quantify energy savings.

Your Utility's Rate Structure

Qualified ESCO's take the time to learn if your utility uses an "energy charge rate" and a "demand charge," both of which can vary daily and seasonally. They should know the current rate structures and know when rate changes may come about as a result of pending competition.

Overlaying motor operating profiles and energy demands creates an "energy consumption profile" that, when applied to the "utility pricing profile," estimates energy costs attributable to motor operation. From this "baseline," the ESCO can evaluate the cost-effectiveness of various scenarios for motor, VFD, and controls retrofits.

Traditional Utility Rebates

Your local utility may offer financial rebates for new efficient motors, VFDs, and controls. A qualified ESCO will carefully evaluate potential rebates as these programs can change dramatically from year to year. The ESCO should be knowledgeable about these rebate program nuances.

Performance-Based Energy Savings Incentives

"Performance-based incentives" offer financial incentives tied directly to the actual amount of energy savings produced by the new equipment. Traditionally, two identical premium-efficiency motors would qualify for the same rebate even if one operated 24 hours per day and the other only one hour per day. In the performance-based incentive program, the motor running continuously would qualify for a substantially larger incentive because it delivers more energy savings to the utility. Although they offer larger incentives, performance-based incentive programs have a cost. They require facility managers to *prove* their actual energy savings by measurement and verification (M&V) in accordance with the International Performance Measurement and Verification Protocol (IPMVP).

M&V starts with quantifying baseline energy consumption by means of demand measurements and operating hours monitoring. After the retrofit, additional demand and operating hour measurements are again conducted. The difference in energy consumption (pre- to post-retrofit) is the basis for incentive payments. Where loads are dynamic and controlled operations vary over time, continuous monitoring of power consumption (kWh) is required. A qualified ESCO can conduct the required M&V and provide the energy savings documentation required to obtain the performance-based incentives.

All the Pieces of the Puzzle

As you can see, a qualified ESCO can help you bring together all of the pieces of the energy puzzle. They should be partners with you in improving the reliability of your facility as well as evaluating costs and benefits of upgrades. Qualified ESCOs offer financing, installation, commissioning, measurement, and verification of the entire project to ensure that you achieve a more energy-efficient facility with state-of-the-art equipment for reliability, safety, and long operating life.

Contact Jay Raggio by phone (925) 824-0330 x305, or e-mail: jay_raggio@electro-test.com.

Energy Assets: Tapping the Hidden Value

By Kurt Thielemann and Tim Fess, DukeSolutions, North America

Some of the most creative engineering with energy projects today has little to do with rotating equipment or technical formulas. The opportunity lies with interest rates, off balance sheet financing, and economic value added. Financial engineering is crucial to making an attractive energy project come to fruition. Various financing options including turnkey contracts, performance contracts, or outsourcing supply agreements provide distinct advantages to end users.

For example, steam, compressed air, and chilled water can now be purchased like electricity or natural gas. By using a comprehensive energy service company (ESCO), an end user gains positive economics on its financial position, mitigates risks of ownership, accesses world-class technical capabilities, and can focus on core businesses.

Financial Benefits

Working with an ESCO on an energy project can offer financial benefits including:

- Zero up-front capital
- Off balance sheet financing for utilities (steam, chilled water, or compressed air) under a service agreement structure
- An infusion of capital from the sale of existing assets.

Based on site-specific requirements and initial capital investment, a financial structure can be developed to meet the end user's needs. In a "greenfield" environment where no facility exists, the ESCO designs an energy plant to meet the future production needs. In a "brownfield" application where chillers, boilers, and compressors already exist, an ESCO can monetize assets for the customer. The ESCO implements any modifications to the existing energy infrastructure to reduce operating costs and deliver higher useful output. In either case, the ESCO expends its own capital and labor for engineering, construction management, operations, and maintenance throughout the term of the contract.

Risk Mitigation

ESCOs can minimize the customer's risk associated with the implementation of energy assets. They perform studies everyday in which energy projects, on paper, show an acceptable return on investment (ROI). Frequently, the end user takes the risk of implementing the ESCO's recommendations and experiences cost overruns and/or underachieves energy savings targets, thereby missing the ROI. When this occurs, executive management looks for accountability and may think twice about funding energy projects in the future. The moral is an ESCO should not only author the study but also accept the financial risk associated with implementation.

The reason outsourcing is becoming more intriguing is CEOs are motivated to improve return on assets (ROA), reduce operating costs, and shed operating risk. An ESCO having assets under management structures a contract with guarantees for utility quality and availability while securing fiscal cost control for the end user.

Technical Expertise

Typically, customers looking to solve energy problems search for suppliers with expertise. One advantage of working with an ESCO is access to the industry's best

(continued on page 7)

Case Study

The steam used to heat large hydraulic presses at a manufacturer of residential and commercial goods is critical to the company's production process. Natural gas and coal were being used to fire pre-1960s boilers that were becoming obsolete. The manufacturer faced the prospect of curtailing production because of a steam shortage.

DukeSolutions, a business unit of Duke Energy, is an ESCO focusing on the industrial, commercial, institutional, and federal markets, and worked with the manufacturer to provide steam supply services.

The new boiler plant will consist of three natural gas/oil boilers and one waste wood boiler. DukeSolutions provided the customer:

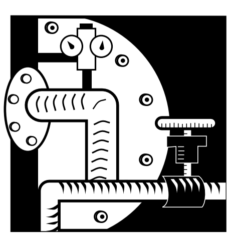
- *An evaluation of the existing and future steam system requirements and the engineering required to design and implement a steam program.*
- *The commitment of resources needed to construct, own, operate, and maintain a boiler plant with a peak capacity of 200,000 lbs/hr.*
- *A cost-efficient means of burning more than 30 tons per day of nonhazardous process waste.*
- *An implementation program that included all permits and licenses for construction and operation of the steam facility.*

Convinced that all requirements could be met, the manufacturer decided to outsource its steam instead of purchasing a new boiler plant. This shift in thinking resulted in these economic advantages:

- *No increase in net operating cost.*
- *Off balance sheet financing.*
- *Zero initial capital.*
- *Elimination of ownership risks.*
- *Reliable operations and maintenance.*
- *Flexible contract terms.*

Even though the benefits of outsourcing utilities appeal to many companies today, the main advantage for this customer was the "one-stop shopping" with an acknowledged leader in the energy business.

Steam Workshops Promote Energy Efficiency



While, many industrial manufacturing plants have the technical capabilities on site to achieve greater energy efficiency, plant and energy managers often believe they lack the time and resources to implement changes. To address this issue, DOE, the Alliance to Save Energy (ASE), Spirax Sarco, and NALCO Chemical are sponsoring a workshop on steam system energy efficiency on October 15, 1999, in Naperville, Illinois.

The workshop will present case studies and success stories from energy managers in the field. Attendees can interact with peers to discuss energy management issues and to learn more about the resources available to help them improve plant performance.

DOE and ASE, along with Allied Partner companies, will present these workshops approximately once every 2 months in cities across the United States. The workshops are open to personnel of industrial manufacturing plants. If you're interested in steam system efficiency projects and would like more information on upcoming workshops, contact David Jaber at (202) 530-2240 or djaber@ase.org.

Performance Optimization Tips

Field Measurements in Pumping Systems—Practicalities and Pitfalls

By Don Casada, Motor Challenge Program, Oak Ridge National Laboratory

This article is the 3rd in a series dealing with practical considerations and pitfalls of field measurements needed to understand pumping systems.

Pump Head

In the May and July issues, we discussed pressure and elevation components of pump head. We'll finish here with the last head element of that trio—velocity.

Velocity

Velocity head equals the velocity squared divided by two times the gravitational constant ($V^2/2g$). For many centrifugal pumps, the suction flange is one pipe size larger than the discharge flange.[1] When suction and discharge pressure measurements are made in different line sizes, an accounting for the different velocity heads must be made. But, in some applications, use of expanders results in identical size suction and discharge measurement points, meaning that the velocity heads in the suction and discharge are equal. Be sure to note the pipe dimensions where the suction and discharge pressure measurements are made, and adjust the head as necessary.[2]

Of course, the velocity is normally calculated from the pipe size and volumetric flow rate. Using common U.S. units,

$$V\ (\text{ft/sec}) = \frac{gpm}{2.45d^2}$$

(d is the inside pipe diameter in inches).

Which leads us to the next important energy element in pumping systems—flow rate.

Pump Flow Rate

Flow rate is usually the single most important parameter to grasp in assessing pumping system operation. Frequently, it is also the most difficult to accurately acquire.

In many systems, no permanently installed flow instrumentation exists. In such cases, either temporary flow instrumentation or alternative methods of estimating flow rate must be deployed. This column focuses on considerations where flow instrumentation exists.

Just because permanently installed flow instrumentation exists does not mean it is dependable. Many factors can affect the accuracy of indicated flow rate. We'll touch on just three: installation layout; degraded or uncalibrated instruments; and unrecognized flow paths.

Installation layout

The most commonly used flow-measuring instruments depend on a fully developed, undisturbed flow profile. This means several pipe diameters of straight pipe, without fittings, upstream of the measuring device. For example, an ASME standard for flow measurement requires from 6 to 35 pipe diameters of straight length upstream of the measuring device to keep associated errors below 0.5%, depending on the type of flow disturbance and meter design.[3]

Figure 1 shows an extreme example of nonconformance. Based on other indications (primarily pump head), the indicated flow rate from this meter is in error by around 25%. Furthermore, the extent of error is influenced by the distribution of main and bypass flow.

A quick review of the physical geometry of a flow meter whose output is used in system analysis is time well spent, whether it provides some "warm fuzzies" or raises the flag of uncertainty, as in this case.

Degraded or uncalibrated instruments

Many common types of flow meters involve a reduced flow area (e.g., orifices) or an inserted, movable part (e.g., turbine meters). The flow-measuring device is thus a likely point for foreign materials, which find their way into even "clean" fluid systems. If the meter totally fails, a problem will be quickly obvious. But not all degradation results in total failure. Simple service wear from erosion and scale buildup can, over time, degrade performance.

One of the most challenging, practical aspects of any flow instrumentation is true, comprehensive field calibration. While pressure instruments can be readily removed and/or tested in service with calibrated pressure sources, flow meters normally cannot. As a result, plugging and wear or other primary device problems would not be discovered during calibration.[4]

However, the fact that an instrument is periodically calibrated suggests that someone really does depend on it, and problems in actual service are more likely to be noticed. Determining whether a flow meter is periodically calibrated, finding out who uses the indication, and then asking questions of the user can give at least a qualitative sense of data dependability.

Unrecognized flow paths

When getting flow data from an instrument, always ask: "Exactly what is this thing measuring?"

Consider the simple flow diagram in Figure 2, with four parallel pumps drawing suction from a common tank and delivering the flow to the "Target." The flow meter installed in a common header may be accurately reporting the flow rate going through it, assuming it is the same flow rate as Pump 2, the only running pump, we may be in error. For example, the recirculation valve at the top, shown as closed might actually be open, or one or more of the discharge check valves on pumps 1, 3, and 4 may be leaking. Pump 2 may be pumping considerably greater flow than the meter indicates. One could conclude

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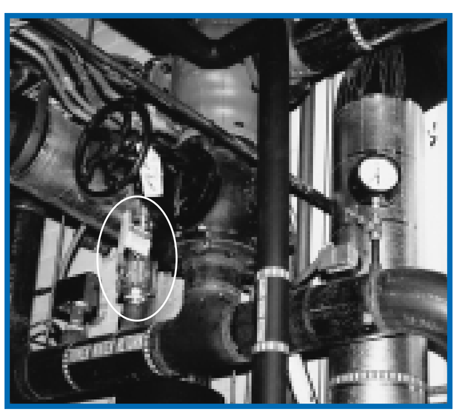

Figure 1. An undesirable flow meter (inside oval) installation.

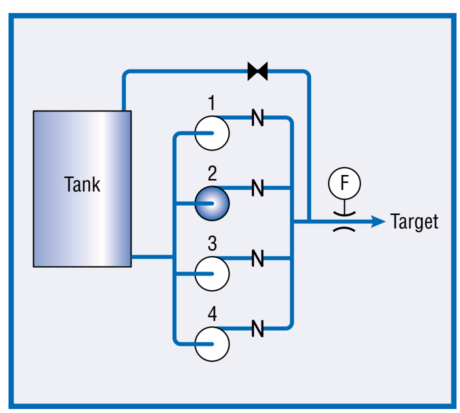

Figure 2. Simple system flow diagram.

continued from page 6

that Pump 2 is performing below expectation, when it is really a valve(s) problem. This could lead to unnecessary corrective maintenance actions.

But I Don't Have a Flow Meter!

Some industrial systems have *no* flow instrumentation. What are we to do in that case? Tune in next time, same channel.

Comments/questions welcome by e-mail: a85@ornl.gov.

[1] In many applications there is **no** suction pressure measurement connection. An obvious example is in vertical turbine pump applications where the pump draws suction from a tank, river, or other body of water.
[2] In actual applications, components between the pump and the measurement points will result in indicated pump head that is less than in a pump test facility because of losses across these components. Head losses across the intervening components can be estimated and added to the measured head to provide a more accurate comparison with manufacturer test results.
[3] The latest edition of the ASME standard notes the data used to establish the lengths were acquired in 1927 and analyzed in the 1930s. More recent measurements indicate even those lengths may not be enough.
[4] Usually, it is also impractical to even visually verify the condition of the primary sensing element.

References:
1) Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi, ASME MFC-3M-1989.

Correction: In July's Performance Optimization Tips, the term specific weight (*weight*/unit volume) should have been used in the expressions involving head instead of density (*mass*/unit volume). Normally the symbols γ and ρ are used for specific weight and density, respectively. The author apologizes for his mistake.

Energy Assets

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energy experts. An ESCO that has thousands of compressor horsepower under management will have a group focused on compressor system efficiency and controls. This pool of experience can be used to support a supply agreement for compressed air, steam, chilled water, etc. Additionally, most controls groups can integrate the energy assets' supply with the customer's production equipment, providing significant cost improvements.

Focus on Core Business

By outsourcing energy systems services, end users make a cultural decision to rely on proven capabilities available in the marketplace and can refocus efforts to achieve financial goals. In leveraging an ESCO's financial and technical strengths, end users can improve their economic position by utilizing capital for revenue producing actions.

Send comments/questions to kbthiele@duke-energy.com or tdfess@duke-energy.com; (704) 382-2646 (phone); (704) 382-1255 (fax).

Letters to the Editor

Energy Matters welcomes your typewritten letters and e-mails. Please include your full name, address, association, and phone number, and limit comments to 200 words. Address correspondence to:
Michelle Mallory, Letters to the Editor
NREL, MS 1713
1617 Cole Blvd.
Golden, CO 80401
e-mail: michelle_sosa-mallory@nrel.gov

We publish letters of interest to our readers on related technical 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.

Editor:

Please describe performance measurements (including efficiency determination) for pumping systems. We have clamp-on meters for electrical input power to motor measurement, pressure gauges, measuring tapes, and tachometers for RPM measurement. Please suggest a testing method.

Also, we find that flow meters are mostly absent in India, and as portable flow meters are extremely costly, we are seeking alternative solutions. Do any alternatives (such as using characteristic curves) exist?

Indradip Mitra,
Enhanced WAPP Systems (p) Ltd.
New Delhi, India

Don Casada writes Performance Optimization Tips for* Energy Matters *and provided this response to our reader:

You have a good complement of tools, except of course, flow rate measuring equipment.

In the May 1999 Performance Optimization Tips* I referenced two pump performance measurement standards:

- ASME/ANSI Performance Test code 8.2-1990, Centrifugal Pumps
- ANSI/HI 1.6-1994, Centrifugal Pump Tests

I strongly encourage you to obtain these standards, which include good discussion on practical field measurement issues.

The absence of flow meters you observe in India also exists in the U.S. Many portable flow meters are expensive and difficult to operate. On Page 6 of this issue, we discuss some important considerations, even when an installed flow measuring device exists. In upcoming issues, we'll address the situation you mention, where flow rate is not measured. We'll discuss characteristic curves, but also other practical, non-precision ways to estimate flow rate.

Find the series of Performance Optimization Tips on the new **Energy Matters Extra Web page at www.motor.doe.gov/emextra.*

How have you applied information from this newsletter on the job? Send us an e-mail at motorline@energy.wsu.edu.

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MORE COVERAGE OF ENERGY EFFICIENCY OPPORTUNITIES FOR YOUR INDUSTRY

Introducing Energy Matters Extra

There is now an online supplement to *Energy Matters!* In addition to the information you find here in print, check out this new Web page for more coverage of energy efficiency opportunities related to motor, steam, compressed air, and combined heat and power systems. The first edition of EM Extra gives you more on this issue's editorial theme, contracted services.

You'll find news you can use, such as details about a premium efficiency motor incentive program in the state of New York. Link to other resources, such as a new combined heat and power association and just-available fact sheets that offer hot tips on steam system efficiency. Look for the series of technical articles by contributing authors Don Casada and John Machelor. You can also complete the *Energy Matters* Reader Survey online. Find Energy Matters Extra at **www.motor.doe.gov/emextra**.

Coming Events

Understanding Pump Systems/PSAT Workshops
These sessions present the fundamentals of optimizing industrial and municipal pump systems. The workshops present case studies and focus on the Pump System Assessment Tool (PSAT).

- September 28 in Sacramento, CA
- September and October (date/cities TBD) in Northern and Southern CA
- October 5 in Millwood, NY
- October 6 in Brooklyn, NY
- October 6 in Portsmouth, NH
- October and November (dates TBD) in Houston, TX
- November 15 in Latham, NY
- November 16 in Wheatfield, NY
- November 17 in Albany, NY
- January 27 in Vancouver, WA
- January 27 (city TBD) in MI

Call Anna Maksimova at (360) 754-1097, ext.100 for more information.

Adjustable Speed Drive Application Workshops
These workshops address the fundamentals of ASDs and demonstrate the ASDMaster software.

- October (date TBD) in Philadelphia, PA
- October (date TBD) in Hartford, CT
- October 27 in Newcastle, DE
- November 2 in Reading, PA
- November 9 in Upper Darby Township, PA

Call Anna Maksimova at (360) 754-1097, ext.100 for more information.

Fundamentals of Compressed Air Systems
These 1-day Compressed Air Systems training seminars are for plant engineers and maintenance personnel responsible for optimum performance of compressed air systems.

- October 6 in Salt Lake City, UT

For information or a registration form, call (800) 862-2086.

Motor System Management
Six 1-day workshops on motor systems management are designed to reduce the expense and complexities of managing and operating electric motor systems.

- September to mid-November (dates/cities TBD) in the Midwest
- October 5 in Richmond, VA
- October 27 in Everett, WA
- November 3 in West Lebanon, NH
- November 17 in Birmingham, AL

Call Anna Maksimova at (360) 754-1097, ext.100 for more information.

Workshop for Steam Users

- October 15 in Naperville, IL

Call David Jaber at (202) 530-2240 for more information.

Improved Facility Performance through Enhanced Steam Systems

- November 1999 through June 2000 (cities/dates TBD) in WI

Call Steve Nelson or Doug Presny at (608) 238-4601 for more information.

Efficiency and Sustainability: 2000 ACEEE Summer Study on Energy Efficiency in Buildings
ACEEE announces a call for papers for this August 20-25, 2000, conference in Pacific Grove, CA. Abstracts are due to the Summer Study Office by October 15, 1999. Contact Rebecca Lunetta at (302) 292-3966 for more information.

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Information Clearinghouse
Do you have questions about using energy-efficient electric motor systems? Call the OIT Challenge Programs 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.motor.doe.gov

DOE Regional Support Office Representatives

- Tim Eastling, Atlanta, GA, (404) 347-7141
- Lili Griffin, Boston, MA, (617) 565-9714
- Julie Nochumsom, Chicago, IL, (312) 886-8579
- Gibson Asuquo, Denver, CO, (303) 275-4841
- Julia Oliver, Seattle, WA, (510) 637-1952
- Maryanne Daniel, Philadelphia, PA, (215) 656-6964

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