

The logo for NYSERDA, featuring the word "NYSERDA" in a bold, black, sans-serif font. To the right of the text is a stylized orange swoosh that curves upwards and then downwards, resembling a checkmark or a dynamic arrow.

EXECUTIVES FOR ENERGY EFFICIENCY

FINAL REPORT

June 2006

The Alliance to Save Energy



**ALLIANCE TO
SAVE ENERGY**

Creating an Energy-Efficient World

For:
New York State Energy Research & Development Authority
17 Columbia Circle
Albany, NY 12203-6399

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PURPOSE:	This report summarizes the history of the New York Executives for Energy Efficiency program. The New York State Energy Research and Development Authority and the U.S. Department of Energy co-sponsored the development of a strategy to promote energy efficiency to business leaders. A steering committee of New York State government, business, and trade association leaders provided program guidance. A subsequent pilot program offered energy management assistance to interested companies. The total program experience provided many valuable lessons that should be considered when promoting industrial energy efficiency in the future. A companion document to this report, <i>Executive Reactions to Energy Efficiency</i> , presents additional research beyond the scope of the New York Executives for Energy Efficiency Program.



**ALLIANCE TO
SAVE ENERGY**
Creating an Energy-Efficient World

The Alliance to Save Energy is a bipartisan, nonprofit coalition of business, government, environmental, and consumer leaders committed to promoting energy efficiency worldwide to achieve a healthier economy, a cleaner environment, and energy security. The Alliance was founded in 1977 by Sens. Charles Percy (R-III.) and Hubert Humphrey (D-Minn.). The current Chair is Sen. Mark Pryor (D-Ark.) and Co-Chair James H. DeGraffenreidt, Jr. Congressional Vice-Chairs include Sens. Byron Dorgan (D-N.D.), Susan Collins (R-Maine), Jeff Bingaman (D-N.M.), James Jeffords (I-Vt.), Reps. Ed Markey (D-Mass.), Zach Wamp (R-Tenn.) and Ralph Hall (R-Texas). The board includes leading voices on energy from business, the environmental community, national labs, and trade associations. Over one hundred companies and organizations currently support the Alliance through our Associates Program. The Alliance has a long history of initiating efforts to advance energy efficiency through strategic partnerships with government, business and public interest organizations.

**This report and related documents can be downloaded from:
<http://www.ase.org/industry/>**

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EXECUTIVE SUMMARY

The New York Executives for Energy Efficiency program was conducted by the Alliance to Save Energy in 2003-04 to motivate business leaders to improve their companies' business performance through greater energy efficiency. The New York Energy Research and Development Authority (NYSERDA) assembled a steering committee to develop a promotional message for raising business leaders' awareness of energy efficiency. This steering committee was comprised of 19 representatives from New York State business, government, trade association, and consulting organizations.

Following the steering committee's recommendations, NYSERDA and the U.S. Department of Energy (DOE) jointly sponsored a 2004 pilot program that featured a single call-to-action to New York State's business leaders to make their organizations more energy efficient. One company chose to accept the pilot program's offer of very low-cost technical assistance. We believe that more companies did not participate because outreach did not engage the appropriate decision-maker in each industrial organization. Also, there was lingering confusion among industry observers regarding the concept of "energy efficiency."

The concept of "energy efficiency" and the means for achieving it were interpreted differently by the sponsors, the steering committee, the supporting manufacturers' association, and the industry audience. Some participants perceived industrial energy efficiency as one-time engineering *projects* that require capital investment. This contrasts with the practice of energy efficiency as a management *process*, involving both procedural and behavioral changes as well as the implementation of new technology.

Given these results, the Executives for Energy Efficiency program provided valuable insight on the potential to promote industrial energy efficiency to business leaders. The 2004 pilot program did not make leading-edge energy cost control techniques sufficiently clear to industry observers. Due to communication failures, there was a wide gap between what the pilot program offered and what the audience expected. Instead of offering grants to underwrite projects, or providing below-market energy purchasing opportunities, the pilot program challenged participants to change the way they managed their energy consumption. This message appeared to alienate some prospective participants. Many industry decision-makers expect their energy cost control to be achieved by discrete projects, a single department, or even a single individual. Controlling energy costs at an industrial facility will require the efforts of many individuals from several departments within the organization. The cross-departmental, process nature of effective energy solutions, like those offered by the pilot program, will only frustrate those individuals who work without wider organizational support.

It is impractical to expect a single call-to-action to result in industry's instantaneous, wide-spread implementation of energy-efficient activity. Each company's corporate agenda reflects a unique set of operating conditions and business challenges. Even if an organization understands the practical business impacts of energy efficiency, the topic must still compete with other issues for top-management attention. One issue is the sheer scale and cost of facility assets, plus the complexity of the systems in which they operate. An attempt to change systems of this magnitude for the sake of energy efficiency must be balanced with other corporate considerations, such as capital finance strategies and long-term production plans. Any future promotion of industrial energy efficiency should not be judged by the number of companies (or executives) that react at once, but instead by the pace and degree to which individual companies implement efficient practices.

The New York Executives for Energy Efficiency program experience demonstrates how "energy efficiency" is easily misunderstood—both the concept and the means by which energy efficiency is achieved. Future promotion of energy efficiency to industry requires a *dialogue* with key decision-makers within each company. Efficiency proponents should anticipate different lead times as companies approach their decisions to act on energy efficiency. In addition, as companies better understand the variety of approaches to energy efficiency, they will more likely take action without requiring grants and incentives.

I. INTRODUCTION AND BACKGROUND

The New York Executives for Energy Efficiency program was initiated in 2003 to motivate business leaders to improve business performance through energy efficiency. Sponsorship for this effort came from the New York State Energy Research and Development Authority (NYSERDA) and the U.S. Department of Energy's Office of Industrial Technology (DOE-OIT) (now superseded by the U.S. DOE's Industrial Technologies Program).

By 2003, the U.S. DOE-OIT had been attempting for several years to encourage greater, nation-wide use of its BestPractices reference material that describes energy-efficient technologies and practices. At the same time, NYSERDA was concerned by many New York companies' lack of interest in co-funding for innovative energy efficiency projects. Meanwhile, the Alliance to Save Energy was seeking ways to promote industrial energy efficiency to the business community in general. The U.S. DOE, NYSERDA, and the Alliance suspected that industry's top managers were largely unaware of the positive impact that greater energy efficiency may have on their business performance.

The Executives for Energy Efficiency effort included a pilot program that not only drew attention to energy-efficiency opportunities, but also offered technical guidance to assist companies in implementing efficiency solutions. By the end of 2004, only one out of approximately 25 solicited companies responded to the program's February 2004 call-to-action. This result raises a number of questions, all of which are addressed in this report:

1. Why was there not a greater response to the Executives for Energy Efficiency pilot program?
2. How was the pilot program's message perceived?
3. How did the program's goals and deliverables (actual or perceived) differ from what industry wanted?
4. Were the message and vision of the Executives for Energy Efficiency effort fully understood by all concerned?
5. What conclusions can be made about promoting energy efficiency to business leaders?
6. Is the promotion of energy efficiency practical, and under what circumstances?
7. What is the take-away value of the New York Executives for Energy Efficiency program experience?

II. STEERING COMMITTEE OBJECTIVES, ASSUMPTIONS, AND RECOMMENDATIONS

NYSERDA organized a steering committee to advise the program sponsors' future efforts to promote energy efficiency, with specific emphasis on outreach to business leaders. Nineteen professionals from manufacturing, government, trade association, and consulting organizations in New York State served on this steering committee (see Table 1):

TABLE 1:
The Executives for Energy Efficiency Steering Committee

Marolyn Davenport,	Real Estate Board of New York
Bob De Saro,	Energy Research Company
Jim Devine,	WindowTherm
Johnny Evers,	Business Council of New York State
Dan Fessenden,	Carrier Corporation
Ravi Kuchibhotla,	IBM
Jeffery Lawrence,	Center for Economic Growth
Terry Madden,	O'Brien & Gere
John Mandyck,	Carrier Corporation
Tony Martocci,	Bethlehem Steel Corporation
Ken Pokalsky,	Business Council of New York State
Bob Reigstad,	Buffalo/Niagara Partnership
James Rouse,	Praxair, Inc.
Gerard J. Sentz,	County of Erie
Neal Schwartz,	Consultant
Mark Tebbano,	Clough, Harbour, and Associates, LLP
David M. Tosetto,	Elderwood Affiliates
Kent Webb,	Outokumpu American Brass
Randy Wolken,	Manufacturers' Association of Central New York

Objectives. The program's short-term objective was to formulate a strategy for promoting energy efficiency directly to business leaders. Recognizing the limited impact of energy-efficiency communications to mid- and low-level industry personnel, the Executives for Energy Efficiency program sponsors tasked the steering committee with devising an executive-oriented promotional strategy.

The Executives for Energy Efficiency steering committee developed a vision during its inaugural (January 2003) meeting. Program success was defined as (1) reaching the maximum number of chief executive officers, and (2) documenting real energy-efficiency improvements resulting from industry's response to the program. In its second and final meeting in March 2003, the steering committee's key assumptions became apparent as it generated recommendations for promotion.

The Steering Committee's Key 2003 Assumptions:

- "Energy efficiency," to the steering committee, meant *projects*, involving the installation of new, technologically-advanced hardware and typically requiring large, capital investments. This vision excluded the *management* aspects of energy efficiency that are implemented through behavioral and procedural changes. This limited definition certainly shaped the steering committee's subsequent recommendations. However, the "project" interpretation was consistent with the approach taken by many state- or utility-sponsored energy-efficiency programs that issue grants to industry to offset the cost of large, energy-saving projects.
- The steering committee identified *risk perceptions* as pivotal to industry's resistance to energy efficiency projects. To generalize, these perceived risks included (1) the reliability of electricity supply, (2) the possible loss of productivity that could result from a change of assets, (3) the volatility of energy

markets and utility tariffs, which can destroy the projected payback projections of energy projects, and (4) general business climate issues.

The Steering Committee's 2003 Recommendations:

- Promotion of energy efficiency should not attempt to change business leaders' risk perceptions, but instead should promote energy efficiency whenever possible as a means to offset existing business risks. The program's summary report¹, released in August 2003, suggested ways to position energy efficiency as a solution to business leaders' common risk perceptions.

- Promotion should include a clear, business-oriented statement of purpose. The steering committee's approved promotional message described energy efficiency as a way to "build revenues, reduce expenses, and contain business risk." This message would hopefully alert industry to the full business impacts of energy efficiency, and motivate top leaders to take action. The steering committee also recognized the importance of:
 - enlisting the appropriate messenger or "standard bearer" for carrying out promotion;
 - focusing technical content on technologies that are common to all or most industries;
 - providing technical references to make industry's follow-up as easy as possible; and
 - publishing case studies to encourage replication by others.

III. A Pilot Program

The steering committee's recommendations were put into practice in 2004. The Executives for Energy Efficiency pilot program offered a suite of resources to assist each participating company with the implementation of its own energy management plan. The program's call-to-action was designed to enlist multiple companies at one time. Technical content focused on steam, motor drives, and compressed air, which are by far the most common energy-using applications in industry. Assistance offerings featured both consultant (fee-based) and government program material. NYSERDA and the U.S. DOE effectively underwrote all of this so that the cost to participants would be minimal, at \$4,500 each.²

The Manufacturers' Association of Central New York (MACNY) volunteered to promote the pilot program to its membership. MACNY identified member companies that might be potentially interested and invited them to a February 2004 kick-off meeting hosted in Syracuse, N.Y. Approximately 25 different companies were represented at this meeting.

¹ <http://www.ase.org/content/article/detail/940>

² The decision to charge participants was preceded by debate. The consensus was that a minimal charge was necessary to ensure that participants remained focused on the effort. The charge of \$4,500 is indeed minimal when considering the magnitude of energy expenditures and potential savings. A medium-sized industrial facility may spend, for example, \$2 million per year on fuel. Experts assert that the average facility can cost-effectively avoid 10 to 20 percent of their energy consumption or, to continue this example, \$200,000 worth of savings, *per year*. Participants in the program were asked to pay \$4,500 to get an outline of business improvement opportunities worth many times that amount.

Prior to the kick-off, MACNY requested a few of its members with an interest in energy issues to preview the pilot program's assistance offerings and to comment on the feasibility of these for large, industrial organizations. Unfortunately, no feedback was provided. The pilot program's kick-off therefore proceeded without this evaluation.

The Alliance selected the following assistance elements for the pilot program:

- **A one-day facility assessment** to identify the participant's sources and uses of energy and to describe the costs, benefits, and paybacks of specified improvements. These assessments would be provided by Syracuse University's Industrial Assessment Center.³
- **A two-hour management diagnostic** to introduce key company decision-makers to a practical range of energy management procedures and related internal communications. The Envinta *One-2-Five* diagnostic was selected for this purpose for its previously-demonstrated effectiveness for engaging facilities' top decision-makers.⁴
- **A management template** that could help a company to organize the people, activities, and information that creates continuous energy improvement. This template itemizes projects as well as procedural and behavior changes. Science Applications International Corporation provided the *Practical Energy Manager* tool for this function.⁵
- **Technical resources**, featuring software diagnostics, tip sheets, sourcebooks, and other material were selected from the U.S. DOE's BestPractices program. U.S. DOE material is freely available through its website.⁶

The invitation letter to the kick-off promised "relief from high energy bills." This overture differed from the "build revenues, reduce costs, contain business risk" strategy recommended by the steering committee. Still, modification of the message was consistent with another recommendation, that outreach should be conducted in a way that posed energy efficiency as a solution to current business concerns. Accordingly, MACNY's leadership decided that "high energy costs," *per se*, would be the best selling point to encourage its members' participation in the pilot program.

The kick-off was necessarily a short meeting (about three hours, including lunch), which was just enough time for presenters to impart the program's vision and an overview of the pilot program activities. This presentation attempted to explain the concept and practice of energy efficiency; however, the impact of this discussion was certainly limited by time constraints. The full explanation of the goals and benefits of energy efficiency was supposed to be delivered to companies one at a time, in a dialogue with key decision-makers after they signed up and began to participate in the pilot program.⁷ As it turned out, **any company's response to the Executives for**

³ General information about all 26 DOE-sponsored Industrial Assessment Centers can be found at <http://www1.eere.energy.gov/industry/bestpractices/iacs.html>.

⁴ Review implementation experience by the Northwest Energy Efficiency Alliance in a white paper: *Envinta One-2-Five Pilot*. www.nwalliance.org/resources/reports/97.pdf. For Ohio State Energy Office experience, see <http://www.odod.state.oh.us/CDD/oe/Envinta.htm>.

⁵ See (1) <http://www.focusonenergy.com/page.jsp?pageId=1142> and (2) white paper: John Nicol, Timothy Dantoin. *Practical Next Steps When the CEO is Finally Ready for Energy Management*. Proceedings, 2003 ACEEE Summer Study on Energy Efficiency in Industry. <http://www.aceee.org>.

⁶ <http://www1.eere.energy.gov/industry/bestpractices/>

⁷ This was the main purpose of the *One-2-Five* diagnostic management program described above.

Energy Efficiency call-to-action depended on the brief impressions gathered by its representative at the kick-off meeting. Unfortunately, not all of the 25 company representatives at the meeting were top executives. Even at this stage, many top leaders entrusted their follow-through to subordinates. There is no way to know how, or even if, attendees transferred the kick-off meeting's message within their organizations.

Outcome. The pilot program resulted in one company taking advantage of the services offered. A higher participation rate might have ensued if program communications had established for the target audience a clear, mutual understanding of energy efficiency – its concept, the ways it can be achieved, and what it provides. In addition, communication to the industry audience *after* the kick-off meeting inconsistently described the pilot program's deliverables.

MACNY surveyed its members in early 2004 to learn why they declined to participate in the pilot program. Nine of its manufacturer members, most of which were represented at the February 2004 kick-off, responded to a phone survey. While respondents still expressed interest in achieving energy expense reductions, few seemed aware of the "management" approach to energy efficiency that was described during the kick-off.

Crucible Specialty Metals was the only company out of the 25 participants at the kick-off meeting that decided to participate in the pilot program. By the end of 2004, Crucible was well on its way to implementing energy management as a continuous improvement process. The major features of Crucible's experience included:

- inventorying its existing management practices, energy audits, and project proposals;
- defining and prioritizing improvements to include capital projects as well as behavioral and procedural measures;
- securing key management personnel's ongoing support for continuous energy improvements;
- establishing energy performance goals, metrics, and accountabilities for outcomes; and
- merging energy management with existing management practices, including multi-year planning procedures and regular, day-to-day quality control.

The New York Executives for Energy Efficiency pilot program effectively ended with the December 2004 completion of the single participant's case study (Crucible Specialty Metals) and the lack of response from any additional MACNY members.⁸ By that time, it was clear that MACNY members would not respond in unison to the pilot program's call-to-action and assistance offerings, despite the fact that many companies expressed an ongoing interest in reducing their energy costs.

Industrial Energy Efficiency Outreach: Lessons Learned. The key to understanding the outcome of the pilot program is to recognize industry's traditional expectations for energy cost control. Like the steering committee that advised the Executives for Energy Efficiency effort, many industry observers anticipate energy cost control to consist of major "projects" to be undertaken by their engineering

⁸ Appendix A provides a detailed summary of Crucible Specialty Metal's initiation of energy management activities.

departments. Companies usually expect a single department, or even a single staff person, to pursue energy solutions on behalf of the entire facility.⁹

The New York Executives for Energy Efficiency pilot program did not offer single-department solutions. This means, for example, that the program did not issue capital grants to underwrite the costs of large, engineering-department projects. Nor was the pilot program directly responsive to companies that seek procurement-oriented solutions, such as the opportunity to purchase energy at below-market prices. Instead, the program offered consulting assistance for creating an in-house, cross-departmental energy management plan. This concept would certainly disappoint those MACNY members that expected a one-time project or single-department solution.

MACNY performed a follow-up survey of its members to gauge their reaction to the pilot program description. All respondents were still concerned by high energy expenses. However, one surveyed member hinted that the time and effort required by energy management (as he perceived it) was prohibitive. The fact that a small fee would be required to participate in the pilot program disappointed at least one other survey respondent.

Companies refused to sign up for a service that their staff did not expect or sufficiently understand. To effectively demonstrate what was being offered by the pilot program, it would be necessary to demonstrate the proposed energy management discipline to a team of top decision-makers at each facility. In fact, a team-oriented dialogue was the intention of the *One-2-Five* energy management diagnostic, which would have been delivered to individual companies *after* they signed up to participate in the pilot program.

The design of the pilot program correctly anticipated a gap between MACNY members' expectations versus the activities that were offered. However, a critical flaw in the program was the failure to properly prepare prospective participants to appreciate the solutions that were being offered before asking companies to sign up for the program. This suggests that the *One-2-Five* diagnostic, or something similar, should have been administered as part of the recruitment effort for the pilot program.

IV. CURRENT RECOMMENDATIONS

Promotion of industrial energy efficiency must engage facility personnel from a variety of departments. Promotion should also illustrate "how-to" strategies – both technical and managerial – for overcoming implementation barriers. The many indirect benefits of energy efficiency need to be made clear to industry audiences, especially when these benefits offset industries' other, non-energy challenges.

A company cannot commit to implementation until it identifies a strategy that makes sense for its business style and organizational structure.¹⁰ Promotion implies an ongoing mentoring relationship between efficiency proponents and the companies they

⁹ Further elaboration on the "single department" limitation is provided in this report's companion document entitled *Executive Reactions to Energy Efficiency*.

¹⁰ A discussion of energy management strategies, as well as the attributes that an organization should have to pursue those strategies, is provided in this report's companion document, *Executive Reactions to Energy Efficiency*.

assist. A 30-minute PowerPoint presentation to a facility's engineering department is clearly insufficient for achieving this communication.

Businesses that are not accustomed to energy efficiency, or energy management, will need a simple starting point. Energy assessments (audits) may serve that purpose. At a minimum, an energy assessment should provide (1) a blueprint of energy sources and uses within a facility, and (2) a checklist of specific opportunities to improve energy performance, indicating the cost, projected savings, and payback associated with each measure. An energy assessment clarifies the facility's value at risk due to existing, wasteful energy practices.

Energy assessments are the centerpiece of at least two recent industrial energy-efficiency programs conducted outside New York State.

- In Australia, a draft regulation due to take effect in July 2006 would require large energy-consuming entities to secure a facility-wide energy assessment from a qualified energy consultant and publicly report the outcomes. However, any decision regarding the implementation of efficiency improvements is left solely to the discretion of the facilities.¹¹
- At the time of this report's compilation, the U.S. Department of Energy's *Save Energy Now* initiative has been successful in getting 200 industrial facilities to accept a free energy assessment. That initiative offers training and energy-saving information to participating facilities, but does not compel implementation.¹²

Both initiatives assume that an energy assessment, brought to the attention of business leaders, will highlight the potential business impacts of energy efficiency and the need to pursue improvements. With both these programs, it is reasonable to expect the assessment experience to foster *some* implementation that industry would otherwise not achieve.

Finally, it is possible that energy efficiency may be more effectively promoted to business leaders as part of a larger industrial assistance agenda. Energy-efficient practices and results can actually contribute to attaining these and other business priorities¹³:

- regional economic development
- building wealth from existing infrastructure
- demonstrating good corporate governance
- disaster preparedness
- pursuing new markets and revenues

By collaborating with these policy agendas, energy-efficiency proponents can shape comprehensive industrial assistance initiatives that truly motivate business leaders to take action.

¹¹ See <http://www.industry.gov.au>. Search on "energy efficiency opportunities."

¹² <http://www.eere.energy.gov/industry/saveenergynow/>

¹³ For a more in-depth discussion, see the Alliance's report entitled *Efficiency and Innovation in U.S. Manufacturing Energy Use*. http://www.ase.org/uploaded_files/industrial/NAM.pdf

V. CONCLUSION

The New York Executives for Energy Efficiency program experience may be useful for guiding future industrial energy-efficiency promotion efforts. Major lessons-learned from this experience include the following:

- It is not practical to expect a large number of companies to react instantly to an energy-efficiency call-to-action. One reason is the mechanical complexity and scale of the physical capital and process systems that characterize individual facilities. When facility managers evaluate potential changes—including major energy efficiency measures—they usually coordinate these through a multi-year planning process. A second reason is related to the behavioral and procedural approaches to energy efficiency. Facilities can significantly reduce energy waste through the proper maintenance and operation of current plant assets. However, such behavior requires a high degree of cooperation across departmental lines. A time-consuming prerequisite to achieving such cooperation may involve overcoming difficult “turf” issues between departments.
- Executive direction, by itself, is not enough to assure that a company will make energy efficiency a priority. All levels of an industrial organization must have a mutual understanding of the definition, requirements, and expected benefits of energy efficiency. Large companies, in particular, must often overcome their own organizational complexities and disincentives for taking appropriate action. Successful energy cost-control will require staff from engineering, maintenance, finance, and perhaps other departments to collectively address energy-efficiency concepts as they coordinate their standard operating procedures and multi-year planning activities.

Note also that individual companies experience a unique mix of challenges and priorities, all of which compete with energy efficiency for management attention and resources. This suggests that proponents of industrial energy efficiency will need to do two things: (1) emphasize energy efficiency’s practical contribution to other operational challenges, such as safety, emissions control, productivity, and product quality, and (2) allow at least several years’ lead time for their outreach efforts to produce significant results.

Some industrial energy-efficiency programs simply offer facility-wide energy assessments. Assessments describe the impact of current energy practices and evaluate the opportunities for making improvements. It is not the strategy of these programs to *compel* companies to make energy improvements. Instead, it is assumed that the documentation of potential energy-related business improvements will inspire action that otherwise would not take place.

Large companies, in particular, must often overcome their own organizational complexities and accountabilities that prevent their implementation of energy-saving initiatives. For a more in-depth discussion of these points, see the companion document to this report, entitled *Executive Reactions to Energy Efficiency*.

APPENDIX A:

Forging a More Rigorous Approach to Energy Management at Crucible Specialty Metals

*A Case Study Compiled by Science Applications International Corporation
for the Executives for Energy Efficiency Program
January 2005*

Overview

As a manufacturer of specialty steels in a world-wide competitive market, Crucible Specialty Metals continually faces market challenges to deliver the highest quality product for the most reasonable price. In an industry where dozens of U.S. manufacturers have closed their doors over the past few years, Crucible has built a production operation and management approach that has turned the company into a leading manufacturer of specialty steels.

Energy accounts for a large percentage of Crucible Specialty Metals' manufacturing costs; the plant consumes more natural gas than its entire home city of Syracuse, New York. To build support for making energy saving investments and ensure energy considerations are factored into day-to-day operations as well as strategic decision-making, Crucible applied Practical Energy Management[®] (PEM[®]) to create a more integrated approach to corporate energy management. This case study examines the process by which PEM is being applied at Crucible.

Company Background

Crucible Specialty Metals is a leading producer of high technology specialty steels designed for extreme environments involving abrasion, corrosion, stress or heat. Finished products are primarily bar stock, in a wide variety of shapes and sizes, used to provide valve steel for automobile engines, stainless steels, and tooling materials.

Crucible's manufacturing process is highly energy intensive. In 2003, the combined electric and gas bill for Crucible's operation topped \$10 million.

The manufacturing process begins with the melting of steel scrap in an electric arc furnace or an induction furnace. The molten material is then either decarbonized and cast into ingots, or processed as powder metal compacts in the particle metallurgy shop. The ingots or compacts are then rolled into billets or pressed into blooms which are subsequently rolled into billets. From there the billets are conditioned (by grinding), annealed, reheated and rolled into bar stock of various stock shapes and sizes. The bar stock is subsequently heat-treated or annealed to achieve desired properties, shot blasted and pickled, and then finished in preparation for shipment.

Crucible employs a team management approach in which cost and production reviews are held monthly with each operating department. The company has well-established programs for managing key aspects of its operation, including internationally-recognized quality assurance and quality control practices and a rigorous environmental management program. In fact, Crucible recently achieved certification under the TS16949 standard for quality management. TS16949 specifies the quality system

requirements for the design, development, production, installation and servicing of automotive-related products like those produced by Crucible.

Recognizing energy efficiency as an opportunity for reducing operating costs in the highly competitive steel industry, Crucible has historically been aware of energy use and costs. They have negotiated special utility rates, undertaken a number of studies to identify energy-saving investments, and developed an “opportunities” list of energy projects.

In 2004, they completed a Plant Wide Assessment (PWA) under the sponsorship of the U.S. Department of Energy and New York State Energy Research and Development Authority (NYSERDA). The jointly funded assessment identified a series of 16 projects that would generate over \$3,300,000 in energy savings if all projects were implemented. This results in a total installed cost of \$2,500,000 and a payback in 0.8 years. As a result of capital availability, project time and manpower a total of 9 projects have been implemented with a savings of \$1,500,000 realized to date. Subsequent in house studies revealed that additional natural gas savings in excess of \$750,000 plus could be saved with the addition of projects identified in follow up studies found in the PWA study.

Crucible has traditionally addressed energy issues separately from day-to-day operations and long-term planning, so that energy improvements and energy considerations were made individually and outside of established management programs and production considerations.

Practical Energy Management[®]

PEM[®] is an energy management template. Companies can adopt PEM's documents, tools and strategies as needed to enhance their own energy management efforts and to integrate energy management into their existing business practices¹⁴. PEM is compatible with other continual improvement programs such as Six-Sigma, ISO/TS 16949, ISO 14001, and Lean Manufacturing.

PEM[®] provides a structure for energy management that includes the following elements:

- An Energy Policy
- Energy Goals & Targets
- Project Management
- Energy Purchasing
- Facility-Wide Energy Use Profile
- Equipment or Process Specific Energy Use Profile
- Energy Efficiency Best Practices
- Management for Continual Improvement
- Standards & Guidance Related to Energy
- Program Administration

¹⁴ Practical Energy Management[®] was developed by Science Applications International Corporation (SAIC) as part of its work under the Wisconsin Focus on Energy Program.

PEM[®] materials include sample documents for establishing an energy policy, creating energy goals, and project tracking. It provides calculation tools for benchmarking a facility's energy use per units of production and to estimate the energy use of specific equipment. PEM[®] also includes a section on best practices for typical energy end-use systems to provide a first-cut estimate of energy savings opportunities and practical tips for implementation. It also includes sample administrative procedures and methodologies for establishing a continual improvement process for energy management.

Applying PEM at Crucible

Crucible is using PEM[®] to enhance its existing energy management capability while more fully integrating that capability into the company's existing management practices for quality improvement, cost control, production and environment management. The first step in applying PEM at Crucible was identifying existing management practices or documents that could be used either in conjunction with or instead of corresponding PEM[®] material. This effort also helped identify where gaps existed between Crucible's approach and the model established by PEM material. This "gap analysis" was done initially through a series of telephone and email exchanges among Project Team members from mid-August through October 2004.

Various documents and other information related to existing energy efficiency efforts were identified and organized according to the PEM[®] structure for energy management outlined above. Among the identified items were several technical studies on the energy use of major production processes and utility equipment (e.g. lighting and compressed air). These studies were useful in compiling the Facility-Wide Energy Use Profile and the Energy Use Profiles sections of PEM and used as a substitute for the Best Practices section.

The second step in applying PEM at Crucible involved obtaining "buy-in" from senior managers for a more rigorous energy management effort in general and their input on specific tasks that need to be undertaken to make energy management a reality. This step was conducted during two on-site meetings with Crucible's senior-most managers.

Both sessions were attended by about 15 people, including the company's President and Chief Financial Officer, and representatives from Operations, Maintenance, Safety, Environment, Finance and Administration. This strong showing reflected the vitality of Crucible's team management approach, allowed for meaningful discussions and timely decision-making, and indicated that senior management does indeed see the value of a more rigorous energy management effort.

"Energy costs are a major factor in our business," said Jim Beckman, Division President. "We are continuously looking for ways to control our energy costs and use our energy sources better. Improving energy management practices in our company organization and operations is critical to our progress."

During the first session, participants were briefed on Crucible's current energy costs and energy efficiency efforts. They then examined the energy management framework developed in the first step of applying PEM. That framework and specific material within it was subsequently refined based on participant discussions and comments.

This approach identified several opportunities for improving Crucible's approach to energy management.

For example, while Crucible has a strong team management structure for both day-to-day operations and strategic decision-making, it became apparent that energy was not routinely considered in production decisions or in long-range business planning. Similarly, it appears there was no consideration given to establishing specific energy efficiency targets for individual departments or associated performance indicators with which to motivate or gauge achievement, despite the presence of a rigorous cost control system.

In another example, even though the Financial Department uses a well-defined methodology for estimating and assigning energy costs to end-users, many department heads were either unaware that energy costs were being passed on to them or they simply treated energy as a fixed cost.

In general, it was apparent that there was little on-going communication about strategic energy information or efficiency opportunities among department heads and other senior managers. Furthermore, there seemed to be little if any effort to promote general energy awareness among managers and employees.

The various opportunities for improvement identified during the first on-site session were addressed in the second on-site session. Meeting participants identified sixteen tasks across four goals that would help close the gap between Crucible's current approach to energy management and that embodied within the PEM structure. These items became the foundation for Crucible's Energy Goals and Targets plan. The identified tasks include:

- Setting annual energy savings target based on the potential energy savings from a list of technical projects;
- Determining appropriate energy indicators and including them in the Monthly Information Packets distributed to department heads;
- Determining appropriate communication methods for promoting awareness of energy efficiency; and
- Building energy considerations into the 3-Year Business Plan.

The strength of Crucible's team management style was apparent during this session as tasks for improving energy management were thoroughly discussed and assigned to a responsible person. Deadlines were established for completing assigned tasks and a date for a follow-up meeting was set. In fact, Crucible's President volunteered to undertake the tasks of determining appropriate communications methods for promoting energy awareness among company employees and for integrating energy into the 3-Year Business Plan. The President's action clearly demonstrated strong top management support for energy efficiency. Such support is an important ingredient in any successful program.

Another task identified by the participants was to use the existing QA/QC procedures for tracking energy efficiency projects rather than creating a separate tracking system. This will further integrate energy management into existing business practices and ensure that energy related projects are handled in the same manner as other quality, production or cost improvement projects. It will also enable Crucible to keep

appropriate records on green house gas (GHG) emissions associated with its energy use and claim credits for energy efficiency projects. GHG emissions and credits are likely to become an important consideration for American companies doing business internationally as the Kyoto Treaty on Climate Change is implemented.

The third step in applying PEM at Crucible involved tracking progress on tasks identified during the second on-site session. Crucible's Energy Manager is responsible for tracking progress on these tasks and any additional tasks that may be added over time. The Energy Goals & Target Management Plan will serve as the primary tracking device for energy management-related tasks. The effectiveness of Crucible's more rigorous energy management efforts will be assessed as part of the company's existing 3-Year Business Plan review process.

"Going through the PEM process highlighted where we could specifically improve our internal energy management practices, and defined exactly how we can get to the end results," said Ram Kondapi, Chief Project Engineer and Energy Champion.

Conclusions

By applying PEM to its existing energy management efforts, Crucible was able to identify the strengths and weaknesses of its current approach and lay out a plan for creating a more rigorous energy management program.

The company determined that it already has in place many of the elements of an effective energy management program including an effective management structure that promotes cross-functional interactions, strong management support for energy efficiency, good data on energy uses and costs throughout the facility, a ready list of energy efficiency projects, established capital project review and tracking capabilities, and familiarity with the concepts and practices of continual improvement and self-assessment.

Areas in which additional work is needed include establishing annual targets for energy savings, identifying and tracking key indicators for measuring progress toward those targets, effectively disseminating energy use and cost data to energy-users, prioritizing among potential energy efficiency projects, verifying energy savings from implemented projects, and promoting general energy awareness among Crucible employees.

With a more rigorous energy management program that is fully integrated into existing business management practices, Crucible is well-positioned to take full advantage of cost reduction opportunities available through greater energy efficiency. At the conclusion of the PEM sessions, Mr. Kondapi finally noted, "My bottom line objective is to take what we have done here and to use it as a platform to continue to push energy efficiency and management to the forefront of our business practices."