WORLD-CLASS ENERGY ASSESSMENTS

Industrial Action Plans for Greater and More Durable Energy Cost Control

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The Alliance to Save Energy

ALLIANCE TO SAVE ENERGY

Creating an Energy-Efficient World

TITLE:	***World-Class Energy Assessments*** *Industrial Action Plans for Greater and More Durable Energy Cost Control*
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PURPOSE:	This report summarizes recommendations for improving the impact of industrial energy assessments. This initiative responds to the observation that less than half of recommended energy improvements are implemented as a result of traditional assessment methods. The need to rethink energy assessment strategies coincides with industry's greater interest in controlling its energy costs. The Alliance to Save Energy conducted three roundtables at different U.S. locations during the first half of 2006. These events solicited feedback from 80 people, including energy assessment practitioners, representatives from energy-consuming facilities, and government and utility program personnel. All participants in this discussion are interested in promoting industrial energy efficiency and recognize the pivotal role of energy assessments in achieving their goals. The recommendations address the considerations prior to, during, and after an energy assessment. Among this document's leading conclusions is that the assessment experience need not be confined to a report—it can become a relationship between the assessor and the client facility.

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-Ill.) 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 corporate 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

Manufacturers across the U.S. are struggling with volatile energy costs. While many industrial decision-makers anticipate a solution in the form of lower energy prices, others are investigating the merits of efficient practices that reduce unnecessary energy consumption.

Readers that are unfamiliar with industrial facilities and the way they use energy should refer to a one-page primer in Appendix A.

A logical first step for an industrial facility seeking to control its energy costs is to secure an energy assessment (audit) to identify energy improvement opportunities. Traditional industrial energy assessments culminate in a report document. It includes an inventory of different fuel types consumed by the facility as well as a survey of opportunities to improve the operating costs of the facility's major energy-using equipment. However, this purely technical approach fails to explain the broader, organizational implications of energy use. In an industrial production facility, energy choices usually have an impact on equipment reliability, staff safety, product quality, and productivity. Accordingly, an energy assessment should present potential benefits for a wide range of client staff, not just a boiler room operator. These collective benefits are more likely to resonate with the facility's management team. An energy assessment then becomes a "roadmap" for pursuing energy improvements.

Management leaders want to know more than the potential cost-benefit of potential engineering projects. They want to know about the various risks that each improvement poses to the facility's operating objectives, as well as the time required to implement and maintain the improvements. An actionable, world-class energy assessment is not simply a document, but a *relationship* between the energy assessor and the facility staff who will react to improvement recommendations. The report itself will be a "living document" that allows its users to update cost-benefit impacts as energy market conditions and technologies change over time. The static energy assessment report is replaced by a strategic business plan for implementing energy improvements in a cost-effective manner.

See Table 1, next page, for a side-by-side comparison of traditional vs. world-class energy assessment formats.

Many entities provide energy assessments, but the content and quality of assessments are highly varied. Private consultants provide assessments for a fee, while some utilities and universities provide low- or no-cost assessments for economic development purposes. Some equipment vendors provide assessments, but often as a way to drive their product sales. With assessment programs available across the country, it seems reasonable that certain assessors are better than others at some, if not all, aspects of assessment activity. *World-Class Energy Assessments* is an initiative by the Alliance to Save Energy (Alliance) to document the best practices of industrial energy assessment programs. The Alliance collected feedback both from assessment practitioners as well as the clients they serve by organizing a series of regional roundtables on this subject. The intent of these roundtables is to provide a vision for conducting future energy assessments in a way that leads to higher implementation rates.

Energy assessors, especially those who participated in the Alliance's regional roundtables, are encouraged to practice the world-class energy assessment principles described in this report. Industry's business leaders also can use this report's findings to better prepare for future energy assessments and take full advantage of the energy saving opportunities that are waiting to be harvested from their production facilities.

Table 1: **SIDE-BY SIDE COMPARISON** **Traditional Energy Assessments vs. World-Class Energy Assessments**		
Feature	**Traditional Assessments**	**World-Class Energy Assessments**
Goal:	Identify equipment repair, upgrade, and replacement **projects** that will reduce the client's expenses through avoided energy consumption.	Identify, prioritize, and suggest alternative **strategies** for improving the client's business performance through more effective energy choices.
Elements for study:	Energy bills, energy-using equipment, technologies, as well as maintenance procedures and operational behavior.	Energy-using equipment and technology PLUS: • organizational design and relationships • skills and training needs • operations and maintenance procedures • management commitment and communications needed to effectively capture and sustain potential energy savings.
Client participation:	A power house superintendent and a couple of subordinates supply key documentation and provide access to key energy-using assets.	Preparation for an assessment requires input from the general manager plus leadership for engineering, finance, maintenance, procurement, and operations. The client should designate an "energy champion" as the lead contact. Conduct of the assessment itself requires the participation of plant engineers, maintenance leaders, and equipment operators. Presentation of assessment findings requires an audience of all the above.
Deliverable:	A written report that lists potential energy improvement **projects**, indicating their probable cost and payback.	An active, ongoing **relationship** keeps the client apprised of changes to the costs and benefits of potential energy improvements as market variables change. Communication may include: • a written report of the initial assessment findings • a presentation of findings to client staff • implementation scenarios that present different options for organizing recommended improvements • periodic updates of cost-benefit findings as market conditions change • a spreadsheet template for modeling cost-benefit • a listing of contacts for financial and technical assistance services • announcements that recognize implementation milestones, reminding key decision-makers of the progress made and what remains to be done
Outcome:	30-40% of projects may be implemented on an isolated basis as time, money, and interest permit.	The client pursues **continuous energy improvement** through a business plan that identifies what needs to be done, assigns goals and responsibilities, and provides a framework for tracking, evaluating, and communicating progress.

I. INTRODUCTION

Energy-efficient technologies, procedures, and operating behaviors allow facilities to control their energy costs. Energy-efficient principles and activities also contribute to the mechanical integrity and reliability of energy-using equipment such as boilers, furnaces, air compressors, fans, pumps, and motor-drive systems. As a facility boosts the reliability of these assets, it offsets the risk of operational failure or “down-time.” Reliable plant assets work longer and make more products, therefore helping the facility to achieve higher production targets and bring in more revenue.

An **energy assessment** (often referred to as an *audit*) is the key to identifying energy-saving opportunities. The traditional assessment is strictly a technical exercise, led by a mechanical or industrial engineer. It culminates in a summary document that lists recommended energy improvements, giving a brief description of each opportunity, along with its projected cost, savings, and financial payback. The assessment concludes with a presentation of the assessor’s findings. The client then decides when, and if, the organization will act on any of the recommendations.

Industrial facilities[1] face a variety of barriers to becoming energy efficient, including a general lack of awareness of energy waste and ways to reduce that waste. The challenge for an energy assessor is to make those benefits more obvious to the clients’ facility managers and their key staff. An even larger challenge is to ensure that facilities follow through on implementation.

Industry’s top decision-makers may be concerned by the overall cost of energy, but not so much by the technical aspects of energy use. Therefore, the client may need an explanation of energy use and its impact on business performance. For example, many facility managers believe that big, capital project investments are the only solution to high energy costs. They may be unaware of the savings potential inherent in certain behavioral and procedural changes applied to current equipment. The client should understand the options for controlling energy costs and how each option may impact its business activities. With that understanding, the client can better express to the assessor its needs and expectations for effective energy cost control. The energy assessment becomes a foundation for understanding how business performance improves with better energy decision-making.

An energy assessment is worthless if it does not lead to the implementation of improvements. An energy assessor’s report—and the process for developing, presenting, and reacting to it—must be conducted in a way that compels the client to take action. Facility managers deal with competing priorities and their associated risks. When considering an energy improvement, a facility manager may ask: How reliable is the proposed solution? Will it disrupt my process? Will it cost more than it saves? Will the savings not accrue before my next performance report?

Fortunately, there is current evidence that should dispel industry’s reluctance to act on energy improvement recommendations. In 2006, the U.S. Department of Energy’s *Save Energy Now* initiative is documenting the attractiveness (great savings relative to their cost) of industrial

[1] Readers that are unfamiliar with industrial facilities and the ways they use energy should refer to a primer in Appendix A.

energy improvements (see Appendix B for a description of this program and a characterization of its findings through the first half of 2006).

The Alliance to Save Energy notes both documented and anecdotal evidence revealing that less than half of traditional energy assessment recommendations are actually implemented, regardless of who provides the assessment (see sidebar discussion below).

THE TRACK RECORD OF ENERGY ASSESSMENT PROGRAMS

To what extent does industry actually implement energy improvement recommendations? Anecdotal evidence suggests that the very best publicly-sponsored energy assessment programs lead to implementation rates of just over 40 percent:

- Bradley University of Peoria, Illinois, which hosts one of 26 Industrial Assessment Centers sponsored by the U.S. Department of Energy,[2] surveyed 125 facilities that it served between 1999 and 2003 (Najafi, et. al., 2005). The results indicate a 42 percent implementation rate (by volume of energy), or 49 percent (by dollar value of energy savings).
- Enbridge Gas Distribution, an Ontario, Canada based utility company, has conducted at least 92 energy assessments for large steam users through its “Steam Saver” program since 1997 (Griffin, et.al. 2006). The follow-up to these assessments indicates a 42 percent implementation rate by energy volume, or 32 percent by number of projects (in other words, 157 out of 491 potential projects had been implemented through March 2006).

These results beg a number of questions about the practice of energy assessments:

- What are the shortcomings of the typical energy assessment format?
- What characterizes the gap between a traditional energy assessment and what industrial decision-makers need?
- How might assessors improve the energy assessment experience from the industrial client’s vantage point? This would require examining the entire assessment process including the assessment’s preparation, conduct, presentation of results, and follow-up activities.

To answer these questions, the Alliance conducted a series of roundtable discussions that engaged a total of 80 individuals, including assessment practitioners, industrial engineers, and energy policy and program professionals. Roundtable participants are cited in the Acknowledgements section of this report. Appendices C, D, and E present the specific findings from each roundtable as follows:

- Westborough, Massachusetts. February 16, 2006
- Columbus, Ohio. March 1, 2006
- New Orleans, Louisiana. May 12, 2006

The body of this report synthesizes the recommendations that were generated by these roundtables.[3] It should be noted that the roundtables discussed energy assessment practices *as if time and money were not an issue*—in other words, participants described the services and activities that would be provided in the best of conditions. In reality, organizations are hesitant

[2] http://www1.eere.energy.gov/industry/bestpractices/iacs.html

[3] A few recommendations were contradictory. For example, while some participants suggested that facility assessments could be expanded in scope to include non-energy improvement opportunities. Another suggested that the scope should be limited to energy alone. This report resolves those suggestions at the author’s discretion.

to pay for traditional energy assessments, much less the additional activities that are suggested here. Future assessments may draw elements from these recommendations, as needed, to overcome hurdles specific to a facility, its management, and its staff.

THE OUTLOOK FOR FREE ASSESSMENT SERVICES

Energy assessment activities are provided by a variety of sources, including universities, electric and gas utility companies, product vendors, and independent engineering consultants. Large, multi-plant corporations often organize their own in-house engineering staff to provide energy assessments. Many university-based technical assistance centers are publicly subsidized to provide energy assessments, often at no cost, to small- and medium-sized manufacturers as a regional economic development activity. Industrial energy assessment providers are found in every state, but their services vary in scope, quality, and cost.

The funding outlook for publicly-sponsored assessment offerings does not look good for 2007 and beyond. Utilities (especially those operating in deregulated markets) are cutting back on technical assistance in an effort to minimize their overall costs of service. Direct assistance to industry is often perceived as “corporate welfare,” so government-sponsored outreach is being reduced accordingly. For the foreseeable future, manufacturers seeking to control their energy costs can expect to pay for solutions—either by hiring consultants or by developing their own in-house expertise.

Even in the best of times, scarce funding is a fact of life for many publicly-sponsored assessment programs. These organizations could not expect to deliver all the energy assessment services that this report recommends. However, these assessors could partner with other agencies to deliver energy assistance to clients. By “bundling” their services, a regional coalition of assistance organizations can respond more effectively to energy consumers’ needs.

II. ENERGY ASSESSMENTS: THE TRADITIONAL APPROACH

Energy assessments are traditionally a technical exercise, conducted by mechanical engineers for the benefit of the client’s chief engineer or maintenance leader. By virtue of their training, engineers have a great affinity for equipment and hardware. This engineer-to-engineer dialogue usually leads to the recommendation of energy improvement “projects” that focus on equipment, components, and systems. In working with an energy assessor, the client’s facility engineer will often express needs and expectations that only reinforce the “project” approach to energy cost control. This focus excludes improvements that are derived from procedural or behavioral changes.

The organizational aspects of energy cost control become apparent in the campus-like physical layout that characterizes most industrial facilities. Structural features underscore delineations in the client’s organization as well as transitions of authority. Unfortunately, “silos” or departmental turf issues are a fact of life in many organizations. This means that departments within the same company compete against each other for budgetary authority and procedural control. When cooperation across departmental boundaries is limited, many energy-saving opportunities—especially those involving procedural and behavioral change—are much harder to accomplish. The client’s ability to act on energy improvement recommendations is directly related to the client’s organizational structure and its business culture.

A manufacturing organization will almost always assign energy cost control responsibility to a single department or even a single person. This leads to implementation that is limited to reflect the confines of that department's authority and budget. In other words, the department that tackles energy issues tends to understand, seek, and prioritize solutions that its staff can perform while minimizing their interference (and collaboration) with other departments.

For example, a facility may seek energy cost-savings for its steam system. Consequently, the assessor is asked to work primarily with the superintendent of the facility power house, which contains boilers, air compressors, and other large energy-consuming assets. The assessor's focus only begins with the power house. A thorough steam system assessment will cross over into the maintenance department's jurisdiction by examining the distribution system that connects the power house with the many buildings that the power house serves. The assessment continues into the production facilities themselves, now under the purview of the operations or manufacturing department, where the steam or its heat is applied to a variety of work tasks. But here is the challenge: the top management has declared that the powerhouse superintendent's staff and budget shall take care of all steam improvements. These departmental delineations create problems. Against whose budget shall the cost of improvements be applied? To whose budget shall the energy savings accrue? What about labor hours? Who will perform the recommended tasks, and what if departments can't coordinate the recommended activities due to other crucial events on the calendar?

No wonder that less than half of energy assessment recommendations usually get implemented. In most cases, energy cost control is assigned as an "extra" function to a department that not only has other priorities, but also has limited authority and budget to generate solutions beyond its departmental boundaries.

The Logic of "Combined" Assessments. Most facilities are statutorily compelled to secure "audits" for health, safety, and environmental purposes, so these audits are paid for without question. Some clever managers have arranged for these critical audits to also encompass energy-use analysis. By doing this, the cost of the energy assessment is not perceived as an "extra" expense. Also, the audit not only fulfills legal requirements but also identifies energy savings that pay for the audit many times over. Industrial efficiency assessments can easily encompass energy, water, material utilization, safety practices, environmental impacts and related work procedures (see sidebar discussion).

COMBINING ASSESSMENT AGENDAS

A facility assessment can often be conducted for a combination of purposes. Recall that energy use encompasses combustion, heat transfer, and the conversion of heat and power to mechanical force and movement. The assessment of combustion and heat transfer activities has obvious implications for documenting safety compliance in the facility. Combustion analysis will also allow the management of air emissions output and compliance with air pollution regulations. The mechanical integrity of facility equipment varies directly with their energy-efficient operation. In this way, efficiency has a direct impact on equipment reliability and the facility's ability to meet its production targets on time. Also, an energy assessment can benchmark fuel and power consumption as a function of the facility's production volume. These benchmarks are vital components for the facility's planning and budgeting activities.

Industrial assessment clients may even have specific energy improvements in mind. For them, an assessment is only a formality for securing an outside "expert opinion" needed to obtain the project's final approval by top management. From the assessment provider's perspective, serving the client's immediate need is an opportunity to forge a relationship that leads to additional analysis with a broader scope. Additional improvement opportunities will become apparent over time as energy prices change and new technologies become available.

III. PREPARING TO CONDUCT WORLD-CLASS ENERGY ASSESSMENTS

Preparation for a successful energy assessment includes an analysis of a client company's business procedures. The assessor will need to understand the client's:

- **Technical review.** Who in the client company participates in evaluating and implementing changes to its operations, and what procedure does it use to accomplish these changes?
- **Fiscal calendar.** It is useful to know the client's budget cycle. When does the company begin assembling investment proposals in anticipation of setting next year's budget?
- **Project/investment approval.** Which of the client's decision-makers are involved in this procedure, and what are their criteria for making decisions? The assessor should be prepared to present recommendations in a way that addresses the primary concerns of each key decision-maker.

ESTABLISHING AN "ENERGY CHAMPION"

Research by the Alliance to Save Energy shows that companies with a lead energy coordinator—an "energy champion"—tend to be more successful at sustained energy cost control. This is a person with the authority to coordinate energy-related decisions. The assessor should identify the client's staff person who either does or can fulfill this role. The energy champion will be a helpful person to work with during the assessment process and during the subsequent follow-up.

Good communication at the outset will make the purpose of the energy assessment clear to all participants. Otherwise, an investigation performed by an "outsider" may be resisted by some individuals.

The physical examination of the client's facility and energy-related records will require the cooperation of a number of staff, such as procurement and operations professionals. These individuals won't always understand or agree with the assessment process and the recommendations it provides. Some people are very comfortable with "the way we've always done things." To them, energy improvements suggest *change*, and change implies risk. Some of these individuals will play a role in approving—or vetoing—recommended energy improvements. For example, the client's maintenance or engineering staff may feel that an energy assessment will be interpreted as evidence of their poor job performance.

The threat of embarrassment is very real to the client staff involved in an energy assessment. It is a good idea for the assessment to identify positives in the client's current energy management, with credit being given to the key individuals whose support will be needed to advance new recommendations. The support of the client's technical staff will help greatly in securing top managers' eventual approval of forthcoming recommendations.

Departmental Issues Impacting Energy Assessments and Cost-Control. Each department in an industrial organization will have a distinct perspective on energy expenses and the strategies for energy cost control. These perspectives are a function of the professional training and objectives that characterize each department. These are some of the departments that will be impacted by energy recommendations:

- **Engineering.** The chief engineer is usually tasked with the design and installation of equipment, and may have significant influence in developing the operating procedures for that equipment. To many engineers, energy solutions are discrete "projects" that involve capital investment for the installation of new equipment.
- **Maintenance.** These are staff charged primarily with ensuring the integrity and reliability of existing equipment. Because they usually have little involvement in capital budgeting or asset management decisions, the maintenance staff's approach to energy cost control is to fix leaks, adjust controls, and clean or lubricate equipment. These tasks can be accomplished at little expense, but their energy savings impact is limited if the tasks are not consistently performed.
- **Procurement.** Many business leaders perceive fuel prices as the key to energy expenses. The procurement director may then be asked to take charge of energy cost control and even the energy assessment process. Procurement directors want low energy prices (or at least predicable energy bills from month to month), so they shop for the best available fuel contracts, or even switch fuels, if possible. However, procurement savings may be cancelled out by ineffective criteria for hardware purchasing. Hardware purchased from the lowest of three bidders may be cheaper to install but is often less energy efficient, therefore costing more to operate over its economic life.
- **Environmental, health, and safety (EHS) coordinators.** These are professionals who primarily administer their company's regulatory compliance obligations. Such professionals are accustomed to data gathering, record keeping, and the documentation and monitoring of procedures. Because of the legal implications of their work, EHS professionals enjoy some authority to advise or direct staff in other departments.
- **Energy managers.** A small but growing number of organizations are developing departments for the express purpose of energy management. The effectiveness of such a position varies with the energy manager's ability to influence or command other staff to apply energy-saving principles to their daily work.

Effective energy cost control will involve personnel from a number of departments, many of whom assume that energy cost control is "not my job." Both the assessor and the client's lead energy person will have their persuasive skills put to the test. Some staff will ask: "What's in it for me?" The answer to that question needs to be concise and in a language that is relevant to their department. Semantics become an issue. The choice of terminology, as well as the scope and specifics of the assessment service to be provided, are up to the provider (see sidebar discussion).

TERMINOLOGY & PERCEPTION: "AUDIT" OR ASSESSMENT?

Historically, energy assessments have been referred to as "energy audits." The term "audit" is problematic to many observers because it connotes a search for discrepancies that lead to fines or punishment. The phrase "energy assessment" is an evolutionary step toward a less pejorative term. A simple change in terminology may improve industry's receptiveness to energy assessments.

Industry clients without a clear set of energy improvement expectations may benefit by seeing case studies that describe the before-and-after impacts of energy improvements at other facilities.

These case studies may describe technologies and procedures as well as information about financial incentives and utility rebates. A comprehensive case study will describe how energy improvements impact productivity, reliability, environmental compliance, safety, or other operating concerns.[4]

IV. CONDUCTING A WORLD-CLASS ENERGY ASSESSMENT[5]

Some assessors begin the assessment process with a questionnaire or template to collect data that describes the client facility and its energy usage. This "screening tool" should include an inventory of energy-using equipment as well as the procedures and staff roles that support the operation of this equipment. Identifying the facility personnel who are involved in (or impacted by) energy improvements is important—these individuals need to understand how proposed changes may impact their daily operating concerns. The effectiveness of the energy assessment and the implementation of recommended energy improvements will depend on properly identifying the equipment, people, and organizational relationships that determine energy usage.

Observations to Make. An energy assessment should cover both mechanical and organizational attributes of a facility's energy use.

- Observations to make about equipment:
  - the general mechanical condition
  - age and repair histories
  - work capacities and tolerances
  - preventative maintenance schedules
- Observations to make about organizational attributes:
  - Were previous assessments conducted? If so, are they available to review?
  - Were any of the earlier recommendations actually implemented?
  - What kind of energy monitoring system or protocol is already in place?
  - What metrics are used for monitoring the impact of energy use on business performance?
  - How are equipment-purchasing decisions made? Do procurement criteria recognize total-costs-of-operation or simply seek the lowest initial cost?
  - Is there a protocol for making and enforcing procedural changes in maintenance and operations?
  - How do the client's in-house skills for analysis and implementation compare to what is needed to manage and evaluate energy projects or improvement programs?

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[4] The U.S. Department of Energy presents a large number and variety of technical case studies on its website:

- From *Save Energy Now* assessments in 2006: http://www.eere.energy.gov/industry/saveenergynow/partners/results.cfm
- From related DOE program initiatives: http://www1.eere.energy.gov/industry/bestpractices/case_studies.html

Both the U.S. DOE and the Alliance to Save Energy offer case studies that describe the managerial and organizational aspects of energy cost control:

- From the DOE: http://www1.eere.energy.gov/industry/bestpractices/corporate_success.html
- From the Alliance to Save Energy: http://www.ase.org/section/topic/industry/corporate/cemcases

[5] It is beyond the scope of this report to describe in detail the mechanical aspects of energy assessments from a practitioner's standpoint. Readers are referred to an insightful article on this topic (Knapp, 2006).

- Does the company maintain an inventory of needed skills and establish a training program to support those needs?
- What staff, or department, is expected to accomplish energy cost control, and what is the capacity of its authority and budget?
- Will energy improvement initiatives pose benefits to some departments while placing burdens on others? Is there a protocol for reconciling these impacts?

Client staff from different departments, sections, or professional disciplines can be assigned to cooperate with the assessor in their areas of responsibility. The assessor's effectiveness will be improved by getting the cooperation of proper staff contacts. At a minimum, the client should provide a lead engineer or mechanic to assist with evaluating major equipment such as boilers, air compressors, and other large, energy-consuming equipment. Larger, more complex organizations may provide different staff contacts for each major section or department. It is also helpful to involve equipment operators when possible, since these individuals can often share with the assessor some very good energy saving recommendations that would otherwise be ignored. Support from the client's technical staff will be more forthcoming if they understand how an energy assessment and its recommendations will impact their jobs.

An energy assessment can just as easily address a client's skills and behaviors as it does the "mechanical" opportunities for energy improvements. By demonstrating diagnostic software and other useful reference material[6], the assessor is providing the client's key staff with the skill-set needed to effectively implement and sustain energy savings. A world-class energy assessment, then, shows the client not only what can be done to improve energy performance, but also how to sustain the results.

V. EXPRESSING THE IMPACT OF ENERGY SAVINGS

Assessors have several options for describing the financial impact of their recommended energy improvements. "Payback," still the most widely used measure of value, describes the number of years it takes for the cost of an investment to be recovered through the annual savings that it provides. Many facilities observe a two-year payback hurdle-- in other words, the investment in an energy improvement must pay for itself in two years or less. Some facilities demand an even shorter payback. Despite the existence of more sophisticated measures of financial analysis, the majority of small to mid-sized facilities rely on payback as their primary means for evaluating investment proposals.

Industry's corporate managers are often not impressed by proposed "energy savings." Yet the same results may be enthusiastically received when impacts are related to *key performance indicators* (KPIs) of the client's business operations. This means expressing a reduction in energy use (or cost) per unit, gallon, square foot, day-of-operation, or any unit relevant to a facility's operations (see sidebar discussion).

[6] The U.S. Department of Energy's BestPractice tools are ideal for this instruction. See http://www1.eere.energy.gov/industry/bestpractices/resources.html.

EXPRESSING THE BUSINESS IMPACTS OF ENERGY OPTIMIZATION

An energy assessment will make more sense to the client's key decision-makers if its potential results are expressed in meaningful terms. Most businesses use a *key performance indicator* (KPI) to evaluate their business performance. A KPI describes financial results per some basic unit of business activity. Examples of these basic activities may be:

- **Tons of product.** This is typical of factories that produce bulk products by the barge-load or railroad hopper car-load.
- **Barrels of product.** Petroleum refining products are a good example.
- **Thousand square feet of product.** Many textile manufacturers use this statistic.
- **Cases of product.** A beer bottling plant may use this measure.
- **Hours of operation.** This may be suitable for a retail establishment.
- **Heating or cooling degree day.**[7] This indicator is important for hotels, hospitals, offices, and classrooms, and other commercial or institutional buildings.

Outline of a World-Class Energy Assessment. To inspire action, an energy assessment report will need to resonate with the client's key decision-makers. This implies the need for an executive summary that is clearly segmented to address the concerns and goals of several audiences, as follows:

- For a corporate director or top facility manager:
    - How does energy—and the decisions regarding its use—impact overall business performance?
    - What are the options for taking action?
    - To what department or departments should tasks be delegated?
    - What information will assure the top manager that energy cost control is underway and sustained? In other words, how can data be converted into usable progress reports?
    - How will efforts to control energy costs require cooperation across departmental lines?
    - What changes or events must take place in the client organization before energy improvements can be realistically pursued?
    - How should the top manager foster and support the cooperation that is needed for the organization to truly control its energy costs?
- For a finance director:
    - What are the costs involved both in using energy and in controlling its waste?
    - What accounting metrics will relate energy consumption to financial performance?
- For an operations leader:
    - How can standard operating procedures be amended to minimize wasteful energy practices?
    - How can staff be held accountable for energy-smart behavior?
- For a chief of engineering:

[7] A "heating degree day" is the difference between one day's average temperature reading and the annual average temperature for the same location. This measure accounts for how cold the location is on a given day. Heating degree day measurements allow an analyst to adjust cold-weather energy consumption readings for variations in temperature. A "cooling degree day" represents a similar concept, but applies to summertime energy consumed for air conditioning purposes.

- What capital improvement proposals offer the most potential improvement to reliability, productivity, and cost control?

VI. ENSURING THE CLIENT'S FOLLOW-THROUGH

All business decisions strike a balance among risk, time and money. This is especially true for energy improvement opportunities. Traditional assessments are limited to discussing the cost and payback for each recommendation. A variation to this approach would be to comment on the time and risks posed by the same improvements. The "time" discussion can cover time requirements for implementation as well as the impact on staff's time once the improvement becomes a part of daily practice. Risk associated with certain recommendations is another discussion. Clients will want to know the probability of an initiative's ability to reduce costs, or its potential impact on operational performance or product quality.

Scenarios: A Strategy for Presenting Assessment Recommendations. Scenarios can be used to simplify the way recommendations are presented. Different scenarios may describe the business impacts if all, some, or none of the recommendations are followed. The client should understand the benefits and limitations of each scenario. Perhaps the most important scenario is the one that illustrates the impact of "doing nothing." For example, a two-year history of the client's operating income shows business performance without the improvements in place. Instead of developing an energy performance forecast that looks forward (and therefore relies on more guess-work), an analysis can use historical data to "back-cast" performance to more effectively demonstrate the impact of various energy improvements. One scenario may illustrate the selective implementation of only low-cost solutions. Other scenarios may illustrate the effect of pacing improvements over time. Forecasts (or backcasts) are never perfect at predicting *absolute* results, but they are excellent for *comparing the relative cause-and-effect* of certain energy choices.

Implementation scenarios are an opportunity to bring attention to "critical success factors." A critical success factor is an organizational feature or attribute that must be in place if the client is to successfully implement an improvement recommendation. Some examples will help to explain:

- **Remove procurement impediments.** Requiring managers to purchase hardware from the lowest of three bidders can result in the use of lower quality equipment that fails more often, and ends up costing more in the long run.
- **Ensure that staff are properly trained.** The projected payback on a new piece of energy-using equipment may not be attained if staff continue to practice wasteful habits.
- **Remove barriers to cooperation across departmental lines.** Energy improvements probably won't be implemented when one department must pay for it, another must devote labor hours to it, and yet another gets to claim the savings.

OPTIONS FOR ORGANIZING ASSESSMENT RECOMMENDATIONS

Some clients are overwhelmed by the sheer number and variety of energy improvement opportunities—especially when they react to the cost of all recommendations in total. Part of the assessor's challenge is to break down a list of recommendations into manageable scenarios for implementation. Potential energy improvements can be classified in a number of ways:

- **Type of energy system.** Organize the list into distinct mechanical areas. Isolate opportunities for steam, compressed air, interior space conditioning, etc.
- **Investment impact.** Describe non-capital vs. capital investment, or quick vs. longer payback.
- **Operational impact.** Distinguish between initiatives that (1) apply to current systems and procedures and (2) those that will require capital investments or procedural changes.
- **Time.** Simply organize the list into categories that reflect the impact on people's time, both from implementation and from operational perspectives.
- **Risk.** Categorize improvements per their relative risk of success or impact on operations.
- **Departmental impact.** Identify the energy-saving activities and investment that might clearly accrue to distinct departments in the client organization. For example, leak repair and prevention may be a duty for the maintenance department, while the assimilation of new technology may be handled by the engineering section.
- **"Make-or-buy."** Distinguish between improvement activities for the client's in-house staff versus those that require outside expertise.

A "Living Document." A traditional energy assessment is a snap shot of conditions that exist at the time of the analysis. A written assessment report is a static description of the client's energy consumption, price of energy, types of fuels used, costs of specific improvement activities, financial payback, and other variables. Few clients implement all assessment recommendations all at once. As time passes, the fuel prices and other variables change, as do the relative values of individual improvement opportunities. The written report should note the "vintage" of the data used at the time of analysis. Because of the movement in these variables over time, it makes sense to provide the client with an electronic spreadsheet version of the analysis that is summarized in the written report. A world-class energy assessment would include a spreadsheet that allows the client to adjust the "model" of their facility's energy performance as energy prices and other variables change over time. Similarly, the client may arrange for the assessor to provide a periodic update of the assessment results.

Documenting Assistance Resources. A valuable energy assessment will describe the local network of energy assistance providers available to the client. State energy offices, utilities, universities, and regional trade associations are the usual providers of assistance services, often at little or no cost. Available assistance might include technical troubleshooting, "how-to" reference materials, training, and project financing or rebates. A for-profit assessor serving a municipal or non-profit agency (one that is not subject to income tax) may claim the utility company rebate, and then lower the client's cost accordingly. For example, a utility might partner with a financial intermediary to establish criteria for loan eligibility, therefore giving clients a fast-track to securing loans. By assembling a list of locally-available services like this, the assessor adds great value to any assessment report.

THE ROLE OF ENERGY PROCUREMENT STRATEGIES

Energy purchasing strategies are an indispensable component of energy cost control. Providing an analysis of purchasing options should be a natural extension of an energy assessor's practice. At its most basic, purchasing assistance involves helping the client to interpret current energy bills and their related tariff schedules. For facilities that have access to deregulated energy markets, assessors can assist clients in evaluating the variety of purchasing options that are available through energy marketers. Similarly, assessors may be of assistance to clients in developing bids and proposals for energy purchase. Also, many of the independent system operators that manage regional power markets have organized demand response programs. Broadly speaking, these programs allow large power users to profitably shift their electricity consumption to certain times of day. In some jurisdictions, industrial facilities that produce their own electricity can sell their surplus power back to the supply grid.

"Aggregation" activities coordinate a number of energy purchasers into a buyers' consortium. A few state energy organizations and utilities provide aggregation assistance to industries in their regions. Energy assessors need to be aware of these services and refer their clients to them accordingly.

Maintaining Momentum. Clients will usually complete recommended energy improvements over time, as opposed to all at once. While the client's energy leader may keep abreast of improvements, the top management's attention will probably move elsewhere. A well-prepared assessor will maintain a database and calendar for managing client follow-up contacts. A reminder of energy assessment findings can be sent at the start of the client's budget development season. The completion of a major project is worthy of recognition, and a note to that effect can be sent to the client's top management. The note can elaborate on the savings that the project will generate, and how the project brings the client that much closer to capturing all the savings identified in the original assessment. These reminders are an opportunity not just to offer congratulations, but to sustain management support for pursuing additional energy improvements.

VII. CONCLUSION

As energy market turmoil impacts industry's business performance, more companies are becoming interested in reducing their energy waste. However, energy assessments are not often thought of as the first step in finding solutions. Education is the key to addressing industry's low awareness of energy solutions and to overcoming suspicions about the assessment process.

To a large extent, the results of an energy assessment will depend on the assessor's grasp of the client's needs and expectations. The client may simply express a need to "reduce energy costs" without fully understanding how much reduction is possible, what it takes to achieve the savings, or how the energy improvements will impact other aspects of the business. Some industrial clients know exactly what they want from an energy assessment, while others don't. Different department heads within the client organization may anticipate different energy solutions: procurement directors want lower energy prices, maintenance people may focus on the reliability of energy supply, and engineering staff want to identify new technologies. A good energy assessment will all address these areas and more. The assessor's analysis format and final report can be designed to accommodate the client's expectations.

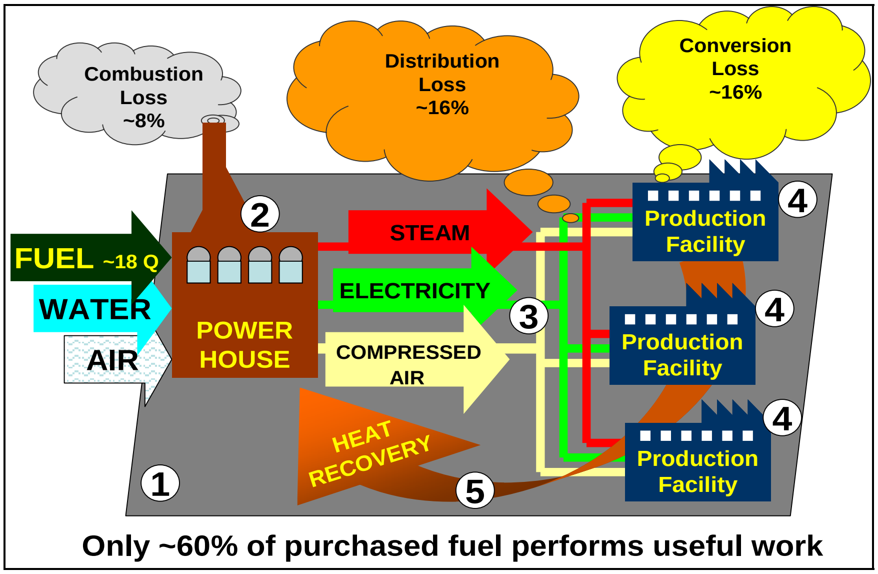
An energy assessment is only a partial step toward the full implementation of energy improvements. To act on an assessment's recommendations, facility decision-makers will need to invest in new equipment, makes changes to certain staff behaviors and procedures, or (most likely) a combination of all these activities. Many individuals in the facility are potentially impacted by recommended energy improvements. The full realization of energy cost control usually requires the support and coordination of several department leaders from within the industrial organization. This decision-making "team" will ideally include representatives from the procurement, finance, operations, maintenance, and engineering departments, acting collectively to approve or reject any of the assessor's recommendations. Very often, it may take only one person's veto to kill a project. Support for energy improvements depends largely on how well these individuals understand and support the assessor's recommendations. Assessors should be prepared to answer the "What's in it for me?" question that is implicit in each decision-maker's evaluation.

Energy consumers don't always have the time to become familiar with incentive programs and services. The success of public-sponsored energy assistance programs may rest on the assessors' efforts to maintain personal contact with key client staff. Periodic communications can announce emerging technologies as well as changes in the utility tariffs that set prices for fuel and power. For example, if a change in tariffs raises the cost of energy, the recommended energy improvements will pay for themselves more quickly through the savings they generate. The assessor can also help the client by measuring the effectiveness of early project implementation. Evidence of savings success will sustain support for future energy projects.

APPENDIX A:
AN OVERVIEW OF INDUSTRIAL FACILITIES AND THEIR ENERGY USE

Industrial activity occurs in facilities that manufacture products. Certain basic products, such as fats and oils, pulp and paper, chemicals, petroleum refining, and primary metals production, are intermediate components which are eventually fabricated or refined into the products actually purchased by consumers. For example, an automobile is assembled from a vast array of intermediate materials, most of which were produced elsewhere before they were shipped to the point of final fabrication and assembly. The finished automobile contains material and sub-assemblies supplied by manufacturers of steel, aluminum, copper, glass, rubber, plastic, paint, and other intermediate products.

A manufacturing corporation may operate one or more production sites. Each site features a number of structures that are arranged on a campus-like setting. The volume and form of energy required by a manufacturing site is highly varied—it depends on the type of product being made as well as the design of the production process and the structures that house those processes. A "typical" industrial facility's layout and energy consumption may resemble this diagram:



SOURCE: DOE-ITP, 2004

The entire site ① is a large property suitable for hosting production facilities, offices, warehousing and storage, employee parking, and infrastructure for moving materials on and off the property.

U.S. industrial power houses ② in aggregate consume about 18 quadrillion Btu annually. Power houses organize the energy needed to transform material inputs into a finished product. Material is transformed by adding and/or subtracting heat and applying force and pressure. Energy is used for motive purposes, i.e., pumping, cutting, lifting, sifting, stirring, rotating, folding, etc. Also, energy is used to control the atmosphere in certain production facilities. The power house may host boilers, turbines, air compressors, and electricity transformers and switchgear. Boilers create steam, which is an efficient medium for transferring heat. Steam can also be used to power a turbine that generates electricity. Alternatively, electricity can be purchased from a merchant and/or utility, in which case the power house merely transforms the purchased electricity into voltages required by the facility. Electricity is also used to operate air compressors. Compressed air performs a wide variety of functions—too numerous to list here. Note that industrial power houses experience energy losses as they convert fuel to heat and power. In the U.S., those losses are, on average, equivalent to eight percent of total industrial energy purchases.

The distribution infrastructure ③ transmits steam, electricity, and compressed air to buildings that host production activities ④. Distribution system losses are characterized by leaks and radiant heat losses, which on average add up to 16 percent of energy purchases. Another 16 percent of purchased energy is lost as heat and power are converted to work in the production facilities. Some facilities recapture residual thermal energy (steam, hot water, and combustion emissions) and return it ⑤ for reuse by the power house. Only 60 percent of industry's purchased energy performs useful work, yet much of that waste can be economically recaptured.

APPENDIX B:
What is the Cost-Benefit Profile of an Industrial Energy Assessment?
Evidence from the U.S. Department of Energy's Save Energy Now Initiative

A particularly destructive 2005 hurricane season wreaked havoc on oil and gas production infrastructure in the Gulf Coast region. This damage, in addition to already tight global fuel markets, drove U.S. energy prices to unprecedented heights. In the aftermath of price spikes, even "stable" prices remain high enough to threaten the profitability of U.S. based manufacturing facilities. The industrial sector, which is widely dependent on natural gas, pressed the Bush Administration for relief. U.S. Department of Energy (DOE) Secretary Sam Bodman responded by introducing the Save Energy Now initiative on October 3, 2005:

"America's businesses, factories, and manufacturing facilities use massive amounts of energy. To help them during this period of tightening supply and rising costs, our Department is sending teams of qualified efficiency experts to 200 of the nation's most energy-intensive factories. Our Energy Saving Teams will work with on-site managers on ways to conserve energy and use it more efficiently."

On a broader level, DOE has begun distributing a portfolio of "BestPractices" information[8] to 50,000 facilities. DOE's BestPractices pertain to plant systems commonly found in industry, such as steam, process heating, motor drives, compressed air, and insulation. The portfolio consists of diagnostic software, survey guides, tip sheets, and similar material intended for plant managers to perform self-led energy improvements with their existing staff and resources.

The DOE very quickly identified 200 forward-thinking participants for energy assessments and actually had to turn away eager applicants. Results for the first 36 *Save Energy Now* assessments are summarized here (see Figure 1, next page). In all, the 200 plants selected for energy assessments represent a variety of industries and are located in 39 different states. Experts at DOE have projected the anticipated savings for all 200 plants based on the results from the first 36 energy assessments (through April 2006). These are traditional, technology-only assessments of energy use. According to these projections:

- The 200 plants present 63 trillion Btu in annual savings potential.
- The equivalent dollar figure of the savings is expected to be $500 million.
- Not every improvement recommendation will be implemented. DOE expects a 40 percent implementation rate.
- These 200 assessments cost the taxpayers $3.1 million. This includes the direct cost of the assessments plus program overhead. The return on this investment is about 65:1.

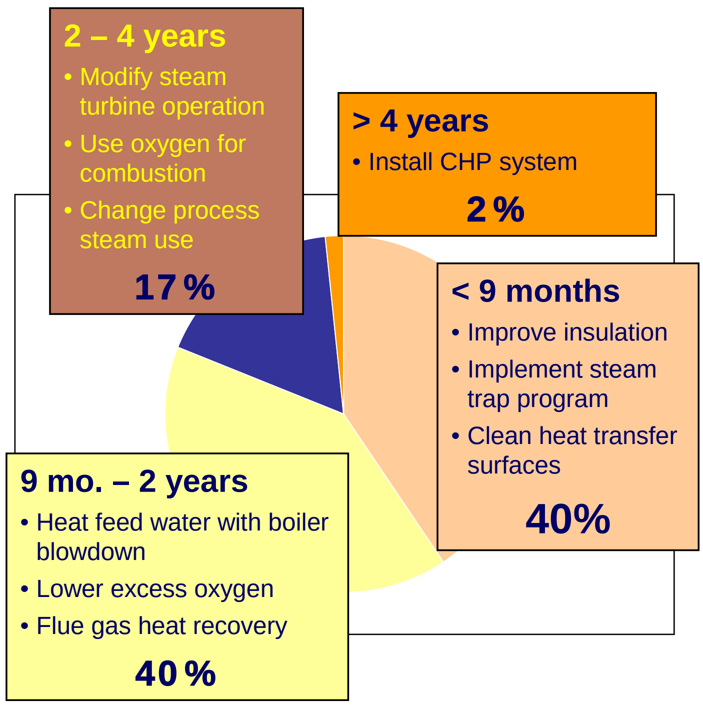
In total, these first assessments identified total potential natural gas annual savings of 11.3 trillion Btu. To put this in perspective:

- These savings are equal to the annual natural gas consumption of 155,000 homes.
- This represents $95.6 million per year, or an average of over $2.6 million per plant.

[8] http://www1.eere.energy.gov/industry/bestpractices/

- Forty percent of the identified savings can be achieved with a payback of nine months or less. Improvement measures include insulation upgrades, steam trap programs, and the cleaning of heat transfer surfaces.[9]
- Another forty percent of the potential savings can be achieved with a payback between nine months and two years. These opportunities include heat recovery and combustion optimization.

Figure 1:
DISTRIBUTION OF FINANCIAL PAYBACK
Initial Industrial Energy Improvement Opportunities
Identified by the U.S. DOE's Save Energy Now Initiative



SOURCE: U.S. Department of Energy, Industrial Technology Program

If a facility were to pay market value for one of these assessments, the cost would range anywhere from $5,000 to $12,000, depending on the size and complexity of the facility. Recall that the average value of identified savings potential per plant is $2.6 million. Assume that only 40 percent of the recommendations will be implemented. That's an average of about $1,000,000 in savings per facility. What's the return on investment for an energy assessment if someone actually paid for it? Let's be conservative and use the higher cost assessment value ($12,000). The average return on investment is about 83:1.

Industrial facilities that secure an energy assessment will learn about their energy savings potential. Why aren't more facilities doing this? Facilities that refuse energy assessments may end up paying much, much more through energy waste and lost productivity.

[9] Non-technical readers can get a definition of these terms and a better understanding of their importance by referring to the U.S. Department of Energy's Industrial BestPractices website: http://www1.eere.energy.gov/industry/bestpractices/.

APPENDIX C:
Recommendations from the February 16, 2006 Roundtable in Westborough, Mass.

PART 1: INITIATING THE ASSESSMENT RELATIONSHIP

- Energy assessment activity is commonly initiated through:
    - program relationships between public-sector energy agencies and participating equipment vendors
    - gas and electric utilities' account managers who manage customer relations
    - customer-initiated inquiries
    - independent assessors' business development
    - contact established via internet and other marketing material
    - personal contact: especially maintained by vendors or other product agents

- What should characterize the assessor/client relationship?
    - Assessors should not pre-screen potential clients.
    - Assessors need to educate potential clients as to what is expected from an energy assessment.
    - The assessor will have to spend some time with all levels of client staff.
    - The assessor will need support from lower-level client staff to back up proposals to the client's top management.
    - Free assessments often generate non-committal clients. Co-pay by the customer ensures commitment.

- What should the assessor's message be to the potential client?
    - Propose a "facility assessment" as opposed to an "energy audit." Remember that the assessment can capture energy, environmental, productivity, and other impacts.
    - Ask the client about its preference for assessing financial performance. For small- to medium-sized facilities, use only "payback" to describe the value of assessment results. More sophisticated financial measures are less widely understood.
    - Implementation success is directly related to number of face-to-face contacts with the same facility. Multiple client visits, each with a different vendor/stakeholder, utility, etc., builds the client's familiarity and comfort with the assessor and with energy improvement concepts in general.

- What do clients know about energy and energy assessments? What do they expect?
    - Clients are largely unaware of energy improvement incentives and assistance programs available to them.
    - Education about energy assessments is constantly churned out by energy offices and utilities, but it's either (1) not getting into the hands of the right decision-makers, or (2) companies do not follow up on recommendations. (But interest in assistance programs has grown with the run–up in energy prices.)
    - Some customers know exactly what they want, while others don't. Assessments are adjusted accordingly. Initial assessment proposals can be focused on specific projects, but repeat follow-up contacts allow for a broader scope (but repeat follow-up obviously costs more over time).

- How should assessment programs invest their limited resources?
  - U.S. DOE Industrial Assessment Centers need to leverage non-DOE resources, including economic development offices, utilities, Manufacturing Extension Partnership (MEP) offices[10], etc.
  - The assessor can pool a listing of incentives prior to the start of the assessment to raise the client's interest in implementation.

PART 2: PREPARING THE CLIENT FOR AN ENERGY ASSESSMENT

- Know in advance who the "champion" is (the person who takes the lead in managing the client's energy issues). Large facilities may need separate champions for distinct systems.
- Other managers in the client organization will be affected by the assessment process and the eventual implementation of energy improvements. Secure their support for the process.
- Perform pre-audit data collection when possible. A "screening tool" or template will facilitate this process. Identify the client's key business performance indicators and anticipate relating these to energy performance.
- Perform research on the energy performance of facilities similar to the client's. Present these findings along with information about available incentives, rebates, and related environmental issues.
- Establish a checklist to determine these company attributes:
  - Budget cycle
  - Technical review protocol
  - Project approval protocol
  - Process for selecting vendor bids
  - Design protocol
- The assessor should employ a modular report format so that each section can focus on certain systems.
- Assessment reports need a general, high-level summary of findings as well as technical details. Separate these discussions for the appropriate audiences:
  - Executive summary for the client's top management
  - A financial/accounting component
  - Technical details in appendices
- Find out how the client makes financial decisions. Determine the chain of command, and get some face-time with these people.
- Involve equipment operators who will be impacted by recommendations—collect their buy-in. Make clear to them what the assessment's outcome entails.

PART 3: ASSESSMENT CONDUCT

- Determine a leader on the assessor's staff as well as on the client staff.
- Include client staff in the actual conduct of the assessment. Explain assessment activities to the client. Ask their staff to assist with the placement of testing equipment and with data collection. Involvement will elicit much better support from the client staff.
- Conduct the assessment using a team structure: assign specific areas for each person (process, environmental, combustion, air compression, motors, etc.).

[10] http://www.mep.nist.gov/. This network of non-profit organizations provides technical assistance to industry. A combination of federal, state, local, and private resources underwrites the cost of MEP activity.

- Expand the assessment scope to include non-energy benefits (which will improve the payback calculation).

PART 4: REPORT PREPARATION AND PRESENTATION

- Organize the presentation of assessment findings to reflect the expectations established at the beginning of the process.
- Make clear the assumptions at the time of report (energy costs, fuel types input). Anticipate making updates to the assessment report as variables change.
- Ensure that all key client personnel are on hand for the presentation.
- Invite representatives from assistance provider organizations, if possible. Ask them to elaborate on their services for the client.
- Make customer aware of opportunities to reduce energy costs through the timing of their operations (load shifting). In states where it is permitted, indicate the client's potential to sell electricity back to the local electricity grid.
- Provide utility rate analysis. Describe opportunities to purchase energy through aggregation services. Provide guidance with preparing proposals for energy procurement.
- Prepare assessment reports with an intention to cause implementation (not simply to report for its own sake).

PART 5: FOLLOW-UP WITH CLIENT

- Keep in regular contact with client. Offer to evaluate projects after their implementation.
- The assessor can build a database for follow-up purposes. The database can also be used as a platform for reanalyzing recommendations after market variables change. A database that documents project performance can be used in response to risk concerns expressed by future clients.
- Help the client to secure energy-use metering systems (you can't manage what you don't measure).
- Understand the client's annual budgeting cycle. Be sure to send reminders of the assessment findings in time to coincide with budget preparation.
- Determine a close-out date, or a point in time where full implementation is achieved. Provide a status report. Public sector assessment programs may, with the client's approval, issue press releases or awards to recognize a facility's completed work. Corporate newsletters can do the same—to keep the energy cost control visible throughout the organization.
- Keep clients updated about new technologies as they become available.
- Contact clients as utility tariff changes occur. Explain how the new tariffs impact payback calculations.
- Describe alternatives for project financing. For example, utilities may partner with a pre-qualified bank to provide loans.
- Municipal energy purchasers can indirectly benefit from rebates or tax incentives. For example, an equipment vendor can accept a utility rebate, and then lower the cost to the municipal client by that amount.
- An equipment rebate may complicate an industrial facility's tax considerations. An equipment vendor can claim the rebate and lower the cost to the client accordingly.

- Utility rebates might have a long processing time. The equipment vendor can pay the client immediately an amount equal to the rebate then claim it from the utility after the project is certified as complete.

APPENDIX D:
Recommendations from the March 1, 2006 Roundtable in Columbus, Ohio

PART 1: INITIATING THE ASSESSMENT RELATIONSHIP

- Work with the client's engineers, finance, and operations directors. Also include equipment operators.
- Anticipate a client decision-team to include managers from manufacturing, engineering, and finance, as well as a plant superintendent.
- Agree about what the energy assessment should say:
    - Include factual information about improvements and their savings potential.
    - Describe energy impacts and no more.
- Facility staff and the assessor should collaboratively determine assessment expectations. What equipment should be the focus if time is limited? Use the 80/20 rule (80 percent of value will probably be detected with the first 20 percent of assessment effort).
- Deal with threat of change. The assessor MUST have support from the facility's general manager (and other key decision-makers). Make employees comfortable with the concept of an energy assessment and the recommendations that it yields. Show examples. Make the purpose of the assessment clear to employees.

PART 2: ASSESSMENT CONDUCT

- An assessment is as thorough as the time put into it (you get what you pay for).
- The facility staff should work with the assessment team. Facility staff can help the auditor to interpret energy data and related inputs.
- The first or biggest opportunities may require capital expenditure. Arrange efforts to identify easy, low-cost savings to get started.
- Perform separate assessments for process vs. environmental equipment.
- Metering data (i.e., data describing energy flows before and after improvements) are necessary for justifying capital investment.
- Establish baseline energy consumption. In other words, determine the facility's energy consumption when process machinery is idle. This might be accomplished at night or during weekends.

PART 3: PREPARING RECOMMENDATIONS

- Record observations in a way that does not embarrass facility staff or suggest that they are not doing their jobs right.
- Record what's currently being done right in the plant.
- Recognize all levels of staff involved in decision-making.
- Simplify report formats. Organize technical information in appendices.
- Develop a software version of the report to allow the calculation of potential value to change with market conditions.
- Develop operating benchmarks that describe the "normal" or expected energy consumption that is anticipated in optimal conditions.
- Include some success stories or case studies in the report.
- Emphasize the incremental approach to implementation—not needing to do it all at once.
- Offer scenarios for implementation:
    - "Do nothing"
    - "Easy, cheap efforts"

    - "Major investments or process changes"

PART 4: PRESENTING THE RECOMMENDATIONS

- Make a face-to-face presentation. The presentation team should include the people who participated in the assessment.
- Describe recommended improvements in terms of the risk, time, and cost associated with their implementation. This should help to overcome management hurdles.

PART 5: FOLLOW-UP WITH THE CLIENT

- Specify a follow-up calendar in the assessment report.
- Follow-up entails a periodic update of implementation scenarios to reflect market changes over time.
- Document successes since the last update. Use this information to sustain the client's momentum.

APPENDIX E:
Recommendations from the May 11, 2006 Roundtable in New Orleans, Louisiana

Promotion of energy assessments: What's the message?

- Assert that reducing energy waste is good for business.
- All facilities have room for improvement.
- If possible, express the need for the assessment (and subsequent improvements) as a direct response to one of the client's key problems—financial, mechanical, or otherwise.
- Energy management is a process, not a project.

Who should be the messenger who promotes energy assessments?

- The facility's energy champion (lead contact for energy issues) should partner with the leader of the assessment team to deliver the "value of energy efficiency" message to the facility's top management.
- Make "heroes" of the facility staff: improve their morale and support for energy improvements. Present recommendations as if staff are the ultimate source of the ideas.
- Stimulate demand for energy assessments at all levels of the client organization. A successful assessment effort will have support from the top down and from the bottom up.

Should clients be pre-screened for eligibility?

- Prescreening clients for their eligibility for an energy assessment is a good thing. There should be different approaches for different customers:
  - To large energy consumers: express energy efficiency as lost opportunities.
  - Small or mid-sized consumers: react to specific facility problems. Fix those and grow the relationship from there.
  - Assessment services for smaller facilities may not be cost-effective. Instead, expect to provide small facilities with do-it-yourself informational resources.[11]

Who is the audience for an energy assessment?

- Identify the client's decision team. Prepare for technical as well as financial managers.

Who should be on the client's decision team?

- Aside from the technical and financial leaders, secure the participation of the general manager. Discuss expectations with each of these individuals.
- Interact face-to-face with the decision team. Keep email and memos to a minimum.

Who should be the "champion" (client's lead representative or energy decision-maker)?

- The client's energy champion should be the staff person with the most passion for energy cost control. This will vary from plant to plant.
- Consider a senior person with knowledge, credibility, connections and influence.
- Encourage the director of the most energy-intensive department to take the lead.
- DO NOT assign the energy champion role to a temporary authority. A person with influence is needed.

[11] http://www1.eere.energy.gov/industry/bestpractices

What should the business context for the assessment be?

- Structure the assessment in reaction to the client's "hot button" issues. Energy may not be a compelling stand-alone issue. Think about reliability, environmental compliance, safety, productivity….

What are the expectations of the client? The assessor?

- Establish a time frame for the assessment process—for the assessment itself, and for implementation.
- Define the client as an entire company, a facility, or a building or system within the facility.
- The assessment results should outline ways to save money. Categorize assessment findings:
    - Low-time, low-cost solutions
    - Solutions that optimize total costs of operation
- The assessor should expect cooperation from the client staff, including access to people and data.

Who should participate in the assessment itself?

- Establish a client team: the champion communicates, paves the way for the assessment activities. Lower-level technical staff can participate in assessment tasks.
- Equipment operators and cost-center directors should participate.
- Get upper management participation, at least in closing meetings.
- Designate a contact on the client staff for specific equipment areas.

What roles should client participants assume?

- Experienced client staff should participate, and be honest and open-minded about energy-related activities. Ask them about what they already know—the assessment needs to recognize what the facility is already achieving.

What data, documents, or diagrams should be collected in advance?

- Collect data on fuel and power consumption.
- Get a general description or diagram of the production process.
- Identify the facility's key performance indicators (tons, gallons, square feet, units, etc.)

What observations and questions should be asked about facility equipment?

- Describe energy-using equipment's general mechanical condition, age, capacities, tolerances, historic capabilities. Look at preventative maintenance schedules.

What observations and questions should be asked about the client's organization and procedures?

- Were previous assessments conducted, and are they available to review?
- What earlier recommendations have already been implemented?
- What kind of energy-related monitoring programs are already in place?
- How successful were earlier assessments?
- Have alternate energy sources and purchase contracts been considered?
- How well does upper management support the implementation of energy recommendations?

- Are energy monitoring data regularly collected, reviewed, and acted upon?
- Is there currently an energy management system in place?
- How many people or departments are directly involved in energy management?

What are the critical success factors to look for (i.e., what conditions or attributes must be in place in order for implementation to be successful)?

- The facility will need a coherent energy management strategy.
- Eventually, investment capital will be needed to fully pursue energy improvements.
- Need to ensure employee awareness of the link between their behavioral choices and their impact on energy costs.
- Upper management support needs to be sustained.
- Need to have a strategy for the assessor and client to follow-up with each other to discuss progress.

What inferences and conclusions should be drawn from assessment data?

- Examine the quality of data and the inferences about the facility's energy-saving potential.
- Avoid making conclusions if the data is suspect.
- It's important to identify a category of low-cost, fast payback solutions.

What potential implementation scenarios should be presented to the client?

- Develop scenarios for the client to consider different timetables and action plans:
  - Do nothing: that is, show the impact of carrying on business-as-usual.
  - Low-cost quick-fixes.
  - Capital investments.
  - A sustained, energy management process approach.
  - Option: organize a menu of options and let the client pick from these.

How should draft reports be circulated for approval prior to final acceptance?

- The assessor should meet with those client staff with a vested interest in energy solutions. Discuss the draft with these individuals to determine what changes to the report, if any, are needed for their approval.

What should the final report include?

- There's only time for one written report (don't bother with different versions).
- It's the energy champion's job to summarize the implications for various observers.
- Use the verbal presentation to address the benefits and concerns for various observers.
- The body of the report should discuss the assessment findings in layman's terms. Commit technical details to the appendices.
- Discuss the client's organizational and procedural issues in a way that does not embarrass or implicate people. Focus instead on the consequences of certain behaviors.
- Address the issue of perceived risk. Recognize the trade-off between cost and reliability (or convenience).

How should the assessor follow-up with the client over time?

- One in-person presentation should be given immediately after the assessment is complete, while the results are still fresh.

- Subsequent follow-up should follow a timetable established jointly by the assessor and the facility's energy champion.
- At a minimum, re-examine the energy assessment during each capital budget development cycle.
- Find other ways to keep decision-makers aware of the recommendations.
- Employ ISO 9000 quality management principles. This involves comparing energy improvement progress to industry standards.

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