Energy Management Pathfinding: Understanding Manufacturers' Ability and Desire to Implement Energy Efficiency

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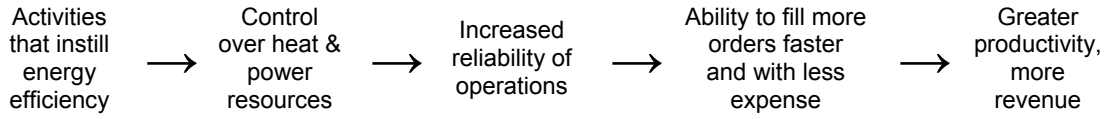
ABSTRACT

Manufacturers are scrambling for relief from today's energy expenses and price volatility. Most industry decision-makers believe the solution is to seek the lowest available energy prices. Too often, managers fail to grasp the opportunities offered by *energy management*, which focuses on both consumption and prices. Industry can be resistant to energy management for a variety of reasons. Simply put, energy management has no traditional place in the typical manufacturer's chart of organization, job descriptions, and performance accountabilities. While technology is fundamental to energy efficiency, it is people who make it work in an organizational context. DuPont, Frito-Lay, Unilever, and Kimberly-Clark are a few of the forward-thinking companies that have found ways to integrate energy management into their daily operations to positive effect. The Alliance to Save Energy is documenting these companies' experiences in a series of case studies that reflect the organizational and behavioral aspects of corporate-wide energy management. Case studies show that energy management motives and approaches are somewhat varied—there is no "one size fits all" solution. Ultimately, it is a manufacturer's organizational character and commitment that determine its ability to manage energy consumption.

Energy Efficiency, Energy Management, & Business Impacts

From the manufacturer's perspective, fuel and power are merely catalysts that refine raw materials into finished products. *Heat and power optimization* are the real value propositions behind energy efficiency. As an organizational *process,* "energy management" contributes to the *outcome* of improved business performance. "Energy efficiency" refers to practices and standards set forth in an energy management plan. Energy efficiency initiatives are selected for their potential to reduce expenses, build revenue capacity, and contain operating risk. For manufacturers:



Unchecked energy expenditures are like a tax burden imposed cumulatively on each stage of production. Plants of all types, sizes, and locations use energy, so the potential for energy-driven productivity gains is everywhere. Energy management is an ideal opportunity to improve competitiveness through productivity improvement. The benefits only begin with reduced energy bills. Other impacts include greater capacity utilization, reduced scrap rates, more effective emissions and safety compliance, and enhanced risk management.

Efficiency should not be confused with *conservation*. As opposed to conservation, which often denotes sacrifice, energy efficiency is an indispensable component of any effort to improve productivity. Ultimately, energy efficiency contributes to wealth.

American industry continues to waste energy. No one knows that better than Frito-Lay, Unilever, DuPont, 3M, Kimberly-Clark, and other manufacturers that have implemented the most aggressive energy management programs. At stake is the viability of manufacturing facilities that employ people and sustain local communities. For this reason, the Alliance to Save Energy, with support from the U.S. Department of Energy's Industrial Technologies Program, has compiled 10 corporate energy management case studies to date. Most of these companies participated in DOE training courses and took advantage of information resources developed by the U.S. DOE to facilitate their accomplishments to varying degrees (see Appendix A). The intent of this case study series is to encourage industry observers to learn from their peers.

Many efficiency proponents believe that if you show the projected dollar savings or payback for energy improvements, top managers will accept these proposals. That's not always true. Organizational size and complexity pose formidable hurdles to capturing efficiency opportunities. Manufacturing enterprises have organizational structures, accountabilities, and incentives that are designed to make products and get them out the door. While most companies will express a desire to "reduce costs," waste is not fully recognized in day-to-day practice. Control of energy waste requires cross-functional authority and communications that don't exist in most facilities. Given this reality, energy waste will continue, no matter how financially attractive a project looks on paper.

A fully developed industrial energy management program is a work plan for continuous improvement. This plan will engage human, technical, and financial resources, and its progress will be monitored for attainment of certain goals. Criteria for action will reflect input from engineering, maintenance, financial, and utility staff. Staff will be held accountable for outcomes. The only energy improvements undertaken are those which provide business value to the organization. Appendix B offers a summary of concepts that relate energy efficiency to business outcomes.

A Sample of Energy Management Leaders

Energy management is practiced to varying degrees by manufacturers throughout industry. No one industry dominates the practice. While it is easier to identify energy management leaders among Fortune 500 companies, there are also small, privately held companies that excel at stewardship of energy and other resources. Here is an overview of ten companies' accomplishments:[1]

- **3M.** By reducing its energy consumption per pound of product by 27 percent between 2000 and 2003, this diversified manufacturer already exceeded its goal of 20 percent by 2005. This goal required 3M's tier-1 plants (52 facilities worldwide) to achieve 3M's own "World Class" energy management label. 3M uses its energy performance in its product marketing. Superior energy cost control at 3M reduces the embedded energy cost that 3M's customers would normally absorb. **Notable feature:** 3M's executive management believes that resource stewardship makes good business sense. Energy

[1] The full texts of these case studies are online at www.ase.org/section/topic/industry/corporate/cemcases/

management goals and results are routinely communicated to Wall Street analysts. 3M, and the manufacturers that purchase inputs from 3M, are responding to markets that increasingly demand products with low environmental impacts.

- **C&A Floorcoverings.** Based in Georgia, this privately held, five-plant company demonstrates successful energy management by a mid-sized manufacturer. C&A has implemented a management system for matching energy-efficiency initiatives with business goals. After two years, C&A achieved 10 percent savings on an annual natural gas expenditure of $824,500. **Notable feature:** C&A adopted MSE 2005, an ANSI-certified standard for energy management developed by Georgia Tech, as a template for an in-house energy management program. By the end of 2004, C&A was close to becoming the first organization to become fully certified per the MSE 2005 standard.
- **Continental Tire North America.** Continental began shutting down certain North American facilities due to energy waste and other cost inefficiencies. One Illinois-based facility became proactive at energy management and was rewarded by getting a larger share of overall production quotas. The Illinois plant used a combination of energy consultants and in-house management structures to achieve a 31 percent reduction in energy consumption per tire. **Notable feature:** Continental successfully partnered with an energy services company (ESCo) to design and implement energy management procedures that were self-sustaining after the ESCo's tenure concluded.
- **DuPont.** With over 100 plants in 70 countries, energy management practices at DuPont are supported by two top-level strategies. The first is designating energy efficiency as a high priority corporate issue. The other is the application of "Six Sigma" methodology to the energy management process. **Notable feature:** Through 2002, DuPont applied Six Sigma to behavioral tasks, including plant utility management. Over 75 energy improvement projects, many requiring no capital, were implemented across the company's global operations. The average project netted over $250,000 in annual savings.
- **Frito-Lay.** This leading snack food manufacturer's energy management features aggressive energy reduction goals with a focus on results. This demands a high degree of monitoring, measurement, and communications. Frito-Lay organized the required engineering talent as its Resource Conservation Group. While surpassing intermediate targets on the way to even larger savings, Frito-Lay's efficiency initiatives have returned over 30 percent on investment. **Notable feature:** Large and challenging energy reduction goals were used to rally and motivate staff to generate results.
- **Kimberly-Clark Corporation.** This personal care products manufacturer has a broad mandate for environmental stewardship. KCC's more than 165 plants worldwide practice energy efficiency, air emissions abatement, wastewater treatment upgrades, process water use reduction, packaging reduction, landfill elimination, toxic chemical elimination and environmental management system implementation. Five-year plans help coordinate benchmarking efforts across a global facility network. KCC's energy conservation efforts are currently in the middle of a second five-year plan, which seeks to expand on the success of the first plan (1995-2000). The first plan led to a corporate-wide, 11.7 percent reduction in energy use per ton of product. **Notable feature:** A large, global population of mills allowed KCC to generate its own proprietary energy benchmarking discipline. Sharing best practices across plants prevents "reinventing the wheel."

- **Merck & Co. Inc.** This pharmaceutical products and services corporation seeks to improve the productivity of existing assets while reducing energy expenses. A corporate energy program is mobilized by goals that hold site managers accountable for annual performance targets. Energy costs at manufacturing sites are on a growth-adjusted pace to be cut 22 percent between 2001-2005. This equates to at least 250,000 tons of avoided carbon emissions and 11.5 percent energy expenditure savings. **Notable feature:** Energy efficiency was employed to boost the production capacity of existing assets, thus avoiding the need to finance new capital assets.
- **Mercury Marine.** This manufacturer of marine propulsion systems consolidated energy decisions under the authority of a central facilities manager (CFM) and implemented a power monitoring system that permits electricity costs to be tracked and billed to individual cost centers. Valuable energy flow data gives the CFM leverage in gaining corporate approval of energy technology upgrades. The centerpiece of these efforts in 2004 was the installation of a new, centralized compressed air system that carved roughly half a million dollars from an annual $7 million electricity bill. **Notable feature:** Simple and effective energy management (1) gave a single manager the authority to make energy improvements, (2) assigned cost control responsibility to production units, and (2) used information technologies to monitor energy flows and to directly bill production units for their actual energy use.
- **Shaw Industries.** Concerted efforts to manage energy at Shaw Industries got underway in mid-2004. By primarily using the U.S. Department of Energy's plant audit methods and BestPractices reference materials, a newly-hired demand-side engineer documented potential energy savings at a rate of $1 million per month for the first six months of his tenure. **Notable feature:** U.S. DOE resources were effectively adopted by in-house personnel to drive their energy auditing and remediation activities.
- **Unilever HPC.** Unilever's Health and Personal Care Division's energy management program coordinates 12 facilities by combining energy-use targets with an energy service outsourcing strategy. A simple budget-to-actual spreadsheet compares energy performance at 14 facilities. **Notable feature:** Because its use resulted in a saving $4 million on energy and another $4 million in avoided costs, the spreadsheet has captured the attention of individual facility managers as well as Unilever's Board of Directors.

The energy management features exhibited in the 10 Alliance case studies are summarized in Tables 1 and 2 below. **Table 1** compares each company's tactics, approaches, management tools, functions, and modes of organization and communication. **Table 2** summarizes authority, leadership, and accountability profiles for each company.

Energy management at all 10 companies includes:

- Leadership of energy improvements provided by a key manager or "champion"
- Technical planning, evaluation, and assistance rendered by an in-company energy team

Features that are frequent, but not universal include:

- Performance goals and metrics specific to energy use (eight cases)
- Routine audits or baseline assessments of plant-wide energy use (seven cases)
- A database to archive energy performance benchmarks and/or project profiles (six cases)

Table 1. Common Features of In-House Industrial Energy Management Programs (Based on a Sample of 10 Case Studies)

	3M	Continental Tire	C&A Floorcovering	DuPont	Frito-Lay	Kimberly-Clark Corp.	Merck & Co.	Mercury Marine	Shaw Industries	Unilever
TACTICS & APPROACHES										
Performance goals and metrics	☑	☑	☑	☑	☑	☑	☑			☑
Project-based approach	☑			☑	☑	☑		☑	☑	☑
Behavioral/procedural approach		☑	☑	☑	☑	☑	☑	☑		
Multi-year planning horizons	☑			☑	☑	☑	☑			
Make prominent use of ESCOs	☑	☑								☑
Employ a standardized protocol for energy or quality control			☑	☑					☑	
Energy stewardship supports marketing strategy	☑		☑						☑	
TOOLS & FUNCTIONS										
Energy performance reflected in budget-to-actual comparisons	☑				☑	☑	☑			☑
Database to archive energy performance metrics and/or projects	☑	☑	☑	☑		☑	☑			
Routine auditing or self-assessment of energy consumption	☑	☑	☑		☑	☑	☑		☑	
Use DOE analytical software and related reference material				☑			☑	☑	☑	
Corporate energy implementation guide	☑		☑							
Easier financial criteria for energy improvement investments					☑					☑
Direct billing of energy costs to teams within a plant								☑		
ORGANIZATION & COMMUNICATIONS										
Corporate energy coordinator or "champion"	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
In-company energy team offers technical evaluation & assistance	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Energy performance results released in investor publications	☑			☑	☑	☑				☑
Energy performance communicated to all employees			☑			☑	☑			☑
Plant-level teams and/or supervisors support energy improvements	☑	☑	☑		☑		☑	☑		
Participate in government-business energy-efficiency collaboratives	☑			☑	☑		☑	☑		
Improvement suggestions filtered up through staff			☑	☑		☑			☑	
Internet or intranet workshops, online peer networking	☑			☑			☑		☑	
Categorically recognize high-performance plants	☑					☑				
Energy awareness events for employees (past or planned)								☑		☑

Source: Alliance to Save Energy

There are both *project-based* approaches and *behavioral* approaches to energy management. The project approach concentrates on hardware upgrades. The behavioral/procedural focus enhances efficiency awareness and decision-making among production personnel. Note that:

- Four of the 10 companies combine a project-based approach with a behavioral/procedural approach
- Three focus on primarily on behavior
- Three companies take a projects-only approach

Half of the companies studied:

- Implement a multi-year planning horizon for coordinating their efforts
- Use budget-to-actual comparisons that incorporate energy consumption data
- Publish their results for investor relations purposes
- Participate in government-sponsored energy events, programs, and collaboratives

Some leadership and accountability lessons are evident in Table 2:

- There is no singular approach to energy management.
- Every organization has a unique, established balance of authority and influence (1) between corporate headquarters and its subordinate facilities, (2) across facilities, and (3) among personnel within facilities. Creativity and initiative are extremely helpful in tailoring an energy management program to fit each company's unique circumstances.
- Companies rarely compel their plants to make energy-efficient choices. Instead, accountability is usually indirect through (1) general cost control responsibility, or (2) regular plant/personnel evaluations that position energy as one of many areas for performance credit.
- In-company energy support networks provide crucial assistance, but implementation is usually exercised *at the plant manager's discretion*.

Some programs are relatively complicated, involving overlays of management teams and detailed reporting metrics (Merck, Frito-Lay). Others are amazingly simple, yet equally effective:

- Mercury Marine puts energy decision-making authority in the hands of a central facilities manager. Process managers must follow his lead with respect to energy decisions. Also, an investment in power monitoring equipment allows Mercury to accurately bill power costs to substations within the plant. Cost accountability is all the motivation needed for sub-unit managers to enforce smart energy behavior on the part of their staff.

Table 2. A Comparison of Corporate Energy Management Styles: Authority, Leadership, Organization, and Accountability (A Sample of 10 Case Studies)

3M

- **Authority:** Broad corporate goal to reduce overall energy consumed per volume of product.
- **Leadership:** Corporate leaders regularly review all plants' energy performance.
- **Who Decides to Act?** Plant managers act, with influence from plant-based energy teams.
- **Organization:** A corporate energy management team provides technical assistance and evaluation. Plant-based energy teams pursue implementation.
- **Accountability:** Energy stewardship is one of many variables used to evaluate plant performance annually.

C&A FLOORCOVERINGS

- **Authority:** Top management periodically reviews energy performance.
- **Leadership:** An energy coordinator leads all functions required by the MSE 2005 standard for energy management. Top management stands behind this standard.
- **Who Decides to Act?** Key individuals decide to act per their accountabilities set forth in the MSE 2005 standard.
- **Organization:** An in-house, cross-disciplinary team was assembled to initiate MSE 2005.
- **Accountability:** Once implemented, the MSE 2005 standard sets roles and accountabilities for key personnel.

DUPONT

- **Authority:** Broad, five-year, corporate-wide goals require reduced energy consumption, increased use of renewable energy, and reduced carbon emissions.
- **Leadership:** Corporate direction requires use of Six Sigma quality control methodologies for virtually all procedures at DuPont.
- **Who Decides to Act?** A Six Sigma culture at DuPont is the incentive for all staff to seek improvement projects.
- **Organization:** A corporate energy management team helps plants by providing technical assistance, documentation, and communication to build and replicate knowledge of energy solutions.
- **Accountability:** Personnel promotions at DuPont are contingent upon gaining proficiency in Six Sigma. This drives DuPont's professionals—including energy utility engineers—to improve operations through application of Six Sigma.

CONTINENTAL TIRE

- **Authority & Leadership:** A facilities engineer takes nominal leadership of an in-plant energy team. Key supervisory engineers enforce energy discipline largely through personal influence and leadership. Corporate officers have no role in goal setting or progress reviews.
- **Who Decides to Act?** The facilities engineer acts on the consensus of the in-plant energy management team.
- **Organization:** A cross-disciplinary energy management team discovers, evaluates, and prioritizes energy improvement opportunities.
- **Accountability:** Plant personnel generally observe in-plant leadership. While corporate officers play no day-to-day role in energy management, their long-term decisions regarding plant closure usually include energy cost performance.

FRITO-LAY

- **Authority:** Aggressive corporate goals specify desired reductions in energy and water. Goals are pro-rated across plants. A senior vice president for operations reviews comparisons of plants' progress.
- **Leadership:** A group leader for energy & utilities coordinates corporate-wide discovery and evaluation of improvement opportunities.
- **Who Decides to Act?** Plant managers and personnel make implementation decisions.
- **Organization:** Several tiers of energy leadership are involved: a corporate tier provides technical assistance, a regional tier coordinates audit functions, and site champions assume implementation details.
- **Accountability:** Corporate comparison of plants' budget-to-actual energy performance is the mechanism for ensuring compliance.

KIMBERLY-CLARK

- **Authority:** Corporate-wide five-year plans impose goals for energy savings.
- **Leadership:** The vice president for energy and environment ultimately leads technical support, benchmarking, databasing of results, and corporate-wide communication/promotion of success stories.
- **Who Decides to Act?** Individual plant managers make actual implementation decisions.
- **Organization:** A corporate energy management team provides technical support, energy auditing, benchmarking, and documentation services. Plant staff perform implementation.
- **Accountability:** Energy performance is integral to plant and plant manager performance evaluations.

MERCK & CO.

- **Authority:** Five-year plans establish corporate-wide goals for energy cost reduction. The senior vice president for manufacturing monitors reported energy performance.
- **Leadership:** The senior manufacturing head and energy manger coordinates corporate-wide energy management functions. Facility representatives participate in developing a 4-point strategy for strategic planning, reporting, best-practice identification, and awareness development.
- **Who Decides to Act?** Each facility's general manager makes ultimate implementation decisions.
- **Organization:** At the corporate level, "Global Energy Management" is led by an Energy Reduction Initiative Team, which is in turn comprised of a core team (for monthly review and guidance) and an expanded team (of in-house subject experts called upon as needed). Team subcommittees each represent many functions, including engineering, benchmarking, procurement, etc. Facility representatives identify improvement opportunities for their individual sites.
- **Accountability:** Energy performance is a line-item in each general manager's performance evaluation.

MERCURY MARINE

- **Authority & Leadership:** A central facilities manger assumes responsibility for all energy improvement decisions, including discovery, evaluation, and technical assistance. There are no energy-saving goals or corporate reviewers.
- **Who Decides to Act?** Individual unit managers agree to energy improvement decisions made by the central facilities manager.
- **Organization:** Personnel with a variety of professional disciplines form an in-house energy management team to identify improvement opportunities and assist with implementation. Unit managers petition the central facilities manager and energy team for assistance as needed.
- **Accountability:** Unit managers have cost control responsibilities. An in-plant power metering system permits direct energy cost assignment to unit managers. Energy management is therefore integral to cost performance.

SHAW INDUSTRIES

- **Authority:** Senior management issues a general directive to "get some energy savings."
- **Leadership:** A demand-side engineer leads a corporate Energy Management Department.
- **Who Decides to Act?** An individual site's plant engineer or maintenance supervisor takes responsibility for action.
- **Organization:** The six-person corporate Energy Management Department supports plants with energy accounting, acquisitions, monitoring, and technical assistance (auditing and evaluation).
- **Accountability:** Individual plant managers are influenced by the Energy Management Department. The demand-side engineer communicates success stories to boost awareness and encourage greater responsiveness to recommendations.

UNILEVER

- **Authority:** All energy management results are reviewed by a senior vice president.
- **Leadership:** The energy & environmental manager leads a corporate energy team that advises staff and energy service vendors.
- **Who Decides to Act?** Plant managers make the ultimate decision to implement improvements.
- **Organization:** Plant managers approve a budget that incorporates planned energy consumption. Budget input comes from various stakeholders in each plant. Energy service vendors are contracted to do much of the implementation.
- **Accountability:** Quarterly budget-to-actual energy performance comparisons hold plant managers accountable for results.

Source: Alliance to Save Energy

- Unilever routinely circulates a plant-by-plant comparison of energy performance, comparing each plant's budget-to-actual performance. Pride, competitive spirit, and perhaps a bit of shame are all that's needed for laggard plants to seek assistance coordinated by the corporate energy manager.
- Continental Tire's "corporate" energy policy is to leave energy management up to individual facility managers. There is no corporate officer who actively monitors energy performance. The company's Illinois facility has effective energy management tactics and enjoys an increasing share of corporate production quotas. Continental is shutting down facilities with poor efficiency records.

Motivations for pursuing energy management are surprisingly varied. Perhaps the most obvious reason is to "control energy expenditures," although this is far from being the only reason. Some companies put a premium on resource stewardship, for both public relations and risk management purposes. Other companies wish to sustain and replicate operational improvements that would be otherwise lost in complex, multi-facility environments. Table 3 summarizes the motivations for undertaking energy management, as expressed by the ten companies in the case study series.

The summary of motivations in Table 3 clearly reflects the multi-purpose nature of energy management:

- **Energy expense control** and management of energy price volatility
- **Non-energy expense control,** such as avoided capital expenditure
- **Increased revenue potential** through identification and replication of capacity improvements
- **Improved product marketing** through visible resource stewardship
- **Risk mitigation** related to environmental liabilities and operational reliability

Table 3: Motivations for Initiating In-House Industrial Energy Management Programs (Based on a Sample of 10 Case Studies)

	3M	Continental Tire N.A.	C&A Floorcovering	DuPont	Frito-Lay	Kimberly-Clark Corp.	Merck & Co.	Mercury Marine	Shaw Industries	Unilever
Dealing with the volatility and complexity of energy markets				☑	☑			☑	☑	☑
Consolidating, coordinating, and replicating improvement knowledge			☑	☑		☑		☑		
Expense reduction opportunity	☑	☑	☑					☑	☑	
Environmental compliance			☑	☑		☑				
Energy management leads to new product/revenue opportunities	☑								☑	
Disenchantment with ESCO services					☑					
Improve plant capacity, performance		☑					☑			

Source: Alliance to Save Energy

A comparison of the 10 case studies presented here suggests that industrial energy management is not prescriptive in nature. It is tempting to argue that some companies' approaches are stronger than others'. Upon further thought, it is useless to suggest that Company A is somehow "better" at energy management because it achieved greater relative energy reductions than Company B. After all, one company may have already been somewhat more efficient to begin with. The structure of authorities within companies is a major factor. So too are market conditions and asset management strategies. Is energy management helped or hindered by corporate policies regarding investment, human resource development, and outsourcing? The answers are unique for every company.

Conclusion: Challenges and Lessons Learned

Federal, state, and trade association programs attempt to boost general industry awareness of energy management principles through workshops, industry conferences, and trade press. Industry's response is at best lukewarm. Many companies are frankly intimidated by the prospect of implementing energy projects, much less day-to-day energy management processes. After all, competitive pressures have stripped manufacturers to the point where surviving staff are over-tasked in simply "keeping the car on the road," much less finding time to monitor and adjust performance. Also, despite every effort to reach industry's empowered decision-makers, awareness outreach too frequently attracts the wrong audience. This is because energy efficiency is almost always perceived as a technical or maintenance pursuit, so it is delegated to maintenance staff who are uninterested in, or unprepared to tackle, the organizational measures needed to make meaningful energy improvements.

A few forward-thinking companies have allowed their energy management experience to be documented for industry's wider benefit. It is clear that each corporation approaches energy management with a strategy that reflects the company's organizational characteristics. Among the leading determinants are the degree of corporate authority and involvement, depth of in-company technical support, leadership, and the capability to express energy performance's contribution to business goals.

Appendix A: U.S. Department of Energy Resources Used by Companies Studied in this Report

The U.S. Department of Energy documents energy-saving technologies and practices for common plant utilities such as steam, motor drives, compressed air, and process heat. The DOE BestPractices website features downloads for energy survey guides, technology sourcebooks, tip sheets, and diagnostic software. Please visit: http://www.oit.doe.gov/bestpractices/.

3M:
- Attended DOE steam, compressed air and process heating training
- Received DOE Decision Tools for Industry CD
- Downloaded DOE pumping, steam system scoping, and MotorMaster+ software tools
- Attended DOE/EERE showcase
- Requested information/publications from the DOE/EERE Information Center
- Requested presentation on DOE process heating tool through a webcast
- Received a competitive DOE plant-wide assessment
- Received two DOE/Industrial Assessment Center assessments
- Worked with DOE to publish a technical case study on motors
- Attended DOE BestPractices presentation

C&A Floorcoverings:
- None recorded

Continental Tire:
- Various BestPractices Tip Sheets regularly used for reference

Dupont:
- Attended DOE pumping and compressed air training
- Attended DOE/EERE showcase
- Received DOE Decision Tools for Industry CD
- Downloaded DOE pumping, MotorMaster+ and steam assessment software tool
- Requested information/publications from the DOE/EERE Information Center
- Received a DOE/Industrial Assessment Center energy assessment
- Participated in DOE roadmapping and R&D activities

Frito-Lay:
- Received two DOE/Industrial Assessment Center assessments
- Requested information/publications from the DOE/EERE Information Center

Kimberly-Clark:
- None recorded

Merck & Co.:
- Attended DOE steam, compressed air, pumping, and process heating training
- Received DOE Decision Tools for Industry CD
- Downloaded DOE pumping and MotorMaster+ software tools

Mercury Marine:
- Attended DOE compressed air training

Shaw Industries:
- Uses DOE's Industrial Assessment Center methodologies for plant energy audits
- Employs MotorMaster+ software
- Employs various DOE tip sheets and references for compressed air, steam

Unilever:
- Attended DOE steam training
- Received DOE Decision Tools for Industry CD
- Downloaded
- DOE steam software tool

DOE/EERE = U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy

Appendix B: Relating Energy Efficiency to Business Outcomes

BUSINESS OUTCOMES SOUGHT	HOW ENERGY EFFICIENCY CONTRIBUTES TO BUSINESS OUTCOMES
EXPENSE CONTAINMENT	
• Reduced scrap rates, waste of inputs	Energy efficiency techniques improve control of heat and power resources. Heat applied at the correct temperature, for the correct duration, and in correct proportion to process materials will reduce scrap rates.
• Reduced per-unit expenditure for fuel and power	Improved knowledge of energy utilization patterns gives the plant leverage in deciding how much energy to purchase. Lower per-unit energy prices can be obtained in bulk commodity contracts.
• Avoided penalties and fees for regulatory non-compliance	Efficient fuel combustion reduces emission of pollutants, helping to ensure compliance with air quality regulations.
• Reduced hazard insurance premiums	Energy efficiency measures can also enhance mechanical integrity. An engineer's log book that demonstrates a reduction of problem incidents may be leverage for a reduced hazard insurance premium.
FINANCIAL PERFORMANCE	
• Improved profit margins	A dollar saved through energy efficiency is a dollar earned.
• Improved asset turnover	Energy efficiency contributes to process integrity. As downtime is avoided, plant assets generate more product per period of time.
• Increased free cash flow	The reduction of energy waste means less expense for energy purchases. Avoided expenditures add to cash balances.
• Improved shareholder value	Dollars saved contribute directly to earnings per share.
• Improved accounting of input costs	A data-oriented energy management system should generate information for accurate assignment of energy (and perhaps other) input costs.
• Improved understanding of asset productivity	Information derived from data-oriented energy management provides a window on asset productivity, which will suggest priorities for future asset management decisions.
• Better understanding of capital investment priorities	
MARKET & OUTPUT GROWTH	
• Increased revenue	Energy efficiency improves operational integrity of assets and helps to control process inputs. Control provides reliability. Reliability reduces downtime and improves the utilization of productive capacity. Orders are filled faster, allowing more orders to be filled per year. More orders mean more revenue.
• Improved capacity utilization	
• Enhanced marketability of "environmentally friendly" products	Consumers are demanding more environmentally-friendly products. More product fabricators are seeking like-minded input suppliers.
RISK MANAGEMENT	
• Reduced plant downtime, improved reliability	Energy efficiency emphasizes technologies and procedures that support mechanical integrity.
• Reduced vulnerability to energy market turbulence	Energy management improves knowledge of input consumption. This knowledge gives the procurement officer some leverage in seeking advance-purchase contracts that lock in commodity prices.
• Increased capacity to handle the evolution of regulations and technology	Facilities that understand the variables that drive their energy consumption are also in a better position to react to changes in emissions regulation. Increased knowledge of the connection between energy use and operating efficiency also prepares decision-makers to more effectively evaluate capital investment alternatives.