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

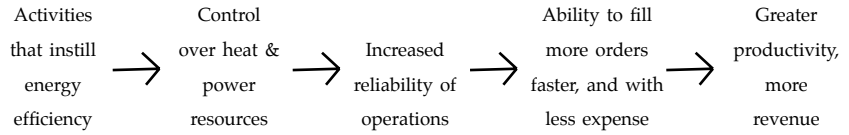
Christopher Russell
Director, Industry Sector
Alliance to Save Energy

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 build energy management into their daily operations to positive effect. The Alliance to Save Energy (ASE) 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. ASE offers a typology of industrial energy management strategies to illustrate the range of opportunities available to industry. Ultimately, it is a manufacturer's organizational character that determines its ability to manage energy consumption. A checklist included in this article allows the reader to diagnose a manufacturer's aptitude for undertaking various energy management strategies.

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. For manufacturers:



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.

Unchecked energy expenditures are like a tax burden imposed cumulatively with 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 (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. This is more than a "hippies, beads, and flowers" issue. 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 (DOE) Industrial Technologies Program, has compiled ten corporate energy management case studies to date. Most of these companies used 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 the 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 single 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 the stewardship of energy and other resources. An overview of ten companies' accomplishments is as follows:*

3M

This diversified manufacturer seeks to reduce energy consumed (Btus) per pound of product by 20 percent over the 2000 – 2005 time

*The full text of these case studies are online at www.ase.org/section/topic/industry/corporate/cemcases/

frame. This goal will require 3M's tier-1 plants (52 facilities worldwide) to achieve 3M's own "World Class" energy management label. 3M has already surpassed that target and 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 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 the Management Standard for Energy (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

A lack of corporate involvement effectively puts energy management in the hands of facility managers. Continental has begun shutting down certain North American facilities due to energy waste and other cost inefficiencies. When one Illinois-based facility became proactive at energy management, it 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 are self-sustaining after the ESCo's tenure concluded.

DuPont

With over 100 plants in 70 different countries, energy management practices at DuPont are supported by two top-level strategies.

The first is designating energy conservation as a high priority corporate issue. The other is applying "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 their 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 global portfolio of over 165 plants practice energy conservation, 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 give 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 electricity bill of $7 million. **Notable feature**: Simple and effective energy management (1) placed the authority to make energy improvements in a single authority, (2) assigned cost control responsibility to production units, and (3) 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 material, 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 Person 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 savings of $4 million on energy and another $4 million in avoided costs, the spreadsheet has captured the

attention of individual facility managers and Unilever's board of directors as well.

The energy management features exhibited in the ten ASE case studies are summarized in Tables 1 and 2. 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 ten 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:

- 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).

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 ten companies combine a project-based approach with a behavioral/procedural approach;
- Three focus primarily on behavior; and
- 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.
- 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. Their Illinois facility has effective energy management tactics, and enjoys an increasing share of corporate production quotas. Continental facilities with poor efficiency records are being shut down.

Table 1. Common Features on In-house Industrial Energy Management Programs

(Based on a sample of ten 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

SOURCE: Alliance to Save Energy

Table 2. A Comparison of Corporate Energy Management Styles
Authority, Leadership, Organization, and Accountability

(A sample of ten 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 annually evaluate plant performance.

C&A FLOORCOVERINGS

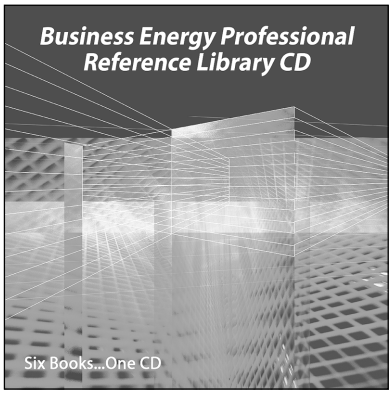
- **Authority**: Top management periodically reviews energy performance.
- **Leadership**: An energy coordinator leads all functions required by the MSE 2005 standard for energy management. Top management stands behind this standard.
- **Who Decides to Act?** Key individuals decide to act per their accountabilities 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 assists plants by providing technical assistance, documentation, and communication to build and replicate knowledge of energy solutions.

NOW AVAILABLE – SIX COMPLETE BOOKS ON ONE CD-ROM…

BUSINESS ENERGY PROFESSIONAL REFERENCE LIBRARY CD



We are pleased to offer this comprehensive 6-volume reference library, specifically designed to provide an economical training, research and reference resource for professionals involved in the non-technical aspects of energy management. Providing over 2300 pages of text, graphics, charts and illustrations, this easy-access CD-ROM is indexed with bookmarks for convenient navigation. *Business Energy Professional Reference Library CD* contains the following six complete books in Adobe PDF® format:

CD ORDER CODE: 0556
PRICE: $395.00

DICTIONARY OF ENERGY EFFICIENCY TECHNOLOGIES
By Michael F. Hordeski
This comprehensive reference addresses the diverse topics that form the backbone of energy conservation in a time-saving dictionary format. Printed hardcover also available, price: $130.00

HANDBOOK OF FINANCING ENERGY PROJECTS,
By Albert Thumann, P.E., C.E.M., and Eric Woodruff, Ph.D., C.E.M.
An excellent resource for those seeking to utilize the innovative methods now available to finance energy efficiency projects. Printed hardcover also available, price: $92.00

INFORMATION TECHNOLOGY FOR ENERGY MANAGERS
Edited by Barney L. Capehart, Ph.D., C.E.M.
Comprehensive in scope, this reference addresses all of the most significant energy and facility-relevant IT concepts you'll typically need to take your operations to the "next level." Printed hardcover also available, price: $145.00

INVESTMENT GRADE ENERGY AUDIT
By Shirley J. Hansen, Ph.D., and James W. Brown, P.E.
Provides detailed guidelines on how to use the "investment grade audit" (IGA), which enables prediction of savings with much greater accuracy than the traditional energy audit. Printed hardcover also available, price: $95.00

NEW TECHNOLOGIES FOR ENERGY EFFICIENCY
By Michael F. Hordeski
This important book details the tools and technologies available for incorporating smaller, clean, efficient energy-generating technologies into your energy management plan. Printed hardcover also available, price: $88.00

WEB BASED ENERGY INFORMATION & CONTROL SYSTEMS
By Barney L. Capehart, Ph.D., C.E.M.
This book documents operational experience with web based systems in actual facilities and in varied applications. Printed hardcover also available, price: $160.00

NOTE: The *Business Energy Professional Reference Library CD* uses Adobe® Portable Document Format (PDF) software. To access the CD, you must have a CD-ROM Drive, and have Adobe Acrobat® Reader installed on your computer. This software may be downloaded free from www.adobe.com.

ORDER FORM

① Complete quantity and amount due for each CD you wish to order:

Quantity	Book Title	Order Code	Price	Amount Due
	The Business Energy Professional Reference Library CD	**0556**	**$395.00**	

② Indicate shipping address: **CODE: Journal 2005**

NAME (Please print) BUSINESS PHONE

SIGNATURE (Required to process order)

COMPANY

STREET ADDRESS ONLY (No P.O. Box)

CITY, STATE, ZIP

Applicable Discount	
Georgia Residents add 6% Sales Tax	
Shipping Fees	**9.00**
TOTAL	

MEMBER DISCOUNTS
A 15% discount is allowed to AEE members.
☐ AEE Member (Member No._____)

③ Select method of payment:
☐ **CHECK ENCLOSED**
☐ **CHARGE TO MY CREDIT CARD**
☐ *VISA* ☐ *MASTERCARD* ☐ *AMERICAN EXPRESS*

Make check payable in U.S. funds to: **AEE ENERGY BOOKS**

CARD NO.

Expiration date *Signature*

④ Send your order to:
AEE BOOKS
P.O. Box 1026
Lilburn, GA 30048

INTERNET ORDERING
www.aeecenter.org

TO ORDER BY PHONE
Use your credit card and call :
(770) 925-9558

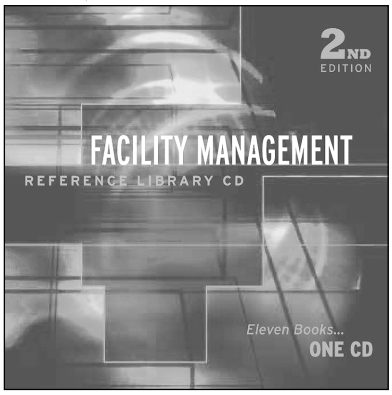
TO ORDER BY FAX
Complete and Fax to:
(770) 381-9865

INTERNATIONAL ORDERS
Must be prepaid in U.S. dollars and must include an additional charge of $10.00 per book plus 15% for shipping and handling by surface mail.

NOW AVAILABLE – 11 COMPLETE BOOKS ON ONE CD-ROM…

BRAND NEW EDITION

FACILITY MANAGEMENT REFERENCE LIBRARY CD, 2nd Edition



Today's facility manager is faced with a cross-section of job responsibilities and functions. We are pleased to offer this comprehensive 11-volume *Facility Management Reference Library* on CD-ROM. With over 3,800 pages of text and graphics, this CD is an economical training, research and reference resource. You can print, create custom documents, and easily find information you need. This powerful information tool contains the following 11 complete books in Adobe PDF® format:

CD ORDER CODE: 0554
PRICE: $450.00

BIOTERRORISM : A GUIDE FOR FACILITY MANAGERS
By Joseph Gustin / Printed hardcover also available, price: $98.00

CYBER TERRORISM: A GUIDE FOR FACILITY MANAGERS
By Joseph Gustin / Printed hardcover also available, price: $98.00

FACILITY MANAGER'S GUIDE TO SECURITY: PROTECTING YOUR ASSETS
By Robert Reid / Printed hardcover also available, price: $98.00

HANDBOOK OF FACILITY ASSESSMENT
By James Piper / Printed hardcover also available, price: $135.00

WATER QUALITY & SYSTEMS: A GUIDE FOR FACILITY MANAGERS
SECOND EDITION
By Robert Reid / Printed hardcover also available, price: $92.00

DISASTER & RECOVERY PLANNING: A GUIDE FOR FACILITY MANAGERS
THIRD EDITION
By Joseph Gustin / Printed hardcover also available, price: $98.00

FACILITY MANAGER'S HANDBOOK
By Joseph Gustin / Printed hardcover also available, price: $88.00

INDOOR AIR QUALITY: A GUIDE FOR FACILITY MANAGERS
SECOND EDITION
By Ed Bas / Printed hardcover also available, price: $92.00

LIGHTING UPGRADES: A GUIDE FOR FACILITY MANAGERS
SECOND EDITION
By Damon Wood / Printed hardcover also available, price: $92.00

BOILER OPERATOR'S HANDBOOK
By Ken Heselton / Printed hardcover also available, price: $150.00

PUMP USER'S HANDBOOK: LIFE EXTENSION
By Heinz Bloch and Allan Budris / Printed hardcover also available, price: $135.00

NOTE: The *Facility Management Reference Library CD* uses Adobe® Portable Document Format (PDF) software. To access the CD, you must have a CD-ROM Drive, and have Adobe Acrobat® Reader installed on your computer. This software may be downloaded free from www.adobe.com.

ORDER FORM

① Complete quantity and amount due for each CD you wish to order:

Quantity	Book Title	Order Code	Price	Amount Due
	The Facility Management Reference Library CD, 2nd Edition	**0554**	**$450.00**	
			Applicable Discount	
			Georgia Residents add 6% Sales Tax	
			Shipping Fees	**9.00**
			TOTAL	

② Indicate shipping address: **CODE: Journal 2005**

NAME (Please print) BUSINESS PHONE

SIGNATURE (Required to process order)

COMPANY

STREET ADDRESS ONLY (No P.O. Box)

CITY, STATE, ZIP

③ Select method of payment:
☐ **CHECK ENCLOSED**
☐ **CHARGE TO MY CREDIT CARD**
☐ *VISA* ☐ *MASTERCARD* ☐ *AMERICAN EXPRESS*

CARD NO.

Expiration date *Signature*

Make check payable in U.S. funds to:
AEE ENERGY BOOKS

MEMBER DISCOUNTS
A 15% discount is allowed to AEE members.
☐ AEE Member (Member No._____)

④ Send your order to:
AEE BOOKS
P.O. Box 1026
Lilburn, GA 30048

INTERNET ORDERING
www.aeecenter.org

TO ORDER BY PHONE
Use your credit card and call :
(770) 925-9558

TO ORDER BY FAX
Complete and Fax to:
(770) 381-9865

INTERNATIONAL ORDERS
Must be prepaid in U.S. dollars and must include an additional charge of $10.00 per book plus 15% for shipping and handling by surface mail.

Table 2. (*Continued*)

- **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 VP for operations reviews comparisons of plants' progress.
- **Leadership**: A group leader for energy and 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 VP 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 implementa-

Table 2. (*Continued*)

tion 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 sr. VP for manufacturing monitors reported energy performance.
- **Leadership**: The senior manufacturing head and energy manger coordinate 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 manager 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 make energy improvement decisions per the advice of 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

Table 2. (*Continued*)

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 and 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

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 replication of capacity improvements.
- **Improved product marketing** through visible resource stewardship.
- **Risk mitigation** related to environmental liabilities and operational reliability.

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 that are uninterested in, or unprepared to tackle, the organizational measures needed to make meaningful energy improvements.

LESSONS LEARNED: TEN CASE STUDIES

A comparison of the ten 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 other's. 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

Table 3. Common features of in-house industrial energy management programs.

(Based on a sample of ten 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

have already been somewhat more efficient to begin with. The structure of authority 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.

It is clear that a 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, and capacity to express energy performance's contribution to business goals.

THEORY: CORPORATE RECEPTIVENESS TO ENERGY MANAGEMENT

The purpose of this section is to propose a typology of corporate "aptitudes" for energy management. This discussion is based on the Alliance to Save Energy's observation and research. Until these theories can be properly tested, readers are asked merely to consider this persuasive argument.

Human, technical, and financial criteria all contribute to a robust energy management program. Collectively, these attributes constitute a "culture" and receptiveness not only to energy management, but to operational efficiency in general.

The following is a listing of organizational attributes that enable energy management. Manufacturers will enjoy a wider range of energy management options (moving up on a continuum from "do nothing" to sustained, daily energy management) by adopting as many of these attributes as possible. How can the presence of these organizational attributes be determined? Appendix C offers a checklist of considerations for this purpose.

ORGANIZATIONAL ATTRIBUTES THAT DETERMINE AN APTITUDE FOR ENERGY MANAGEMENT

- **Fundamental business viability**. Companies that are the subject to merger or acquisition, labor disputes, bankruptcy, or severe retrenchment may have fundamental distractions that will

interfere with the attention that energy management deserves. A preponderance of such conditions indicates management turmoil that makes energy management impractical.

- **Replication capacity**. Logical attributes for replication include (1) a multi-plant organization, and (2) general consistency in process activities and products across plants. Staff's ability to cooperate across sites and functional boundaries is crucial. Organizations must simultaneously engage many different professional disciplines and accountabilities to maximize their energy management potential.

- **Energy leadership (or "champion").** Successful energy improvements are usually led by an "energy champion," a manager that (1) understands both engineering and financial principles, (2) communicates effectively both on the plant floor and in the boardroom, and (3) is empowered to give direction and monitor results.

- **Energy market capability**. This dimension is straightforward: Does the corporation wish to purchase energy through ongoing market activity? If so, the corporation should be prepared to maintain sophisticated search and verification procedures to support its contracting activities. Purchasing decisions should reflect the collaboration of procurement, production, and plant utilities personnel.

- **Leadership intensity**. Quality of operations should be demanded, facilitated, and recognized by top officers of the corporation. Adoption of professional and industry standards is helpful in attaining this attribute. Energy-smart operations will hold employees accountable for adherence to energy management goals and other quality standards.

- **Pride intensity**. Energy efficiency is as much dependent on behavior as it is on technology. A positive, can-do attitude on the part of staff is helpful in attaining potential energy savings. Rewards and recognition can be harnessed to good effect.

- **Fiscal protocol**. The finance question is not always *how much*. Are

purchase decisions made on first cost or life-cycle costs? Who in the organization pays, and who claims the savings? Do savings count only fuel bill impacts, or include the value of material waste minimization and greater capacity utilization? What criteria determine adequate payback?

- **Engineering protocol**. Successful energy management depends on an ability to understand energy consumption. This requires benchmarking, documenting, comparing, remediating, and duplicating success stories. Internal skills, procedures, and information services are engaged. The likelihood of building value through energy efficiency varies directly with the depth of these technical capabilities.

In the absence of an energy management process, energy expense control is reduced to one-dimensional efforts. Many manufacturers (either wittingly or not) settle for something less than full energy efficiency potential due to a lack of time, interest, or understanding. The approach taken by individual manufacturers is very much a function of their organizational attributes and business culture.

ENERGY MANAGEMENT STRATEGIES

The aim of this section is to present the range of energy management options available to industry. Every manufacturer employs SOME energy management strategy, even if the choice is to do nothing about energy consumption. Consequently, every manufacturing organization adopts one or more of these strategies:

1. DO NOTHING

Ignore energy improvement. Just pay the bill on time. Operations are business-as-usual or "that's the way we've always done it." The result is essentially "crisis management," in that energy solutions are induced by fire-drill emergencies and undertaken without proper consideration of the true costs and long-term impacts.

WHO DOES THIS? Companies that do not understand that energy management is a strategy for boosting productivity and creating value. Or, companies that are subject to merger, buy-out,

bankruptcy, union disputes, relocation, or potential closure. Or, companies that are extremely profitable and don't consider energy costs to be a problem.

PROs: You don't have to change behavior or put any time or money into energy management.

CONs: You don't save anything. Income is increasingly lost to uncontrolled waste. Because you don't inventory your energy usage, you are exposed to volatility in energy markets. You are less prepared to adapt to evolving emissions compliance agendas, and you are less capable of spotting opportunities presented by new technologies. Because you don't monitor anomalies in energy flow data, you are more susceptible to lapses in mechanical integrity and plant reliability.

2. PRICE SHOPPING

Switch fuels, shop for lowest fuel prices. No effort to upgrade or improve equipment. No effort to add energy-smart behavior to daily O&M procedures.

WHO DOES THIS? Companies that "don't have time" or "don't have the money" to pursue improvement projects. Or these companies truly believe that fuel price is the only variable in controlling energy expense.

PROs: You don't have to bother plant staff with behavioral changes, or create any more work in the form of data collection and analysis.

CONs: Lack of energy consumption knowledge exposes the subject company to a variety of energy market risks. You don't know where your waste occurs, nor do you identify opportunities to boost savings and productivity. You are also exposed to energy market volatility and emissions and safety compliance risks.

3. OCCASIONAL O&M PROJECTS

Make a one-time effort to tune up current equipment, fix leaks, clean heat exchangers, etc. Unable/unwilling to make capital investments. Revert to business-as-usual O&M behavior after one-time projects are completed.

WHO DOES THIS? Companies that are insufficiently organized to initiate procedural changes or make non-process asset investments. They cannot assign roles and accountabilities for pursuing

ongoing energy management.

PROs: You spend very little money when just pursuing quick, easy projects.

CONs: Savings are modest and temporary because you don't develop procedures for sustaining and replicating your improvements. Familiar energy problems begin to reappear. Energy bills begin to creep back up.

4. CAPITAL PROJECTS

Acquire big-ticket assets that bring strategic cost savings. But beyond that, day-to-day O&M procedures and behavior are business-as-usual.

WHO DOES THIS? Companies that lack the ability to perform energy monitoring, benchmarking, remediation, and replication as a part of day-to-day work. However, they have the fiscal flexibility to acquire strategic assets that boost productivity and energy savings.

PROs: Obtain fair to good savings without having to change behavior or organize a lot of people.

CONs: Forfeit savings attributable to sustained procedural and behavioral efforts. Also, savings from the new assets may be at risk if adequate maintenance is not applied.

5. SUSTAINED ENERGY MANAGEMENT

Merge energy management with day-to-day O&M discipline. Diagnose improvement opportunities, and pursue these in stages. Procedures and performance metrics drive improvement cycles over time.

WHO DOES THIS? Companies with corporate commitment to quality control and continual improvement, well-established engineering and internal communications protocol, and staff engagement through roles and accountabilities.

PROs: Maximize savings and capacity utilization. Increased knowledge of in-plant energy use is a hedge against operating risks. Greater use of operating metrics will also improve productivity and scrap rates while reducing idle resource costs.

CONs: You need a lot of in-house talent, cooperation, and a capable energy "champion" to do this.

It is beyond the scope of this article to comment on which

strategies are predominantly encountered in industry. Anecdotal evidence suggests that all industrial energy management strategies can be categorized per one of these five selections. It is also possible for firms to practice multiple strategies simultaneously, for example "price shopping" for low-priced fuel commodities in concert with a "capital projects" focus.

It should be noted that most of the ten of the experiences documented in the ASE's case study series can be categorized as "sustained energy management." As such, these companies integrate energy management with day-to-day operating procedures and accountabilities.

ENERGY MANAGEMENT PATHFINDING: MATCHING STRATEGIES WITH CORPORATE ATTRIBUTES

This section will build on the theory of corporate receptiveness to energy management, as presented above. The energy management strategies available to a manufacturer are a function of its organizational attributes, as summarized in Table 4. Note that this is currently presented as theory.

This typology presumes that energy management for multi-site organizations is more demanding than for single-site companies. Accordingly, adoption of a certain strategy by a multi-site organization requires all the organizational attributes that a single-site organization would be expected to muster, plus the capacity to replicate.

Managers that are contemplating improved energy management are encouraged to consider the case study results and theory presented in this article. To act on this information, the steps are:

1. Refer to Appendix C, "Determining an Organization's Aptitude for Energy Management." Note which organizational attributes have been substantially attained by the subject company.

2. Compare the attained attributes to the information in Table 4. The presence (or absence) of certain attributes determines which energy management strategies are available to the subject company.

3. Use these findings to understand what the subject organization can or cannot achieve in terms of energy management.

Table 4. Theory: Matching Corporate Attributes to Energy Management Strategies

	ORGANIZATIONAL ATTRIBUTES							
	FUNDAMENTAL VIABILITY	REPLICATION CAPACITY	ENERGY CHAMPION	ENERGY MARKET CAPABILITY	LEADERSHIP INTENSITY	PRIDE INTENSITY	FISCAL PROTOCOL	ENGINEERING PROTOCOL
STRATEGIES FOR SINGLE-SITE ENERGY REDUCTION:								
Do Nothing								
Price Shop				REQUIRED				
Capital Projects	REQUIRED				REQUIRED		REQUIRED	REQUIRED
Occasional O&M Projects	REQUIRED				REQUIRED	REQUIRED		
Sustained Energy Management	REQUIRED		REQUIRED		REQUIRED	REQUIRED		REQUIRED
STRATEGIES FOR REPLICATING ENERGY REDUCTION AT MULTIPLE SITES:								
Do Nothing								
Price Shop		REQUIRED		REQUIRED				
Capital Projects	REQUIRED	REQUIRED	REQUIRED		REQUIRED		REQUIRED	REQUIRED
Occasional O&M Projects	REQUIRED	REQUIRED	REQUIRED		REQUIRED	REQUIRED		
Sustained Energy Management	REQUIRED	REQUIRED	REQUIRED		REQUIRED	REQUIRED		REQUIRED

SOURCE: The Alliance to Save Energy

EXAMPLES FOR INTERPRETING TABLE 4:

- A manufacturer should have attained the attributes of "fundamental viability," "leadership intensity," "fiscal protocol," and "engineering protocol" in order to effectively pursue *capital projects* as a single-site energy reduction strategy.
- Alternatively, a manufacturer that has attained "fundamental viability," "replication capacity," "leadership intensity," "pride intensity," "engineering protocol," and has an "energy champion," should be capable of pursuing both the *occasional O&M projects* and *sustained energy management* strategies across multiple sites. In this instance, the company may wish to start with the lesser strategy (O&M projects) and evolve into the practice of sustained energy management.

Keep in mind that this exercise indicates what a manufacturer can expect from energy management, given its *current* organizational attributes and business culture. There may be a desire to evolve to a higher level of energy management than what the current organization allows. What if a manager wants to advance energy management in his or her organization? There are windows of opportunity. An obvious example is when energy market turmoil brings top management's attention to fuel costs. Also, take advantage of annual planning sessions or strategic reorganizations to propose the kind of organizational processes needed to practice sustained energy management. Remember that energy cost control is as much dependent on people as it is on technology. Learn from the case studies shared here.*

CONCLUSION

Volatile energy markets are here to stay. So are competitive and regulatory pressures. Energy price movements will put some manufacturers out of business, while others will decide to move offshore. Surviving manufacturers will not only provide superior products and

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

service, they will maximize value through operating efficiencies. Energy efficiency is an indispensable component of wealth creation.

Energy procurement strategies such as shopping for low energy prices and supply contracts are only partial solutions to soaring energy expenses. Management of consumption is an underappreciated opportunity. While technology is the foundation for managing consumption, it is the human dimension that makes technology work. Organizational procedures, priorities, and accountabilities are crucial to energy management.

A few forward-thinking companies have allowed their energy management experience to be documented for industry's wider benefit. Frito-Lay, DuPont, and Kimberly-Clark are among these companies. The "best of the best" companies' energy management programs feature corporate accountabilities, a mechanism for providing technical support, and a "champion" to manage energy improvement efforts.

A manufacturer's ability to manage energy consumption is ultimately a function of organizational attributes and corporate culture. This article advances "energy management pathfinding" concepts. Appendix C presents the criteria that define seven distinct organizational attributes needed for energy management. While sustained, day-to-day energy management is recommended for providing the greatest and most durable value, it is also the most demanding in terms of operational character. Many companies will find that they are suited for strategies that are less challenging, but may also provide less value. The same management diagnostic presented in this article serves as a pathfinder for matching organizational characteristics with appropriate energy management strategies.

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.
- Employ 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 also 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 the 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 efficeincy 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 • Better understanding of capital investment priorities	Information derived from data-oriented energy management provides a window on asset productivity, which will suggest priorities for future asset management decisions.
MARKET & OUTPUT GROWTH	
• Increased revenue • Improved capacity utilization	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.
• Enhanced marketability of "environmentally friendly" products	Consumers are demanding more environmentally-friendly products. More product fabricators are seeking like-minded companies to supply their inputs.
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.

APPENDIX C: DETERMINING AN ORGANIZATION'S APTITUDE FOR ENERGY MANAGEMENT

This appendix serves two purposes:

1. To further define the organizational attributes that a manufacturer needs to pursue energy management as a continuous-improvement process, and
2. To determine if a subject organization has substantially attained each of the organizational attributes listed ("fundamental viability," "replication capacity," etc.).

Please see below. For each attribute, a number of conditions are posed in a bulleted list. When considering a subject company, ask: *are most or all of these conditions true?* If yes, then the subject company has substantially attained that attribute. The degree of attainment for each attribute varies directly with the number of considerations that can be affirmed for each attribute. There are no scores, *per se*. If the subject company has attained a majority of the bulleted considerations listed under an attribute, consider that attribute to be substantially attained.

The range of topics covered by these conditions would be best answered by a high-level manager or perhaps a team of managers. After this exercise, note all the attributes that have been substantially attained. Compare those results to Table 4. That table indicates which energy management strategies are available to the company, given its organizational attributes.

Fundamental Viability:

___ Your plant capacity is generally stable or growing.
___ Your company is NOT CURRENTLY experiencing excessive turnover of managerial and corporate personnel.
___ Strikes or other labor-related work stoppages are NOT considered an ongoing concern for management.
___ Your company is NOT the current subject of a merger or acquisition attempt.
___ Your company is NOT in receivership, Chapter 7, or Chapter 11 status.

Replication Capacity:

___ Your company operates more than one manufacturing facility.
___ Your manufacturing processes and products are mostly similar across all plants.
___ Your facilities are designed and operated per one standard; standards do not significantly vary by facility for asset selection, procedures, and management styles.
___ Staff from different plants (or divisions) regularly collaborate to share their common issues and solutions.
___ Maintenance management is set up to serve multiple sites; individual sites adhere to centralized maintenance planning and procedures.
___ Your corporation currently uses (or is it willing to use) contract vendors for ongoing energy management.

Energy Champion: (NOTE: ALL of these conditions must be met to have a true "energy champion")

___ Your lead energy person has thorough knowledge of technology and staff capabilities at the facility level.
___ Your lead energy person can prepare financial analyses to support engineering proposals and convincingly present these to top managers.
___ Your lead energy person applies more than 50 percent of his/her time to energy issues.
___ Your lead energy person can give direction or at least influence decision-making by general managers.
___ Your lead energy person understands utility tariff structures and administers relations with utility providers.

Leadership Intensity:

___ Your organization actively maintains disciplines of excellence such as Six Sigma, ISO 9000, or Total Quality Management.
___ Process technologies, procedures, or staff expertise are a selling point in marketing your products.
___ Current and future environmental impacts from manufacturing operations are a concern to your top management.
___ A corporate officer consistently reviews cost and quality performance data for all facilities.
___ To most of your corporate leaders, "energy efficiency" is perceived as an "opportunity" as opposed to a "hassle."

___ Staff compensation, raises, and rewards are impacted by their stewardship of energy, raw materials, and other inputs.
___ Production metrics are integral to performance evaluations for facility managers and staff.
___ Your facilities are subject to public scrutiny or "good citizenship" expectations.

Pride Intensity:
___ All or most plants are consistently high performers with respect to health and safety compliance.
___ Most plant-floor staff are well trained for their jobs.
___ Staff turnover is NOT considered a problem.
___ Your typical plant worker philosophy can be described as: "Do what's right," instead of "Do what's easy."
___ You describe your plant equipment as "well maintained" as opposed to "poorly maintained."
___ To most of your facility staff, "energy efficiency" means "opportunity" as opposed to "hassle."
___ Key facility personnel maintain professional certifications.
___ Your organization prescribes and enforces technical training for facility personnel.

Fiscal Protocol Intensity:
___ Asset purchases are judged primarily by life-cycle costs (acquisition plus life-time operating, maintenance, etc.), instead of first costs (cost of acquisition).
___ Your organization uses (or is willing to use) leases and other off-balance sheet methods to finance major acquisitions.
___ Your organization's investing strategy seeks large payback as opposed to fast payback.
___ Most of your facilities take utility tariffs into account when planning their operating times.
___ Facilities invest in plant improvements (as opposed to simply fixing what's broken).
___ Energy-related capital project proposals assigned a hurdle rate equal to or lower than other project proposals.
___ Any energy savings are returned to the facilities that successfully implement capital improvements.
___ Your facility managers understand utility tariffs and their role in

determining energy expenses.

Energy Market Capability:

___ Your company is willing to make an ongoing effort to use energy marketing services to obtain the lowest-cost energy commodities and risk-hedging securities.

Engineering Protocol Intensity:

___ Your facilities maintain a scheduled maintenance routine for powerhouses, motor drives, pumps, compressed air, and similar utilities.
___ Your facilities maintain a protocol for responding to anomalies in operating performance data.
___ Your chief engineers are comfortable with using software to analyze engineering issues.
___ Plant managers develop (or help to develop) project proposals for capital budgeting purposes.
___ Your facilities maintain procedures for safety, health, and/or waste management.
___ Most or all of your facilities maintain an action plan for improving process efficiencies.
___ Your organization maintains a database or archive that documents engineering problems and solutions.
___ Your facilities track the volume of factor inputs required per unit of production.
___ Your facilities monitor scrap or error rates.
___ Your annual budgets include factor inputs and production targets as well as dollar figures.
___ Production, inputs, and cost performance data are created and utilized at the facility level.
___ Your engineering problems and emergencies are generally unpredictable and unique as opposed to predictable and recurring.
___ Company-wide production stats are made available to all facility staff by publication, discussion, or graphic display.

ABOUT THE AUTHOR

A five-year employee of the Alliance to Save Energy, **Christopher Russell** was promoted to director of industry sector in 2004. In this

capacity, he leads the alliance's efforts to advance energy efficiency in the manufacturing and agricultural sectors. Russell frequently writes for trade press and speaks at industry conferences nationwide.

To complement the engineering dimension that dominates industrial energy dialogue, the alliance industrial sector programs deal with managerial and financial aspects, so that the dialogue moves "from the boiler room" to corporate boardrooms.

Russell entered the energy industry in 1992 as a market analyst with Washington Gas. From 1995, he was both an industrial policy analyst and market analyst with the American Gas Association. He joined the alliance in 1999 as a program manager. Russell holds an MBA and an MA from the University of Maryland and a BA from McGill University of Canada.

Board and professional affiliations: Certified Energy Manager (Association of Energy Engineers); Advisory Board Member, Texas A&M Industrial Energy Technology Conference; Steering Committee Member, Maryland Industries of the Future Program

Christopher can be reached at crussell@ase.org; (202) 530-2225

ADDITIONAL READING

Please see the Alliance to Save Energy's Industrial Energy Efficiency Clearinghouse: http://www.ase.org/section/topic/industry/clearinghouse/, where you will find:

- Industrial Steam Efficiency: Checklist for Getting Management Approval
- Reduce Your Industrial Natural Gas Bill: 10 Timely Tips
- Energy Management
- Financial Resources
- Training
- Cutting Edge Technologies
- Improving Current Technologies
- Professional Development