Corporate Protocols for Capital Investment: Implications for Industrial Energy Program Design

Christopher Russell, Energy Pathfinder Management Consulting, LLC
and the American Council for an Energy Efficient Economy

ABSTRACT

Industrial energy efficiency potential relies to a large extent on capital investment in new, efficient technologies. While energy decisions may accrue largely to the boiler room, investment decisions do not. The challenge for energy efficiency proponents is to understand the organizational dynamics of capital investment in the industrial sector. A better understanding of the protocols and stakeholders will allow more effective energy program engagement. The issue is driven as much by communication as it is technical feasibility. Energy programs that wish to achieve greater implementation of energy efficiency will need to adopt a language, tactics, and metrics that are meaningful to the corporate managers who drive capital investment decisions.

A 2012 survey of industrial sector managers, program administrators, and market facilitators provides an overview of capital decision making as it is currently practiced by industry. The raw survey results describe the hurdles and current best practices for advancing energy-related investments. This information helps program administrators to recognize and navigate prevailing capital investment practices, and in addition reveals ideas for evolving beyond the present program paradigm.

Introduction

A non-scientific survey of manufacturers, program administrators, and facilitators provides a balanced view of industrial investment decision making as of late 2012. Survey responses describe the motivations for energy-related capital investment, competing considerations, outsourcing practices, limits, and impacts. This study yields a number of critical success factors for implementing energy-related capital investment projects.

We found that capital investment procedures are not specific to any individual industry or group. We do, however, find generalities according to the size of enterprise. Generalities by size also describe industrial perceptions of energy and program assistance opportunities. While small organizations tend to be less sophisticated or less deliberate in their approach to energy improvements, their decision-making can be faster and more flexible than it is in large corporations.

Methodology

This study synthesizes the results from a series of phone and email interviews with industrial energy managers, engineers, sustainability managers, plant managers, presidents and vice presidents from a diverse pool of companies. During the summer of 2012, a total of 139

individuals were contacted and were asked to participate in the survey.[1] In total, 30 individuals, all from different companies, agreed to participate. All respondents were assured that their individual replies would be held in confidence, and that responses would be reported here in the context of overall patterns and trends.

Implementation rates for industrial energy efficiency programs vary (Russell 2010). Still, all programs have room for improvement. A better understanding of capital investment decision-making processes at the corporate level will allow industrial energy program administrators to boost implementation rates while making better use of their limited resources.

Survey Findings

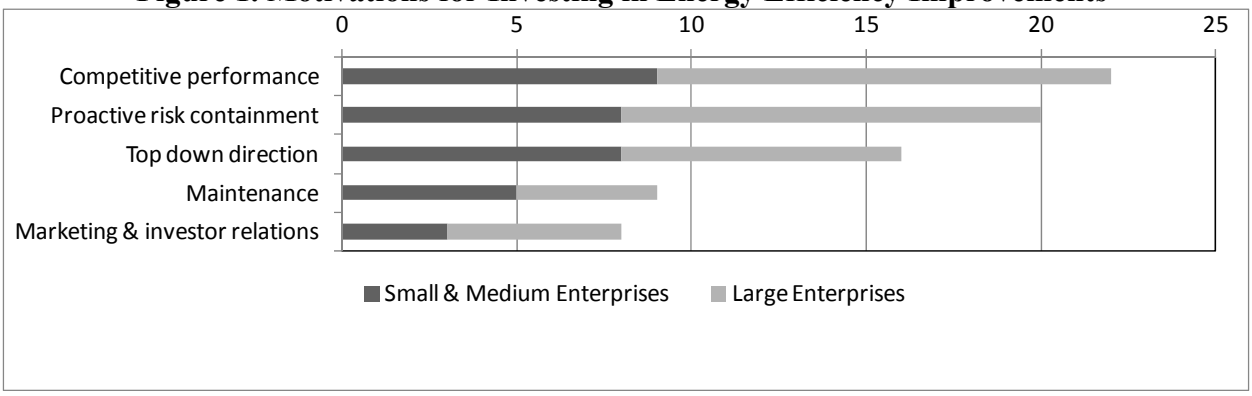
Motivation to Act

Industrial sector interest in energy efficiency is often the result of top-down corporate goals to achieve cost reductions of any kind. These are sometimes to be achieved emphatically through environmental sustainability initiatives. Any purposeful pursuit of sustainability is sometimes the initiative of a single, visionary manager or board member. While such direction may lead to the creation of corporate goals, those goals may or may not have clear accountabilities attached to them. A few respondents indicated that such "soft" goals were merely for appearances, to support marketing or general public relations agendas. Generally, capital investment strictly for energy-saving benefits is pursued by the most energy-intensive industries. About half the respondents report that general cost improvement, productivity, reliability, or all the above drive their facility investment priorities. Many respondents indicate that energy improvements are welcome but are only incidental consequences of facility improvements.

Apart from performance goals is the ever-present need to replace or repair existing equipment. Replacement activities contribute directly to plant reliability. Nine respondents indicate that breakdown or replacement needs supersede energy efficiency as an investment driver. These responses were split evenly among large companies, SMEs, and facilitators. About one-third of respondents say that energy improvement opportunities would be largely dismissed were they not linked to equipment replacement episodes. Figure 1 summarizes the motivations for energy efficiency investment as expressed by survey respondents. Note that respondents frequently cited multiple reasons.

[1] For current purposes, please note that "respondents" are individuals whose survey observations are presented in this paper. Ten respondents represented large manufacturing companies with annual revenues of $10 billion or more. Another 10 were "SMEs," or small- and medium-sized companies, any of which have annual revenues below $10 billion. SMEs are more likely to be privately held and owner-managed. Their smaller scale is reflected in simpler organizational structures and, usually, less procedural rigor. Accordingly, the dynamics of their capital investment methods can be distinctly different from large corporations. There were also 10 "facilitators," which include solution providers, trade groups, or coordinators of government- or utility-sponsored assistance programs. Among facilitators, three work primarily with large companies, while the balance work with SMEs. Each facilitator observes dozens of mostly small and medium- sized companies. An "energy program administrator" is a professional who designs and administers an industrial sector energy efficiency program on behalf of a utility or government entity.

Figure 1. Motivations for Investing in Energy Efficiency Improvements



Respondents could cite multiple motivations.

Smaller companies and facilities tend to be less interested in energy savings than larger ones. However, according to one facilitator, their numbers are slowly growing: he notes that 20-25 percent of all unsolicited inquiries about new equipment are driven by consumer interest in energy efficiency. Other survey respondents also indicate that state and utility energy program outreach continues to drive industry's investment, if not primarily for the sake of energy efficiency, but for the additional value that efficiency may provide over and above business growth and equipment replacement needs. However, some respondents point to the low availability of internal capital, which is a function of the overall financial health of the company, aversion to investment in today's economic climate, or both. Tight credit markets also limit access to conventional bank finance.

Competing Considerations

Broadly speaking, industrial asset management is a trade-off between two choices: squeezing incremental value from existing facilities and equipment—*doing things right*—versus updating facilities to obtain a strategic competitive advantage—*doing the right thing*. The trade-off reflects management strategy, and has direct implications for capital investment. By choosing to *do things right*, a company implicitly commits to refining its current products, markets, and processes. By contrast, a company wishing to *do the right thing* is thinking beyond today in anticipation of tomorrow's opportunities for innovation, relocation, expansion, and growth. This choice determines whether business returns are maximized for the short run or for the long term. These strategy differences explain why two manufacturing facilities, similar in every physical aspect, can demonstrate vastly different appetites for investment in energy efficiency.

At least seven respondents indicate that business growth is the primary goal of capital investment. Aside from meeting business growth needs, many manufacturers are compelled by statutory safety and environmental compliance needs to invest in existing facilities. Add to this the capital requirements to simply repair and maintain current facilities. According to most respondents, energy improvement proposals compete with (rather than contribute to) these primary investment goals. While "efficiency" is not entirely dismissed, it is usually a secondary priority. One respondent states that the primary goal for energy management is to ensure that energy supplies are distributed adequately throughout a facility in a timely fashion—a task that is sometimes at odds with efficiency rather than because of it.

Unless it is to replace a failed asset, an energy efficiency improvement is more difficult to justify than a growth-oriented investment. At least five respondents indicate that energy improvements are more easily addressed in new construction than in the retrofit of existing facilities. About half the respondents indicate that capital spending plans favor proposals that promise growth, address mandatory safety or environmental compliance, or both. A similar number of respondents (not always the same counted for the last point) say that energy impacts are at least one of many factors to be considered when evaluating a capital investment. Six respondents (four of them large companies) indicate that energy improvements compete with all other capital funding requests. However, three respondents (all were large companies) indicate that their organization maintains a capital budget track for energy separate from all other investment purposes. A dedicated energy fund ensures that at least some capital is available each year for energy improvements. Of note is the claim by at least five respondents that energy projects are often the kind of items paid for from either non-capital funds or from any budget remainders at the end of the fiscal year. To the extent that this is true, it suggests that industrial energy improvements happen more by chance than by deliberate effort.

It is not accurate to conclude that energy improvements always "compete" with all other capital investment opportunities. As one large company respondent points out, energy improvements are sometimes the consequence of modernization or automation efforts. Documenting these impacts will help when assembling justifications for future improvements.

Capital Project Culture

Industrial investment decision making reflects the prevailing business culture of the organization. Survey respondents provide insight on business culture as it shapes energy-related investments.

Business cultures, and therefore capital budget styles, vary throughout industry. There's nothing to indicate, for example, that food processors as a group manage capital in a way that's distinct from pharmaceutical manufacturers. The survey suggests a general difference between large, multi-plant companies versus SMEs, whose capital expenditure processes are often less rigid and certainly localized, often driven directly by the owner.

The business of manufacturing is intrinsically capital intensive. The mechanical nature of manufacturing ensures that it is an engineer-driven culture. Engineers are trained to craft solutions in the form of "projects," that is, discrete episodes of hardware design and implementation. Engineers instinctively perceive industrial energy improvements to be a project of some sort. Manufacturers' preference for projects is reinforced by the corporate tradition of capital rationing. Typically, a manufacturing enterprise develops an annual capital budget—reinvesting some of its earnings in its facilities in order to sustain or grow the business. By nature, the capital budgeting process stimulates a fierce internal competition among the departments within a business unit, since needs are almost always greater than the available funds. Proposals with clear, concise, measureable impacts—presented as "projects"—are usually the most effective way to compete for capital funds. One lesson is immediately clear from these observations: when a manager says the company "doesn't have money" for energy improvements, this may be misleading. A more accurate statement may be that the energy champion cannot compete effectively with other departments for the money that's available.

Large companies in particular (11 of 14 respondents) utilize an elaborate decision-making process to evaluate capital investment proposals. The vetting (decision) process for a

specific proposal will often be conducted by a couple of teams: one that champions the proposal and the other with approval authority. The project proponent team may be comprised of an energy manager plus staff from engineering, maintenance or production. The approval team may include managers from operations, finance, environmental/health/safety, marketing, regulatory affairs, or other departments. Corporate review may examine economic, regulatory, and legislative considerations. Each manager's influence on investment decisions will vary. At least three respondents note that an energy project is more likely to be awarded funding if the approval team includes an individual who is familiar with the proposal throughout its development. In general, expect leaders from operations and finance to carry the greatest weight for approval decisions. At least two respondents note that the approval team not only evaluates investment proposals, but will also set the company's current investment priorities. The approval team sets these priorities in light of prevailing economic conditions as well as marketing considerations and regulatory requirements. Given these guidelines, subordinates develop investment proposals accordingly.

It is important to remember that professionals that share the same job title are not created equal, either in terms of their individual abilities or the authority vested in them by their organization. For energy program administrators, the path to implementation includes scoping the management team for each individual facility, becoming familiar with each manager on the decision team for energy improvements.

The complexity of the capital investment vetting process tends to increase with the size of the company and the magnitude of dollars involved. In general, proposals with successively higher dollar amounts are required to sustain additional levels of review. Industrial organizations tend to perform investment analysis in stages, beginning with a quick, low-effort feasibility analysis, usually performed by the staff that are closest to the concept. If a proposal passes this first hurdle, it will usually encounter one or more subsequent feasibility reviews, each requiring progressively more analysis.[2] This step-wise approach reflects the cost of devoting staff or consultant time to a project proposal. Note that in a tight fiscal environment, management may not have the resources to pursue such analyses, which effectively stalls the development of worthwhile investments. All of these observations explain why manufacturers do not react quickly to energy improvement incentives. Carefully designed energy program assistance should instigate many of the improvements that are otherwise forfeited for reasons of time and money.

A facilitator commented that procrastination—bred by a lack of time—explains why companies fail to pursue so many good energy improvement opportunities. Another facilitator notes that even the easy, low-cost opportunities can be difficult to perform simply because of limited time availability. Meanwhile, the clock is always ticking on the budget calendar, a conundrum underscoring the need to spend money sooner rather than later before annual spending capacity is exhausted. Energy efficiency programs often recognize this hurdle, and will respond by offering free or cost-shared project analysis services for selected technologies. One respondent, however, indicates that capital funding for a proposal must be approved before a concept moves into final design and engineering. Another notes that in some companies, approval for capital expenditure can be rescinded at the eleventh hour, as top executives make

[2] Engineering jargon such as "80/20 feasibility analysis" is often used in the vetting process. This example assumes that a cost benefit analysis can be achieved with 80 percent certainty after investing only 20 percent of the level of effort needed for a definitive analysis. Another firm may pose a "50/50 analysis." These analysis percentages are not fixed in any way by industry—they reflect the judgment and customs of individual firms.

last minute changes to priorities or as emergency conditions suddenly prevail. As this respondent puts it, a capital expenditure is not certain until a final spending request has been ratified.

One program administrator notes outright unwillingness by large and small companies alike to borrow for energy projects, despite the enticement of low interest loans. The administrator attributes this to facility managers being unable or unwilling to assign collateral to such loans. This may also reflect debt covenants imposed by existing lenders that prevent borrowers from obtaining additional debt.

The origin of capital investment proposals varies widely across and within industries. Proposals may originate at the facility level to be considered for corporate approval. In other instances, corporate energy teams advocate concepts for facilities to consider. As at least five respondents indicate, capital spending by large companies is frequently managed at business unit levels below the top corporate office. As a result, the criteria for investment awards and performance evaluation can vary across business units. This is for valid business reasons: as growth prospects vary across business units, so will the need for capital infusion.

When energy improvement is pursued as a capital project, its implementation is squarely dependent on the pace and timing of a capital expenditure process. Almost all respondents indicate the use of an annual capital budget. A small number of respondents (mostly large companies) use a three- or five-year planning horizon to coordinate spending on projects that take more than 12 months to develop. These longer plans are usually subject to annual adjustment. At least one respondent said that an energy improvement is more likely to be approved if it has been developed through the capital planning process. By contrast, SMEs can often develop projects more quickly, especially when they don't have a rigorous approval process. One facilitator notes that the decision cycle can be as fast as 24 hours.

Capital investment analysis may involve nothing more than a simple payback calculation that compares energy savings to the cost of the project. Survey respondents offered an array of creative approaches for making energy improvement proposals more compelling. One facilitator observes that some companies' proposal evaluation is extended to consider tax, depreciation, and maintenance implications. For at least three respondents, it's not just the "payback," it's the additional impacts that matter. One large company respondent says that the company will also evaluate a capital proposal for its potential to "change the facility's evolution" by making it more productive, faster, or more flexible. In many instances, a "good" energy project is one that also simplifies maintenance or generally makes work easier or more routine. They are projects that can be implemented with minimal interruption of the core business or without diversion of resources. As one facilitator notes, a truly good project is not only problem-free, it elicits expressions of appreciation from production people upon its conclusion. Regardless of the industrial organization's type or size, evaluation of proposed investments can be as much art as science, relying on the management style of key individuals. Again, no patterns are evident across industry to predict preferences. One respondent indicates that life-cycle costs are expressly considered; another specifically avoids them. Yet another respondent claims that avoided cost measures are of no interest. Another individual notes that preferred investments are ones that feature a low risk of economic failure, or in other words, they want to avoid any project with significant potential to turn cash flow from positive to negative.

Simple payback remains the most frequently cited investment metric. Seven respondents claim that capital investments are expected to pay for themselves in three years or less. Another three respondents (two of these being large companies) indicate a 12-month threshold. A chief

financial officer expecting a 12-month payback or better essentially wants budget-neutral investments. In other words, capital expenditures are expected to be recovered through benefits realized before the end of the current budget year. This may not reflect a lack of capital, but rather the company's extreme risk aversion, due to uncertainty about future market or economic conditions. It could also simply reflect an industry subject to rapid change. Or, it may reveal a disconnect between personal and organizational goals. For example, a corporate finance officer's personal bonus potential emphasizes current-year results over future results, even though the magnitude of future results may be much greater. In financial jargon, this means that future returns are heavily discounted. A couple of respondents note that their energy team may negotiate the criteria for project evaluation, opening the conversation to include secondary benefits beyond crude payback criteria.

The popularity of simple payback is not absolute. One large company claims to avoid this metric because it fails to account for too many variables. This company prefers to use discounted cash flow analyses. With ready access to spreadsheet software, there's no reason not to perform a more robust investment analysis. The real limitation is the organizational willingness to learn and adopt new methods.

Once committed to pursuing an energy improvement project, facility staff must coordinate its implementation with any other projects and ongoing production activities. Implementation usually cannot begin before the start of the budget year from which its funds are allocated. Also, managers usually plan for project implementation to coincide with scheduled facility maintenance shut-down episodes.

The Dynamics of Third-Party Outsourcing

Most respondents indicate that third-party consultants and contractors are employed to varying degrees to assist with the analysis, design, and fabrication of capital projects (7 large, nine SMEs, and two facilitators' observations of SMEs). Of these, the majority tend to employ local, trusted vendors with whom a long-term relationship has been established (12 total, eight large, four SMEs and facilitators). By contrast, there was one large company respondent that uses outsourcing sparingly, pointing to the difficulty of orienting an outsider to the complex facilities that an internal engineering team can adequately analyze. The kind of work that is outsourced varies. Companies tend to use their own staff for the engineering and installation of smaller projects. In a couple instances, respondents say that they retain critical feasibility studies while outsourcing simple, run-of-the-mill analysis. Some others do exactly the opposite. One large company respondent notes that third-party analyses boost the credibility of the staff's internally generated improvement concepts.

The overwhelming preference for long-term, trust based vendor relationships frequently eschews formal bidding procedures. But when bidding is performed, requests for proposals are usually issued to a well-established short list of familiar vendors. The bidding process is most often performed at the facility level as opposed to corporate, favoring local vendors. Especially among SME facility managers, the local vendors often enjoy professional group or even personal relationships. Note that two companies (one large, one SME) issue corporate direction to its facilities dictating the use of specific vendors. The large company limits such direction to certain technologies such as lighting retrofits.

Limits to Progress

Survey respondents commented on the hurdles, or at least extenuating circumstances, that determine the pace and volume of energy improvements. Note, however, that the respondents speak mostly from the perspective of middle managers from facility departments. These respondents may have strong knowledge of facility management agendas, but not all will necessarily understand or correctly interpret the dynamics of their top management's capital investment practices. Nor do corporate leaders always understand the realities of facilities management. In short, capital projects are often deliberated by decision-makers with disparate agendas and less than perfect knowledge. Dissenting opinions may exist within an organization's management team regarding what is, can be, or should be done regarding energy improvements.

Respondents also reveal disconnects between decision-makers within an organization. At least two respondents (both large companies) note that corporate leaders provide staff with few resources to back sustainability pledges made to the public. In one example, there are no accountabilities to compel the chief financial operating officer to make investments in sustainability outcomes—despite the company's public pledges. At least three respondents note that energy managers are simply not empowered to pursue energy-saving investments if these would supersede the competing wishes of operations or maintenance directors. One large company respondent notes that energy projects are more difficult to implement if the impacts are felt across departmental lines. Supporting this idea, another respondent notes that an energy improvement is more easily accepted when the idea comes from the department that has responsibility for the impact. Another reason for stalled energy projects is ever-changing incumbents among the decision team. Incoming managers bring with them a learning curve and a different set of values and priorities. The greater the rate of management turn-over, the greater the chance for delaying, postponing, or outright cancelling capital project proposals.

Industrial investment priorities are shaped by operational philosophies. One facilitator describes the staff of one facility that stubbornly believes in a fixed ratio of energy per ton of product produced. To them, "energy efficiency" means a reduction of output and revenue. Old operating rules-of-thumb last for years, assuming a fixed trade-off among time, energy and money. All too often, these assumptions don't change even as the prices of these inputs vary.

Perhaps the most common barrier to industry's investment in energy improvements is a combination of fear and misunderstanding. A lack of information, or sometimes misinformation, feeds this fear. At least seven respondents (two large, two SMEs, and three facilitators) claim that the balance of an industrial organization cannot see the value of energy improvements. Many key decision-makers perceive no vested interest in the outcomes of such improvements. Fear can be further nuanced from individual survey responses: fear of projects failing to deliver promised results, or fear of adverse affects on production yield, capacity, or quality. Fear also breeds resistance: one facilitator suggests that staff on the shop floor can purposely derail corporate energy directives by simply failing to comply with them. Note that organizational politics can play a role: one respondent indicated that unionized facility staff were reluctant to suggest any changes that might impact collective bargaining work arrangements. Another facilitator says that long-time facility workers are often jaded by past episodes of failed energy efficiency promises. A different respondent, however, says that staff resistance to energy-related changes is minimal. As one large company respondent notes, a lot of the older staff have some good energy-saving ideas on the shelf that were passed over by earlier management teams.

Individual respondents also cite a lack of internal skills, a shortage of funds for employing consulting help (particularly among SMEs), and a lack of time to improve anything "that's not broken." Refusal to acquire outside expertise, for whatever reason, is a failure to benefit from new skills and experience. At least one large company respondent describes a cross section of his organization's staff—which includes an aging cohort of energy-smart professionals with sensitivities shaped by the 1970s oil shocks. Most employees added during the 1990s (a time of relatively low energy prices) tend to be less concerned with energy; unfortunately, these individuals are now entering their greatest years of organizational influence. Meanwhile, today's new hires include young people with a better appreciation for sustainability concepts. This should bode well for future support of sustainability agendas.

The hurdles discussed here—lack of resources, disparate internal philosophies, and disconnects of authority—explain industry's affinity for quick, cheap, easy energy solutions. Some respondents suggest that the easy solutions are becoming harder to find. To make more progress, energy program administrators will need to increasingly address their clients' cultural and organizational issues in addition to the usual hands-on, technical aspects of energy cost control. This implies an agenda that not only takes more time, but aligns energy policy with economic and workforce development initiatives. In short, the traditional engineer-to-engineer dialogue of yesterday's energy programs is probably not sufficient to maximize capital investment in energy improvements.

Impacts of Energy Improvements

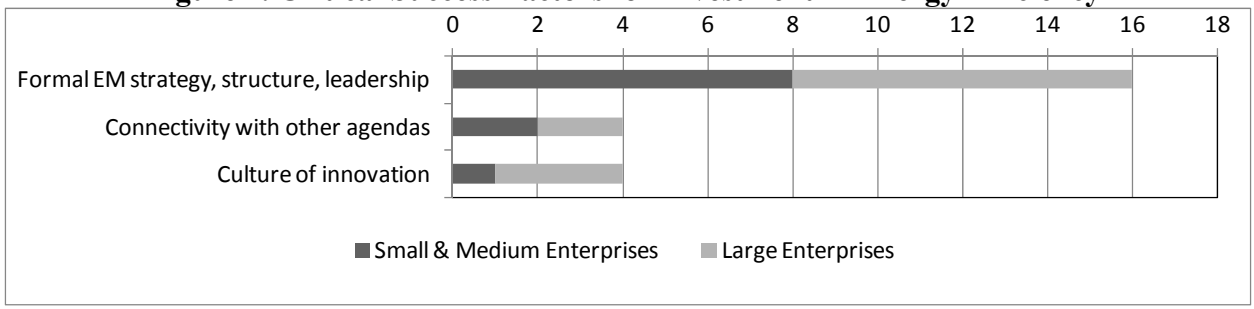
Despite the many difficulties, many energy managers can and do overcome barriers. Two SME respondents note that their organizations originally avoided energy improvements in favor of other investments. But once some initial energy project results were available, managers were convinced and wanted more! Four respondents reiterate that project success is often predicated on non-energy benefits. Specifically: 90 percent of energy projects also have a productivity impact (one large company, one facilitator); energy improvements provide a four-fold return in the form of production improvements (one large company); and two other large companies claim that non-energy benefits "dominate" the returns from energy projects. There's still room for improvement: at least one large company respondent says the company experiences an implementation success rate for energy proposals of 30 percent or less. A facilitator claims an 80 percent implementation rate.

At least one respondent notes that energy improvements are harder to justify with today's relatively low gas prices. Upon reflection, this may reveal a strategic opportunity. The industrial sector is experiencing a re-shoring of production facilities on domestic soil. This is due in part to lower gas prices. But does this not underscore the need to invest in new facilities? If so, this investment is an opportunity to implement advanced, energy-saving technologies that will hedge these new facilities against future energy price increases.

Critical Success Factors

What is it that allows some companies to implement more energy improvements than others? For many respondents, it begins with leadership: the influence of key top managers who communicate an inspired vision across all departments. Exactly who performs this role is determined more by personality and power than it is any specific job title. Figure 2 summarizes what respondents indicate are critical success factors for achieving capital investment in energy efficiency.

Figure 2. Critical Success Factors for Investment in Energy Efficiency



EM = "energy management." Respondents could cite multiple success factors.

To synthesize comments from survey respondents, Table 1 offers a provisional checklist of attributes that facilitate capital investment for energy improvement purposes. The more these attributes are in place, the greater the likelihood of success.

Table 1. Provisional Checklist for Successful Capital Investment in Energy Improvements

LEADERSHIP

- Top management support for cost improvement in general, and good projects in particular
- An empowered energy champion who has influence with multiple departments and directors
- Individuals familiar with the project from its inception are on the approval team
- The project development team draws membership from all departments to be affected by the change

CULTURE

- Company has a formal self-improvement idea generating mechanism
- A history of successful energy improvement projects
- A work culture that is amenable to change and new knowledge

ORGANIZATIONAL MECHANISMS

- Clear accountability for energy performance results
- Corporate goals for sustainability or overall cost improvement
- Capital spending decision-makers are located at production facilities
- Flexible investment evaluation criteria to recognize non-energy benefits
- Ability to schedule the energy improvement to coincide with expected shut-down maintenance episodes

BUSINESS RELEVANCE

- Clear articulation of energy impacts and their linkage to core business goals
- Evidence of a facility's deferred or pent-up demand for capital investment
- Knowledge of the capital renewal cycle for the industry and corresponding windows of opportunity for investment.
- Ability to link discrete energy projects to a current business goal or need

OPENNESS TO OUTSIDE RESOURCES

- Willingness to apply for energy program benefits
- A consultative relationship with vendors and consultants

Conclusions for Future Program Design and Conduct

Respondents to the survey conducted for this paper reiterate the fact that energy improvements are not a priority, but rather a welcome indirect benefit of industrial investment. Industrial energy efficiency program goals must more effectively detect, document, and promote the affinities between energy savings and core business goals, then communicate these fully to key decision-makers in each organization.

Per the classic engineering mindset, many industry stakeholders equate energy efficiency measures with capital expenditure projects. Less technical observers may anticipate energy measures that result from behavioral and procedural change. Both groups are correct. The marriage of these philosophies calls for energy management as a *process* of continuous improvement, relying as much on performance measurement and staff action as it does capital projects. Accordingly, state and utility energy programs are evolving to support energy management practices as a complement to the project approach. This evolution is not without challenge: while capital projects involve a change of equipment, energy management imposes change on personnel roles and accountabilities. The suggestion of organizational change breeds fear and resistance in ways that the project approach does not. Compared to a capital project, the energy management process does not make a neat, one-time funding proposal. To compete effectively in the capital budgeting process, facility managers would rather *do things right*—pursue projects—as opposed to *doing the right things* that true energy management would

require. Energy efficiency programs can coach facilities as they develop energy management disciplines over time—beginning with the easy, low-cost improvements, then by developing monitoring and maintenance best practices for current assets. Once these competencies are in place, energy champions can more convincingly justify capital investment in advanced technologies, pointing to energy as well as other ancillary benefits.

The survey conducted for this study describes the nature of capital investment decision-making within corporations. Instead of finding patterns or preferences specific to individual industries, we found only generalizations about large- versus small- and medium-sized corporations. Capital investment decision-making activities reflect the workplace culture of individual companies, business units, and facilities—this explains why two identical production plants in the same industry can have very different strategies for capital investment. One generalization is that companies usually study investment opportunities in stages, seeking ever increasing analysis and approval at each stage. This process can take months, if not years to yield a decision, especially when large companies ponder large dollar-volume proposals. This suggests the need for energy program administrators to maintain long-term relationships with their facility contacts, monitoring each facility's capital renewal cycles for windows of investment opportunity that may occur every three, five, or ten years, depending on the industry.

To build on their past successes, energy efficiency programs will need to evolve to a new level of interaction with industry. Advisors increasingly encourage industry to adopt internal, continuous energy improvement efforts, over and above episodic capital projects. Continuous improvement programs tend to harvest the "low hanging fruit" that comes from tweaking existing assets. Program outreach must increasingly recognize advanced technologies that not only cause direct reductions in energy intensity, but also cause indirect reductions as a result of improved process throughput and cycle times. Energy savings, both direct and indirect, will increasingly be realized through capital investment in the modernization of industrial infrastructure.

This also suggests a new phase in the design and conduct of energy efficiency programs. One opportunity for program administration is to document the unintended energy benefits of "non-energy" capital improvements—thus inspiring additional investment. Capital asset selection will play an increasing role in the relationship between energy program administrators and their industrial hosts. The effectiveness of this relationship depends on increased knowledge of process dynamics as well as the investment decision-making process. And with knowledge of the production process comes a broader awareness of improvement opportunities. This would permit expansion from a strictly energy-focused pursuit to one of broader resource management, harvesting value from a variety of waste streams. This would ensure that sufficient value is generated to maintain and refine cost control capabilities as a continuous improvement initiative.

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